

Comparative Advantage in Pakistan's Agriculture: The Concept and the Policies

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1. INTRODUCTION

The current debate on policy issues for enhancing agricultural productivity in Pakistan revolves around one issue and that is the substantial misallocation of resources in Pakistan's agriculture. As a result, it is believed, resources are drawn away from commodities in which Pakistan has a strong comparative advantage and towards commodities in which it is a relatively inefficient producer. Cotton is cited in the former and sugarcane in the latter case. It is suggested that if prices of these commodities are corrected and all distortions are removed, then increased specialisation, strictly in accordance with the comparative advantage principle, would ensure maximum gains from improved farm efficiency and enhance the welfare of the farm population. It is also argued that even if international prices of agricultural commodities decline due to the increase in production, Pakistani farmers should not suffer great losses since they currently receive prices which are far below the international prices [Chaudhry and Kayani (1991)].

It is in the context of this current debate about whether Pakistan should specialise in the production of one crop or should it diversify by producing several crops, that the present study is intended to be undertaken. The main objective of the paper is to evaluate the suitability of comparative advantage theory for making this crucial decision of choosing one crop for specialisation and trading it internationally for other crops.

The paper consists of five sections. As is usual the self-explanatory introductory Section 1 is followed by Section 2 which defines the comparative advantage principle and the concept of Domestic Resource Cost (DRC). Section 3 discusses the Pakistan experience and Section 4 gives a detailed critique of the DRC criterion on conceptual as well as on practical grounds. Section 5 derives conclusions and

policy implications of the study.

2. COMPARATIVE ADVANTAGE PRINCIPLE

The Concept and its Development

Comparative Advantage is defined to exist where the relative costs of producing different commodities differ between countries. David Ricardo, the proponent of the principle of comparative advantage, first gave this idea about how trading partners could mutually benefit from specialisation in production and trade under a given set of assumptions. In his two countries, two commodities model, he elaborated the principle by saying that comparative advantage would exist if the marginal opportunity cost of producing one good in terms of the other differed between the two countries. In such a case, each country would have a comparative advantage in one of the two goods and would gain by specialising in the production of that good and trading some of its output for the other good in which it has either no comparative advantage or has a comparative disadvantage. Each country would gain because trade and specialisation would enable it to achieve higher consumption levels.

Heckscher and Ohlin (Swedish Economists) refined the theory of comparative advantage by introducing the concept of factor proportions or factor endowment. According to their theory, the varied factor endowments of different countries lead them to the adoption of different production techniques that result in the emergence of comparative advantage, profitable trade and mutual benefits for trading partners.

For example, a country with a relative abundance of labour in relation to other factors of production such as land, capital and mineral resources, will be characterised by low wage rates relative to the prices of other factors of production. Thus, at the prevailing ratio of wage rates to the prices of other production factors, it would be optimal to adopt labour-intensive rather than capital-intensive techniques of production. Conversely, in countries with a relative abundance of capital to skilled labour, the ratio of wages to interest rates on capital will be high, and this should lead to an optimal choice of capital-intensive techniques. In the absence of trade, the price ratio of labour-intensive goods to capital-intensive goods will be lower in the labour abundant country and the reverse will be true in the case of capital abundant country. In accordance with the comparative advantage principle, it would be to the advantage of both the countries if the labour abundant country produces and exports labour-intensive goods in exchange for capital-intensive goods

from the capital abundant country.

Domestic Resource Cost (DRC) Coefficient:

A Measure of Comparative Advantage

The Domestic Resource Cost (DRC) coefficient has been recognised as a practical measure of comparative advantage of tradable commodities especially in the presence of factor and product market distortions [Chenery (1961) and Bruno (1967)]. The empirical studies on the DRC methodology generally follow the rules set by Corden (1966) and Pearson (1976). The concept in its true sense provides for the measurement of the social opportunity cost of domestic resources for earning or saving foreign exchange. It can be defined as a ratio of the value-added of primary factors of production such as land, labour and capital at their shadow prices to value-added in border prices. In other words, the DRC coefficient compares the social cost of using domestic resources with the net value for foreign exchange generated. If the DRC coefficient of a commodity, say wheat, is less than one i.e., the net foreign exchange earned by the domestic production of wheat exceeds its domestic cost also expressed in foreign exchange, then producing it domestically is an efficient way of saving foreign exchange and the produce exhibits international comparative advantage. Comparative advantage ceases to exist if the DRC coefficient is greater than one.

