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Return on the Investments in the agricultural and industrial systems: a new methodology for sugar cane and ethanol

REINALDO PACHECO DA COSTA
101, Professor Campos de Almeida, Vila Gomes, São Paulo, Brazil, 05591-045
Fone: 55-11-3091.5303
rpcosta@usp.br

KARINE LIMA DE CARVALHO
915, Itapimirum Street, Vila Andrade, São Paulo, Brazil, 05716-090
Fone: 55-11-3771.2311
karine.carvalho@poli.usp.br

ANTONIO RAFAEL NAMUR MUSCAT
128, Almeida Prado Street, University City, São Paulo, Brazil, 05508-900
Fone: 55-11- 30915363
armuscat@usp.br

Production Engineering Department of the Polytechnic School at University of São Paulo

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Abstract

This study analyzed the sugar and alcohol transfer price, aiming to get a consensus between these production systems, expressed under the relation between the sugar cane cost and the total industrial cost. For this, a methodology was proposed to equalize the return rates on the investments in the two systems: agricultural and industrial, allowing the determination of the sugar cane transfer price as a percentage of the total cost of alcohol/sugar that could be used in different situations when considering the agricultural, industrial and market phases.

Keywords: Transfer Price; Method of Expenditure; Economic Model

1. Introduction

When goods or services of a unit are transferred to another one in the same company, the evaluation of the performance each unit can be engaged for economic-financiers information inadequate about transfers, distorting the business-oriented results of yield of the sectors or units.

This work has as objective to analyze the transfer price of the sugar cane and ethanol suppliers and sugar and ethanol plant, with the intention to get a relation of partnership in the formation of the transfer price that could be of mutual profit.

The Brazilian production system sugar and ethanol is formed by thousand of agricultural companies (APS), called sugar cane suppliers, and some hundreds of sugar and ethanol plants (IPS). Although today this is total free sector in terms of the governmental intervention, there are negotiations of prices between the articulated subsystems by two great organizations that represent the two main intervening third-parties: the sugar cane suppliers and the sugar cane plants. Thus, the prices of the sugar cane are referred by negotiations between these entities, and can be understood as transfer pricing between participant units of a same agribusiness complex system.

As the determination of the transfer price affects inverse form, the profits of both of the parts, that is, its increase can cause agricultural improvement profits in detriment of the industrial, it will be developed a methodology for balancing the return rates on the investments in the two systems: agricultural and industrial.

2. Transfer Price

The use of the transfer price for the promotion of the organizational effectiveness is a question that has been studied because affects the results of the company, independent of its size, nature of products and economic sector performance.

With the growth of the economic groups, the productive systems adopt decentralized structures, motivated by the rules of the international trade and by the search yield, having as consequence exchanges between some units of production. Part of the unit production is transferred to another pertaining unit to the same group, where the costs inherent will have to be distributed by whom might benefit from them.

Historically, the transfer price has been a most complex and controversial problems decided by the corporations. (COGAN, 1999 *aput* KAPLAN, 1998).

The term " transfer price " was defined by Horngren (2000; p 636) as being "the price of a subunit (segment, department, division, etc.) of an organization that charges for the product or service supplied from the same organization ".

The transfer price according to Bernard (1998, p.324), "is a possible form for building of prices, technical, understood by all the accepted responsibility centers and accepted as the best form to integrate objectives and activities".

According to Kaplan and Atkinson (1989), the transfer price generally serves for two lines of conflict. In the first , as prices, they guide the process of local decision taking, helping the sugar cane producer company to decide how much to supply and the ethanol/sugar seller company how much to buy. In second, the prices and quantification of the subsequent profits assist to evaluate the yield of the companies, considering each one of them as a center of profits. The conflict between the supplier decision taking of the price and then the evaluation of the performance of each one of the sides of the productive chain is the essence of the quarrel of ` transfer prices '. The criteria for this determination, we have the based prices on the costs production,

market prices, and prices negotiated between companies that are selling and producing, beyond others as the balance of the return, that we will consider ahead.

The transfer price is used to support the coordination decisions of the division to reach the objectives of the corporation as a whole, to give conditions to the divisions to take decisions related to the final price of the product and to preserve the autonomy of the divisions.

