The Economics of Diversifying into Irrigated Non-rice Crops in the Philippines

Leonardo A. Gonzales [1]

Abstract

This paper analyzed the financial and economic viabilities of irrigating non-rice crops in two regions in the Philippines during the dry season, using the domestic resource cost (DRC) approach. Data from IIMI-IFPRI survey in **1985** and the IIMI follow-up survey in 1987 were used to compare the financial and economic profitabilities of **six** crops: rice, corn, mungbean, peanut, onions and garlic.

Results showed that only white open pollinated corn had negative net financial profitability among the six crops analyzed. The domestic production **of** irrigated onions in Central Luzon. peanut and garlic in the Ilocos Region, exhibited high financial profitabilities.

The DKC analysis also indicated that garlic, onion and peanut production systems are economically efficient users of irrigation water. Except for mungbean and white open pollinated corn, other irrigated crop production systems examined were economically efficient **as** import substitutes (rice and peanut) and as exports (garlic and onions).

Results from the economic analysis indicate a high potential in using irrigation water for non-rice crops. Research on the technical, economic and social viability of this new management practice should be encouraged.

Introduction

In Philippine agriculture. rice has been the major user of irrigation water. This **is** understandable considering the importance of rice as a major staple and the multiplier effects that irrigation water has on rice production. Lately, however, questions have been raised whether there **is** economic efficiency in the use of irrigation water to non-rice crops. This paper assesses the economics of diversifying into non-rice crops using the domestic resource cost (DRC) approach with emphasis on the role of irrigation water.

Irrigated rice was compared with five non-rice crops (corn, mungbean. peanut, garlicand onions) during the dry season in two selected regions (Ilocos and Central Luzon) in the Philippines using the 1985IIMI-IFPRI farm level production survey and the **1987** IIMI follow-up survey.

Economics of Crop Diversification: A Domestic Resource Cost Approach

This paper approaches the problem of economic efficiency using the domestic resource cost (DRC) concept. DRC **is** defined as the ratio of domestic cost and border price of output minus foreign cost or expressed as:

$$\text{DRC} = \frac{\text{domestic costs in shadow prices per unit of output}}{(\text{border price of output}) - (\text{foreign cost per unit in border price})} \qquad (1)$$

The numerator **is** expressed in local currency while the denominator **is** expressed in foreign currency, resultingin the "own exchange rate" for theactivity. Mcdallaand Power (1979) argued that the rationale for using DRC as a measure of relative efficiency **is** the importance **of** the foreign

[1] Liaison Scientist for Asia. International Food Policy Research Institute (IFPRI) and Agricultural Economist, The International Rice Research Institute (IRRI).

exchange constraint on Philippine economic development.

The DRC as a measure of comparative advantage can be compared with the shadow exchange rate (SER) of foreign exchange like in investment criterion of benefit cost analysis. Bruno (1972) postulated that depending on the ratio of DRC/SER, sometimes referred to as "resource cost ratio" (RCR), an economic activity can be determined whether it has relative comparative advantage for a country. Thus if,

(a) $\frac{DRC}{SER} < 1$, → comparative advantage

(b) $\frac{DRC}{SER} = 1$, → neutral advantage/disadvantage

(c) $\frac{DRC}{SER} > 1$, → comparative disadvantage

There are several procedures in calculating DRC[2]. First, is to have adequate knowledge on the production costs of the different production systems and be able to value these costs at their opportunity costs and at the appropriate marketing chains. Second, is aconsistent method of allocating production cost into their domestic and foreign economic cost components. The calculations of the economic costs of inputs should be net of taxes or subsidies. Also, the value of output should be computed into border price equivalents, i.e. freight on board (FOB) for exports and cost, insurance, freight (CIF) for imports. Table 1 summarizes the border prices of the commodities included in the analysis.

Rice, corn, mungbean and peanut were analyzed as import substitutes while garlic and onions were evaluated as exports. At one point in the analysis, the long term border prices of rice and corn were incorporated to present a long term view on the economic prices of these two major grains.

Table 1. Border and domestic prices used for DRC calculations, 1987.