More precisely, the DRC coefficient for a tradable commodity can be represented by the following four equations [Mahmood (1994)]:

$$DRC_j = (DFC_j + DMC_j) / (P_j - M_j) \quad \dots \dots \dots (1)$$

$$DRC_j^* = DFC_j^* / (P_j - M_j^*) \quad \dots \dots \dots (2)$$

$$DRC_j^* = (DFC_j^* - VNTB_j) / [(P_j + VTB_j) - M_j^*] \quad \dots \dots \dots (3)$$

$$DRC_j^* = (DFC_j^* - VNTB_j - \alpha_j) / [(P_j + VTB_j) - M_j^*] \quad \dots \dots \dots (4)$$

In Equation (1), the DRC measure is based on "direct input analysis" and is called the *direct* DRC ratio. The term DFC_j is the direct value-added of domestic factors at their shadow prices involved in the production of commodity j . The DMC_j is the accounting value of the domestic non-traded inputs, used in the production of j . The $P_j - M_j$ in the denominator shows net foreign exchange savings/earnings

which is the difference between the per unit world price of j and the international value of imported input (M_j) required to produce a unit of commodity j .

Equation (2) gives the *total* DRC ratio. In fact the direct and the total DRC ratios are equivalent if one uses the correct valuation procedures.

Equation (3) incorporates tradable and non-tradable by-products which is a part of the production of a tradable commodity. $VNTB_j$ thus is the value of the non-traded items whereas VTB_j is the value of the traded by-products.

Equation (4) adds external benefits and costs to the DRC ratio by including the net external benefit (α_j) of an activity into Equation (3).

3. APPLICATION/EXPERIENCE IN PAKISTAN

The DRC criterion has recently been increasingly used to empirically estimate the international comparative advantage of Pakistan's major crops. Several studies have been carried out to estimate Pakistan's comparative advantage in various agricultural crops. Table 1 presents the results of these various studies.

As shown by the various DRC coefficients, a number of conclusions follow from Table 1. First, cotton seems to be the most profitable internationally traded commodity since it has the smallest coefficient among crops in all the studies. Although somewhat less pronounced, Pakistan also enjoys comparative advantage in the case of rice (*Basmati*), wheat, rice (Coarse) and followed by oilseeds. Sugarcane is the only commodity where the DRC coefficients have tended to significantly exceed one. Second, the estimated coefficients vary directly with the distance from a region to sea-port. For example, being closer to Karachi, Sindh has lower coefficients than those in the Punjab for all comparable crops. Rice is an exception due to the non-comparability of coarse rice grown in Sindh and the (*Basmati*) rice of the Punjab. Finally, the time period under consideration is an important determinant of the magnitude of the DRC coefficients pointing to the relative importance of technological change and variations in the world prices and weather conditions. For example, the drastic fall in the DRC ratios of cotton since 1982-83 must mainly be attributed to the introduction of new cotton varieties with a yield potential of 3 to 4 times that of the traditional varieties. By contrast, a haphazard time trend of coefficients for wheat, rice and sugarcane implies short term changes in production resulting from own-price variations relative to other crops or fluctuations in the weather conditions. The DRCs may also vary, to a limited extent, due to differences in procedures and data sources used in each of the studies.