3. The Sugar and Alcohol Sector in Brazil

The sugar and ethanol sector in Brazil is the oldest in the country, being linked to the important historical events of the country. Becoming today the most important agribusiness Brazilian sector, putting into motion about 2%[1] of the Brazilian GIP.

In the last years, the sugar cane agro industry increased its role of prominence in the economy of Brazil. With the growth of taxes around 5% a year, the dynamism of the market was stimulated by factors as the agricultural harvest increase, the exportation and the international prices, mainly of the sugar and ethanol markets (BACCHI, 2006).

Today the country is considered greater sugar cane world-wide, with a planted area of 7,04 million hectares and an annual harvest about 456 million tons. It is also, today, the most important sugar cane and ethanol producer in the world. The sugar production passed more than 8 million tons in 1990/91 for 28 million tons in 2006/07. In 2006, according to data of the Ministry of Agriculture and Cattle of Brazil (CNA), the sugar exportations had reached 18,87 million tons with the USS prescription 6.1 billion; a result 41% superior to the registered one in 2002. The main destinations of our product had been Arab Emirates, Russia, Nigeria, Canada and Egypt.

[1] Fonte: Instituto Brasileiro de Geografia e Estatística

4. The Sugar and Ethanol Production System

The sugar and ethanol production systems can be divided in three (3) subsystems, to know:

Agricultural Production (APS) - agricultural phase until the harvest (also)

Transport (TS)[2] - of the harvest until the discharge in the plant

Industrial Production (IPS) - of the discharge until the storage (sugar and ethanol).

For having different suppliers, sizes technologies and management systems of production, the degree of economic efficiency will be in greater or less ratio in accordance with: i) specific production function of each productive unit, ii) functions of costs (changeable, marginal and medium), where the prices of raw material are implicit including direct man power; e, iii) for the efficiency management.

4.1. Agricultural Production System -APS

The APS is formed by agricultural companies' production, that includes, in some cases, the raw material production sugar cane being managed by the proper processing plant. For conceptual ends, the APS will be treated, however, as being formed by independent agricultural companies.

The agricultural companies could be understood as the aggregate form as competition offers (perfect), therefore in the biggest part of the cases, there are many independent suppliers, that can supply a more than more on plant, characterizing a oligopolies market. (KOUTSOIYANNIS, 1976)

It could be affirmed, therefore, that the suppliers" companies possess different marginal costs for the sugar cane production, and that the offer curve would be the statistics composition of these different curves (curves formed above of the point

[2] Initially to simplify the analysis, the transport of subsystem will be enclosed in a model general. Moreover APS and IPS, there are a system named TS that have by function transport the sugar cane since of agricultural phase until industry phase.

where the changeable cost is minimum, when compared by the volume of production). (KOUTSOIYANNIS ,1976)

As the sugar cane production has increased costs mainly those which vary with the distance of the operations base to the plantation/harvest area, is permissible that the marginal cost for the sugar cane production has accented the curve in function of distance of the plantation, cultural treatments and operations of cut and shipment. It is important to observe that distance incurred for the sugar cane operations production is generally different from the distance incurred for the transport operations after-harvest, that lead to the different purchasers plants.

4.2. Industrial Production System - IPS

The IPS is formed by industrial plants, that form an oligopolies market system (few purchasers in terms of space localization), and many salesmen (sugar cane suppliers, that could, also, so be agricultural company to the plant).

It Could be affirmed, therefore, that plants possess different marginal costs for the ethanol and sugar production, and that the offer curve would be the statistics composition of these different marginal costs curves (curve formed above of the point where the changeable minimum cost, when compared by the volume of production).

As the sugar and ethanol production have been increasing the costs, mainly in function of costs that vary with the use of the capacity of the plant, it is permissible that the marginal cost has accented a little curve in function of the use of the capacity, in this industrial case.

In the industrial case there is a light growth of the marginal cost curve, consequence of that the changeable costs are little increasing with the produced amount, and that the fixed costs (of capacity) are given generally in the beginning of the annual

operation. Small economy of scale in the changeable costs exists, due to function production and prices of raw material that little affect the loss with the scale. It is permissible, also, that it does not have growth of the marginal cost; it can also have a decrease with the increase of the scale.