Commodity	Trade Regime	Border Price ($/mt)	Domestic Price Farmgate (₱/kg)	Domestic Price Wholesale (₱/kg)
Rice	Import Substitution			
Current		267 28 (CIF)	2.77	4 72
Long term[a]		336.28 (CIF)	2.77	5.12
Corn	Import Substitution			
Current		138.62 (CIF)	3.02	3.30
Long term[a]		174.28 (CIF)	3.02	3.30
Mungbean	Import Substitution	302.45 (CIF)	13.70	14.60
Peanut	Import substitution	307.29 (CIF)	11.10	19.80
Garlic	Export Promotion	715.00 (FOB)	10.30	17.97
Onion	Export Promotion	291.00 (FOR)	4.07	10.14

[a]Based on 10-year moving average, 1970-87.

[2]For specific assumptions and sample calculations using this method as applied to the Philippines, refer to Rosegrant et al., (1987).

Another crucial aspect in the DRC calculations is the choice of shadow prices used in costing the different inputs. The shadow prices of land, labor, cost of capital (interest) and the cost of foreign exchange, should be priced carefully to avoid distortions in the calculations.

Empirical Results

Given the different farm budgets by crop enterprises, two profitability indicators can be derived: net financial and economic profits. The difference lies in the use of prices as a tool for valuation. In determining net financial profit (whether on-farm or at wholesale), actual domestic market prices encountered by farmers or traders are used. In contrast, net economic profit, is calculated using border prices or economic prices, i.e , net of tax or subsidy, to value both inputs and outputs.

Financial und economic *profitability* In profitability analysis, yields, production costs and prices are crucial in the calculations. Table 2 summarizes the yields and net financial profitability on-farm and at wholesale of the different irrigated crop enterprises. On the average, irrigated rice production systems in Central Luzon had higher yields (4.39 t/ha) than in the llocos Region (3.61 t/ha), and consequently had higher on-farm net financial profit.

Across the two regions, onion had the highest net financial profit on-farm of f11,838/ha; peanut (₱10,680/ha) and garlic (₱9,832/ha) ranked next to onion in that order (Table 2). Of the six production systems analyzed, only white open pollinated corn exhibited negative financial profit. Data in Table 2 also indicate that traders, middlemen and wholesalers had substantial profits in onion, garlic and peanut. This is due to seasonality and monopolistic element (limited entry) in the domestic trading of these commodities.

At the wholesale level, it is important to note the divergence between the financial and the economic profitabilities among the crops. The economic profits (Table 3) represent the undistorted valuation of the commodity at the wholesale level. Therefore, if the financial profit is higher than the economic profit, it shows that the difference was partly due to government intervention (protection) of imperfections in the marketing system. Such was the caseformungbean. The net economic profit of mungbean production, given the economic valuation of the mungbean production system was negative, yet its net financial profitability was positive. The data further showed that where a positive government output price protection for a commodity exists, a negative divergence between net financial and economic profitability usually follows, This was true for all crops examined with the exception of rice (Table 3).

Table 2. Yields and financial profitability, on-farm and wholesale of different irrigated crop production systems. llocos and Central Luzon, **1987.**

Crops	Yield (t/ha)	Net Profit' On-farm (₱/ha)	Wholesale (₱/ha)
llocos Region			
Rice	**3.61'**	**2,077**	**1,214**
Munghean	**0.88**	**5,607**	**6,147**
Peanut	**1.80**	**10,680**	**25.127**
Garlic	**2.42**	**9,832**	**25,990**
Central Luzon			
Rice	**4.39'**	**2,523**	**2,743**
Onion	**10.66**	**11,838**	**64,350**
Corn	**2.36**	**- 536**	**- 622**

"Residual after subtracting total costs from Gross Revenue

[b]In paddy equivalent, the milling rate is **0.65.**

Table 3. Comparison of net financial and economic profitability at wholesale, different irrigated crop production systems, llocos and Central Luzon, **1987.**

Crao	Net Profitability at Wholesale (₱/ha) Financial	Economic
llocos Region		
Rice	**1,214**	**1,953**
Munghean	**6,147**	**–3,279**
Peanut	**25,727**	**1,210**
Garlic	**25,990**	**21,286**
Central Luzon		
Rice	**2,743**	**3,319**
Onion	**64,350**	**26,407**
Corn	**–622**	**–3.882**