Table 1
*Estimates of Domestic Resource Cost Coefficients
 in Various Studies for Different Crops*

Authors/ Study/Year	Domestic Cost Coefficients of							
	Wheat	Rice	Cotton	Sugar- cane	Cotton Seed	Soy- beans	Rapes/ Mustard	Sun- flower
Appleyard (Punjab)								
1982-83	0.91	0.40	0.70	-	-	-	-	-
1983-84	0.72	0.39	0.53	-	-	-	-	-
Appleyard (Sindh)								
1982-83	0.83	0.52	0.38	-	-	-	-	-
1983-84	0.66	0.50	0.31	-	-	-	-	-
Amir Mahmood (1987)								
	-	-	-	-	0.50	0.51	0.54	0.61
AERC (Sindh)								
1987-88	0.48	0.82	0.21	0.79	-	-	-	-
Mahmood Ahmed (Punjab)								
1989-90	0.51	0.77	0.45	-	-	-	-	-
Longmire and Debord (1990-91)								
Punjab	0.82	0.56	0.25	1.35	-	-	-	1.03
Sindh	0.74	0.92	0.23	1.20	-	-	-	-
Maan and Khawaja (Punjab)								
1991	0.86	-	-	-	-	-	-	-

Source: [AERC (1991); Ahmed (1993); Appleyard (1987); Longmire and Debord (1993); Maan and Khawaja (1993) and Mahmood (1991)].

4. CRITIQUE OF THE COMPARATIVE ADVANTAGE PRINCIPLE¹

There can be no doubt that cotton is one of the major agricultural crops in Pakistan. It is the second most important crop in terms of value-added and cultivated area. It is the only major agricultural commodity the production of which has exhibited rapid growth spurts throughout the past decade. Moreover, it is generally

¹The purpose here is not to deny the theoretical significance of the principle of comparative advantage but to pinpoint its limitations when applied to the uncertain and imperfect world of agriculture in the developing countries.

believed and debated, at all fora, and also in the present study, that Pakistan has an overwhelming comparative advantage in the production of cotton even without additional technological change but it does not specialise as much in cotton production as would be profitable. It is also suggested that if Pakistan specialises in the production of cotton (at export parity prices of course) that would leave the domestic textile industry with a major cost advantage over most competitors despite the high transaction costs endemic in Pakistan's agricultural transport and marketing system.

One of the most crucial questions that arises, therefore, is, should we rise to the call for specialisation in the production of a single crop that is cotton or should we diversify and produce several crops so that the total gains from the production of major agricultural crops are maximised. The question needs to be answered on two fronts: (1) Conceptual and (2) Practical.

Conceptual Assessment

Conceptually speaking, the DRC criterion is, at best, an imperfect measure of the assessment of comparative advantage. The existing literature has been critical of the DRC criterion and has noted many weaknesses. The following paragraphs give a detailed account of these weaknesses:

- (i) The estimation of the DRC ratios, as a measure of the comparative advantage requires the following three steps:
 - (a) The decomposition of the production cost of an activity into traded and nontraded cost components;
 - (b) the estimation of traded as well as nontraded inputs and outputs at their corresponding shadow prices; and
 - (c) the evaluation of the productive factors, such as labour, land, capital and foreign exchange, at their shadow prices.

The above requirements will not create any problem if there exists a full programming model and an economy-wide input-output table. In practice, however, the DRC ratios are usually estimated under less than ideal conditions. Thus, an assessment of the comparative advantage in the absence of accurate and adequate information regarding various parameters of a DRC-based model is open to speculation.

- (ii) The empirical relevance of the DRC analysis greatly relies on the

accuracy attached to the breakdown of the cost of production data into local and foreign exchange components. Any mis-specification error in this regard generates biased results by under- or over-estimating the existing level of comparative advantage. Although, there are not many complexities involved in the estimation of costs of directly imported inputs, the problem arises in the treatment of nontraded inputs which require traded inputs for their own production. The domestic non-traded inputs, the production of which need traded inputs, require a further decomposition into the traded inputs and the contribution of domestic primary factors of production. The estimates of the comparative advantage may still be subject to a bias if some portion of the nontraded cost (traded cost) in the numerator (denominator) of Equation (2) is wrongly included in the denominator (numerator).