5. Balance Criteria of Return Rates

As the investments, they are significantly lower for the agricultural companies; the preliminarily accepted criterion for the parts was the price transfer would have to balance the return rates of the partners. This criterion should have to be complemented by the question of the economic productivity of the partners that present different operational incomes, economic and management - different marginal cost curves -, what also obligatorily should have to enter in the set of criteria to be satisfied by a "just" MODEL.

In the process of method selection for balance the return rates, some justifications had been pointed:

1. For long time, the return rates are equals to the internal return rates. The return rates is known as ROI - Return on Investment;
2. The calculation of return rates is relatively simple;
3. The return rates is understood and many used for the entrepreneurs;
4. There is facilities to decompose return rates in other pointers also detailed of enterprise interest (DUPONT method - GITMAN);
5. Use only one rate that is equally valid for the SPA, SPI and the set of these two subsystems, as if the production system understood simultaneously agricultural and industrial phases.

Therefore, the main questions that should be reflected, for propose a "just" model of calculation of transfer are:

1. The increase final price (sugar and ethanol) – if transferred with the same index (%) -, the transfer price, could cause impacts on the return rates on the different participants (suppliers and Plant). Next it will be showed the simulation of these impacts.

2. The agricultural production cost varies with the volume and distance of the plantation areas to the agricultural operations base (agricultural headquarters). With probability great this could be to imply different marginal costs production. The marginal cost is function of the distance (of the plantation) and the produced volume.

3. The transport cost varies with distance of the agricultural production area and the nature of the respective road type. The transport is offered by a great number of companies and many times for the proper purchasers plants. In this case, it would be ideal to separate these costs for calculate the transfer price.

4. The industrial production costs varies with the sugar cane price, the transport cost of the harvest and with the volume of production. It can be used the above comment that also suggests in the industrial case different marginal costs to modifying the volume of production.

5. If the growth of the marginal cost curve of the APS will be greater that marginal cost curve of the IPS (omitting the transport to the plant), when the prices of industrial products increase and will be transferred a constant rate percentage for the APS [Agricultural Cost / Total Cost], the profit of the IPS increases proportionally.

In principle it was necessary to separate the production systems.

The model that will be development, therefore, must be supported in basic criteria of balancing the return rates that is economic-financier justice criteria. Considering the exposit criteria, the detail specific economic model will be described.

6. Economic model of balancing Rate of Return

This model of balancing of the return rate (RR) will have to equal the return rates on the investments in the two systems: agriculture and industrial. For in such a way, it was demanded a construction of model that offers criteria of mutual profit to diverse stakeholders.

Therefore, the RR model try to calculate the revenue (agricultural point of view) that equals the return rates of the agricultural and industrial processes based on prices of the ethanol and sugar products in the final markets. In this case, it should be observed that the agricultural prescription is the raw material cost for the industrial phase.

Agricultural phase

I^1 - Total Agricultural Investment

C^1 - Total Agricultural Costs

R^1 = Transfer Revenue - (changeable of decision - incognito) - Revenue of the agricultural unit - sugar cane.

RR^1 - Internal Return Rates of the Agriculture phase

$RR^1 = (R^1 - C^1)/I^1$ (Profit divided for investment - agriculture)

Industry phase

I^2- Industry - Total Investment Industry

C^2- Total Industrial Costs (with exception of the raw material sugar cane)

R^2 - Annual Industrial Total Revenue

RR^2 - Internal Industry Return Rates of the Industry

$RR^2 = [R^2 - (R^1 + C^2)]/I^2$ (Profit divided for investment - industry)

Therefore, the balance condition enters the return taxes will be:

$$\mathbf{RR^1 = RR^2}$$

$$(R^1 - C^1) / I^1 = R^2 - [(R^1 + C^2)] / I^2$$

1) Calculation of R^1 - sugar cane production cost

$$R^1 = [C^1 . I^2 + (R^2 - C^2) . I^1] / (I^1 + I^2)$$

2) Calculation percentage of the sugar cane in relation to the industry:

As there is only one incognito (R^1), we have:

$$P r = R^1 / (R^1 + C^2)$$

Pr- is the relative factor between the total agricultural cost (R^1) and the total cost under of the point of view of the industry sector ($R^1 + C^2$).