Comparative *advantage* analysis. Table **4** shows the results of the DRC analysis. Economic efficiencies in the domestic production of rice, corn, mungbean and peanut **as** import substitutes were evaluated. Analysis was also conducted in the domestic production of garlic and onion **as** exports. Results showed that the domestic production of irrigated mungbean and white open-pollinated corn had **no** comparative advantages **as** import substitutes. Calculated DRCs **of** irrigated mungbean and white open-pollinated corn were about **35** which was higher than the **peso's** shadow exchange rate (SER) of **₱25:$1** in 1987. Consequently, the resource cost ratios (RCRs) of these crops were greater than one (1.40), implying a comparative disadvantage (Table **4).**

Table 4. Calculated economic efficiency indicators for different irrigated crop production systems, by trade regimes, llocos and Central Luzon, **1987.**

Crop	Trade Regime	Efficiency Indicators	
		DRC[a]	RCR[b]
Ilocos Region			
Rice[c]	Import Substitution	**17.13**	**0.69**
Rice[d]	Import Substitution	**12.53**	**0.50**
Mungbean	Import Substitution	**34.78**	**1.40**
Peanut	Import Substitution	**18.40**	**0.74**
Garlic	Export Promotion	**7.67**	**0.31**
Central Luzon			
Rice[c]	Import Substitution	**15.44**	**0.62**
Rice[d]	Import Substitution	11.14	**0.45**
Onion	Export Promotion	**12.32**	**0.50**
Corn	Import substitution	**34.71**	**1.40**

[a] DRC = domestic resource cost.
[b] RCR = resource cost ratio i.e. the ratio of DRC with the shadow exchange rate (SER) of the total currency.
[c] at **1987** border price of **35%** broken milled rice,
[d] at long term border price of 35% broken milled rice, using a 10-year moving average.

Among the irrigated non-rice crops examined, garlic for export was the most economically efficient with an RCR of **0.31**. Although irrigated onion and peanut were also efficient import substitutes with RCRs of 0.50 and 0.74, respectively, irrigated rice in Central Luzon, evaluated at its long-term border price was still more economically efficient than these two crops with an RCR **of 0.45** (Table **4).**

Results of the analysis indicate that despite the high economic cost of irrigation water (Table **5)** due to the high subsidies (Table 6) for the specific irrigation systems in the two regions, garlic, onion and peanut production demonstrated that they are economically viable alternative production systems to rice in the use of irrigation water. For mungbean and white open pollinated corn, the problem lies in their relatively low yields (technology). In general, farmers have not totally adjusted their management practices **lo** effectively grow mungbean, corn, and other irrigated non-rice crops.

Table 5. On-farm financial and economic costs of irrigation water by crop production systems, dry season, llocos and Central Luron, Philippines, **1987.**

Crop	Cost of Irrigation Water (₱/ha)	
	Financial	Economic[a]
Ilocos		
Rice	**415**	**3,347**
Mungbean	**249**	**2,008**
Peanut	**249**	**2,008**
Garlic	**249**	**2,008**
Central Luzon		
Rice	**473**	**6.662**
Corn	**284**	**4,000**
Onion	**284**	**4,000**

[a] Calculated at **87.6%** and **92.9%** subsidy rates for llocos (LVRIS) and Central Luzon (UTRIS) irrigation systems, respectively.

Table 6. Estimate **of** subsidy in irrigation for Laoag-Vintar River Irrigation System (LVRIS) and Upper Talavera River Irrigation System (UTRIS), 1987.

I t e m s	LVRIS	UTRIS'
Total capital investment cost (₱/ha)[1]		
Financial cost (₱/ha of service area)	40,787	39,591
Economic cost (₱/ha of service area)[2]	35.885	34.833
Annualized economic cost of investment (₱/ha)	5,388	5,230
Annual cost of operation and maintenance (₱/ha)	583	2,276
Total annualized economic cost (₱/ha)	5,971	7,506
NIA-charges irrigation fee		
Wet season: 100 kg/ha	367	39I
Dry season: 150 kg/ha	374	I42
(economic price of palay each ₱3.67/kg)		
Cropping intensity	I.68	1.26
Effective irrigation fee/ha/yr	741	533
Percent subsidy (I - annualired cost / effective fee X 100)	87.80	92.90

'Includes construction and rehabilitation costs.
'Based on average implicit tariff (IT) for imported raw materials of 13.65%
'Based on **15%** discount rate. 50 years life span of the structure
'NIA charged irrigation fee *25* kg/ha/season higher than LVRIS. The economic price of palay was P3.13/kg in 1987

Source of basic data: NIA

Sustainability of compurarive advantage. Comparative advantage analysis is a dynamic concept. Therefore, results based on 1987 data should be considered as static indicators of the dynamic process towards economic efficiency. There are, however, several factors that determine the sustainability of comparative advantage. Among these are the resource endowments (agro-climatic) factors of the region where the crop production systems take place, farm level management that determines the technology and cost structure of the production system, and the economic environment (economic policy, domestic and international trade). The optimum interplay of these factors would determine the sustainability of competitiveness in the long-run.