- (iii) Furthermore, achieving an accuracy in the decomposition of production costs into traded and nontraded costs is necessary but not a sufficient condition to generate reliable estimates of comparative advantage. In the presence of product as well as factor market distortions, an assessment of the comparative advantage theory involves adjustments for price distortions present in such markets. A failure or lack of accuracy in the transformation of market prices into economic prices will lead to distorted estimates of the comparative advantage, with little practical relevance.
- (iv) The conversion of market prices into shadow prices involves the valuation of tradable inputs as well as outputs at their border prices, i.e., c.i.f. price for imports and f.o.b. price for exports, expressed in domestic or foreign currency at the official or shadow exchange rate. The border prices, however, require adjustments to incorporate the domestic distribution costs of a tradable commodity. An assessment of the comparative advantage which fails to incorporate the domestic distribution costs into the DRC estimation is open to question, especially, when such costs are significant.
- (v) Another requisite in the estimation of the DRC ratios is the valuation of the primary productive factors, e.g., land, labour, capital, and foreign exchange at their corresponding shadow prices. The shadow prices of the productive factors must reflect the cost to the society, in terms of output foregone, when these productive factors are moved from their best alternative use. The estimation of shadow prices, however, in the

absence of a full programming model is a difficult task. The DRC studies, while acknowledging the need for estimating the shadow prices of the productive factors, usually tackle this empirical issue in two ways²: first, by assuming that market prices of the productive factors are a good approximation for their corresponding shadow prices; and second, by selecting a figure considered to be a “reasonable approximation” to the shadow prices of a factor. Once again, the reliability of the comparative advantage assessment under the above assumptions is questionable. As, the accuracy of the DRC ratios will depend upon the extent to which market prices reflect shadow prices, or to the degree the arbitrarily chosen prices are in fact “reasonable” approximations of the shadow prices. Even when the shadow prices are correct they are subject to unexpected changes. The DRC criterion, however, fails to incorporate this element of uncertainty.

- (vi) Theoretically, the DRC coefficient is a net measure of comparative advantage. For instance, if a project generates benefits other than foreign exchange, for example, employment creation and learning effects, then these benefits need to be subtracted from the corresponding costs. In actual practice, it is difficult to incorporate such external effects in the estimation of the DRC coefficients (environmental damage provides another example). As a consequence the degree of comparative advantage, revealed by the DRC coefficient, may be biased and needs to be interpreted with caution.
- (vii) In spite of the fact that the DRC criterion has been considered to be one of the most important and powerful tools for policy-makers to measure economic efficiency for a range of economic activities, it has been criticised for its static nature which measures only the degree of the existing comparative advantage at a given time. Dynamic factors like increased capacity utilisation, the economies of scale, technological change, the effects of “learning by doing”, increased productivity and changes in the future prices of inputs and outputs which can influence the future pattern of comparative advantage are reported to have been ignored while estimating the DRC coefficient.

²These studies include important work by Bruno (1967); Krueger (1974); Bacha and Taylor (1973); Steel (1976); Schydrowsky (1984); Naqvi and Kemal (1983); Herdt and Lessina (1976) and Sukharomana (1983).

Concerns regarding uncertainty can be handled by the use of a technique called sensitivity analysis. But Mahmood (1994) argues that the use of sensitivity analysis to address uncertainties attached to the DRC estimates does not resolve the problem created by the unpredictable behaviour of certain parameters of a DRC model. The reasons cited are two: Firstly, sensitivity analysis is a useful tool only to the extent of testing the responsiveness of a DRC ratio to changes in a given parameter of a model, but offers little assistance if different values of a given parameter assumed different probabilities of occurrence. Secondly, sensitivity analysis is of little help when the objective is to analyse possible determinants of variation in the DRC ratios among various firms, belonging to the same industry or sector. This situation arises when the firms representing the same industry or sector have different levels of comparative advantage or disadvantage. In these conditions, an explanation of variations in the level of comparative advantage among various firms requires an analysis of firm-specific characteristics, such as firm size, labour/capital ratio, type of technology, capacity utilisation, type of ownership etc.

Looking at the various points of criticism against the DRC criterion one point that strikes the most is its static nature. It is a static measure which assesses the degree of the existing comparative advantage at a given time, and thus ignores any dynamic factors. The conditions which determine the extent of the existing comparative advantage of an activity are subject to change over time owing to the exogenous and or the endogenous factors. Consequently, a future pattern of comparative advantage can differ from its existing position. Therefore, an assessment of the future comparative advantage or resource allocation should not be made only on the basis of the existing pattern of comparative advantage. We may not have comparative advantage in cotton in future and some other commodities may turn out to become more profitable internationally.

Practical Problems

Specialisation on the basis of the comparative advantage principle in production is further plagued by practical problems. Many of the conceptual problems are compounded when the DRC criterion is applied to agriculture. First, theoretically speaking, production based on the principle of comparative advantage would be mutually beneficial to trading partners under free trade conditions. In practice, however, tariffs, quotas and trade restrictions are the norms of today's world. The fact, that the less developed countries that specialise in the production of a single primary commodity have often been denied the full benefits of specialisation, is well known to the whole world. Apart from the restrictive trade measures, the primary

producers could also be the victims of highly volatile world prices in terms of the loss of foreign exchange earnings and foregone incomes especially if they specialise in the production of a single commodity for instance cotton in the case of Pakistan. Second, agricultural production in Pakistan is heavily dependent on the whims of nature. Specialisation in cotton production, on a large scale, may be constrained by climatic and soil considerations. Even where such factors permit the cultivation of cotton, pest attacks, floods and nonconductive weather conditions may be tantamount to total loss of farm incomes. The recent virus epidemic is a case in point. The repeated cultivation of cotton on the same fields, as a result of increased specialisation, has been the most proximate cause of the afore-mentioned virus incidence. Third, although specialisation based on the principle of comparative advantage brings greater efficiency of the production process, this may not hold true in the case of its application to agriculture because of the seasonality of agricultural operations and certain agricultural inputs like irrigation water. While diversification allows the farmers to reallocate human and water resources among crops, specialisation tends to restrict this freedom. Furthermore, specialisation in a single crop would endorse seasonality to labour employment and will add to the already acute problem of underemployment. Finally, the DRC as a measure of comparative advantage is, at best, a rough measure, especially for a less developed country like Pakistan where even the actual prices of inputs remain undefined. This makes the estimation of their opportunity costs or social prices indeed a difficult, if not an impossible, task.

5. POLICY IMPLICATIONS

There is no doubt about the fact that the comparative advantage-based specialisation is mutually beneficial to trading partners under free trade conditions and must be pursued when such ideal conditions prevail. This, however, is hardly possible. Therefore, the comparative advantage principle can be applied with limited success in real world situations. Given the conceptual and practical problems for application of the principle of comparative advantage in agriculture, especially in a less developed country like Pakistan, the following implications can be derived for a successful strategy of agricultural development.

First, while the strategy of agricultural development must be guided by the development objectives, the appropriate pricing of the agricultural commodities are the most important means of accomplishing the task. Although the production of a commodity may be socially profitable, it carries no meaning for an individual producer as he responds to private profitability. The divergence between the social and private profitability results from government intervention which causes price

distortions in the commodity market. Consequently the prices paid to the producers fall short of the world prices. Unless producers are guaranteed world prices for commodities, progress in agricultural development, whether through specialisation or otherwise, would not be possible. It, therefore, follows that it would be in the best interest of Pakistan to raise agricultural commodity prices to world levels. In view of the vulnerability of producer prices to the market conditions and the highly volatile nature of the world prices, the government's role in the fixation of commodity prices determined by trend lines of the world prices seems inevitable.

Second, given international prices of agricultural commodities, there is no need for subsidies on agricultural inputs. However, the government needs to assure adequate supply, fair prices and equitable distribution of major inputs across various regions and farm producers.

Finally, in view of the immense risks involved in specialisation, diversification seems to be the most efficient way of ensuring stable and rapid growth of agricultural production. The strategy would be compatible with the stable and growing farm incomes as against all or zero outcome of specialisation. It would provide year-round employment with corresponding reduction in the underemployment of rural labour. The farm sector would make better use of human and water resources and would adjust their availability in an efficient manner. The government would be in a better position to handle its affairs independently rather than be at the mercy of foreign markets.