Analysis of irrigated non-rice crops showed that at the given production cost and border prices for mungbean and white corn in 1987, yields should at least reach **1.20** t/ha and **3.23** t/ha, respectively, in order to maintain competitiveness as import substitutes (Table 7).

Table 7. Actual and breakeven yields for different irrigated crop production systems at given border prices. Ilocos and Central Luzon. Philippines, 1987.

Crops	Border ($/t)	Yield (t/ha)	
		Actual	Breakeven
Ilocos Region			
Rice	267.28	3.61"	1.63"
Mungbean	302.45	0.88	1.20
Peanut	307.29	1.80	1.34
Garlic	715.00	2.42	0.38
Central Luzon			
Rice	259.77	4.39[a]	1.84"
Corn	138.62	2.36	3 23
Onion	291 00	10.66	4.96

[a]Unhulled rice

For other commodities, such as garlic, onion, rice and peanut, breakeven yields to sustain comparative advantage were relatively lower than yields in 1987. This implies that if border prices and the structure of costs of production do not drastically change, the Philippines can sustain economic efficiency in domestically producing these irrigated crops.

Summary and Conclusions

The analysis compared the financial and economic viabilities of irrigated rice production with five irrigated non-rice crops. Results indicate that irrigated garlic, onion and peanut production systems were viable economic alternatives to rice in the use of irrigation water. Mungbean and white open pollinated corn, however, were not economically efficient production systems considering their low yields per hectare and the relatively high economic costs of irrigation water. Sensitivity analyses further showed that the Philippines can sustain long-term economic competitiveness in the production of irrigated garlic, onions, rice and peanut provided the cost of production and border prices of these commodities do not drastically change.

Finally, one should bear in mind that comparative advantage is a dyndmic concept. Although results from the analysis are static in nature, the power of this analytical tool is its ahility to examine alternative directions for policy reforms which insure that scarce resources can be allocated more efficiently.

References

Bruno, M. 1972. Domestic resource cost and effective protection: clarification and synthesis, JPE 80(1).

IIMI. 1986. Study of Irrigation Management for Crop Diversification. Final Report. TA **654** Philippines.

Gonzales, L.A. 1984. "Philippine agricultural diversification: a regional comparative advantage analysis". Final Report submitted to the Asian Development Bank **as a** sub-project component of Assessment of Food Demand/ Supply Prospects and Related Strategies for Developing Member Countries of ADB.

_________. 1988. "Agricultural incentives and comparative advantage of food crops production in Indonesia and the Philippines". Paper presented during the 7th Biennial Conference of the Agricultural Economics Society for Southeast Asia (AESSEA), Intercontinental Hotel, Manila.

_________. J.F. Sison, N.D. Perez and R.A. Guino. 1985. "The comparative advantage of diversifying to irrigated non-rice crops in the Philippines: **a** domestic resource cost approach". Interim Report submitted to the Asian Development Bank as a sub-component of the "Assessment of Food Demand/Supply Prospects and Related Strategies for Developing Member Countries of ADB, Phase II".

Guino, R.A. and **L.A.** Gonzales. 1988. Irrigation investment under different rice-based cropping patterns in the Philippines". Paper presentcd at the 4th Meeting of the Federation of Crop Science Society of the Philippines (FCSSP), Davao City.

Medalla, E.M. and J.H. Power. 1979. "Estimating implicit tariffs and nominal rates of protection". *In* Bautista, **R.M.** and J.H. Power, Industrial Promotion Policies in the Philippines. PIDS, Manila.

Rosegrant, M.W., L.A. Gonzales, H.E. Bouis and J.F. Sison. 1987. "Price and investment policies for food crop sector growth in the Philippines." Final Report submitted to the Asian Development Bank for the Project Study of Food Demand Supply Prospects and Related Strategies for Developing Member Countries of **ADH.** IFPRI, Washington.