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Comments on
“Comparative Advantage in Pakistan’s Agriculture:
The Concept and the Policies”

Before I comment on the paper, I wish to say a few words about the authors. As you all know Dr M. Ghaffar Chaudhry, specialises in Pakistan’s agriculture and Ms. Shamim Sahibzada specialises in project evaluation and welfare gains from trade. The two together represent the unique specialisation necessary to analyse this important subject for Pakistan. Taking this opportunity, I congratulate both the authors for making this valuable contribution to the subject.

The main objective of the paper under review is to evaluate the suitability of “Comparative Advantage” theory for making the crucial decision of choosing one crop for specialisation and trading it internationally for other crops. The paper is basically a review piece and it is the classic example of the use of the concept of comparative advantage. The main body of the paper is divided into three sections. Two rather short sections dealing with the comparative advantage principle: the concept and its development and domestic resource cost (DRC) coefficient as a measure of comparative advantage and the application experience of this concept to Pakistan. The main contribution of the paper is its slightly longer critique of the comparative advantage principle, both in terms of the conceptual problems and the empirical application.

While both the concept of comparative advantage and of the DRCs as one of its measures is widely known in literature and so are the limitations, the strength of the paper is a critique of the use of these in the context of Pakistani agriculture which draws heavily upon Dr Chaudhry’s vast experience and keen insight into its problems. The authors correctly list several practical problems amongst them the fact that consumption based on the comparative advantage principle would be mutually beneficial to trading partners under free trade conditions. Also in the face of tariffs, quotas, trade restrictions and highly volatile world prices may not be beneficial for a small country attempting to specialise in the production of a single commodity. Moreover, by its very nature agricultural production is dependent on climatic and soil conditions and as shown in the example in the paper, increased specialisation can lead to the greater incidence of virus and disease. The problems

of seasonality of agriculture and of the resultant loss of employment in the off seasons by specialising in one crop are also hinted at.

The paper makes three policy recommendations: (i) that it is in the best interest of Pakistan to raise agricultural commodity prices to world price levels but at the same time giving government a role in the fixation of commodity prices; (ii) eliminate all subsidies on agricultural inputs and at the same time ensure adequate supply, fair prices and equitable distribution of major inputs across various regions and farm producers; and (iii) diversify agriculture so as to ensure stable and rapid growth of agricultural production. This, according to the authors, would ensure that the farm sector makes better use of human and water resources and would adjust to their availability in an efficient manner. In this way also, according to the authors, the government would be in a better position to handle its affairs independently rather than be at the mercy of foreign markets.

I have a number of small points that I would like to raise with the authors. These points should be taken as issues for clarification rather than as critical objections to this work.

- (i) The entire discussion ignores the strategic importance of food security. In fact in many instances, governments interfere with relative prices simply to ensure the security of adequate domestic production of food for its people. Leaving prices to the market alone, would lead to the sort of unimodal specialisation that the paper is hinting at. This specialisation is born out of the divergence between the private profit motive and the social priorities.
- (ii) The authors recommend the freeing up of the market so that commodity prices are fixed/determined by "trend lines" of the world prices. The paper does not address as to how such prices will be controlled at these levels especially in the light of the seasonality and uncertainty of agricultural production, both domestic and global.
- (iii) The entire community of agricultural economists is grappling with the issue of risk and uncertainty in agriculture. This has implications not just for price setting but is also one of the important reasons for crop and enterprise diversification at the farm level. The paper has not discussed these important determinants of what and how much is grown and why? Nor does it address these in the context of its proposal to set prices at global levels based on "trend lines".
- (iv) Agricultural economists use DRCs to merely indicate comparative advantage. It does not necessarily mean that they advocate policies to

ensure specialisation in one crop only. These merely indicate that there are distortions affecting different commodities differently the removal of which can lead to greater efficiency.

Despite these limitations the paper bears the mark of excellence that characterises all of Dr Chaudhry's work and I like to congratulate both the authors once again for putting up this effort.

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