Rearranging the terms of equation:

3) Sugar cane Revenue as function of excess of Profit of the system:

$$R^1 = [C^1 + [I^1/(I^1 + I^2)] * (R^2 - C^1 - C^2)]$$

Observe that ($R^2 - C^1 - C^2$) is excess of the agricultural system + industrial total. Important to stand out that this equation demonstrates the Revenue (R^1) to be transferred to the agricultural area must remunerate its costs (C^1), and to add a proportional result to the agricultural investment (I^1) relative to the total investment system ($I^1/(I^1 + I^2)$).

This shows that when having excess in the system as a whole, the agricultural sector could participate in accordance with proportional effort of investment.

7. Transfer Price Simulation

Let us admit the following data: (Values in R$ 1000,000.00)

Table1 – Simulation Transfer Price – Economic Model

	AGRICULTURAL			INDUSTRY	
	I^1 =	64		I^2 =	214
	R^1 =	?		R^2 =	108
	C^1 =	35		C^2 =	30
				AUM p =	0%
	Condition of Balance				
	TR^1	=		TR^2	
	$(R^1-C^1) / I^1$	=		$(R^2-R^1-C^2)/I^2$	
	0,15	=		0,15	
R^1 =	R$45				
Pr =	$R^1/(R^1+C^2)$		59,95%		

Observed that the relation between I^1 and I^2 is of ~ 30%

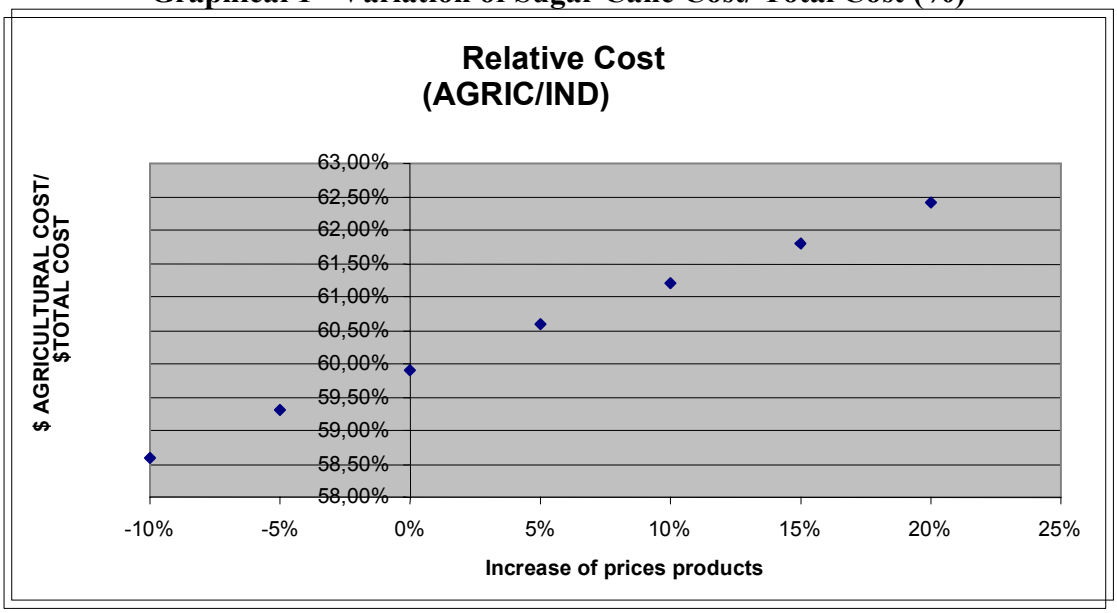
Considering the data of the table, the internal rates of return would be 15 % in year for both the activities.

8. Analysis of Model RR

When the price final product increases, it is necessary to change the relative factor between sugar cane cost and total costs of the industrial for activity return rate of the two partners keep balanced.

Moreover, the presented model will have to consider the transport costs so that these can be incorporated the analysis with intention to keep the balance criterion enter the return rates. The graphical synthesizes the results this relation between agricultural costs (R^1) and total costs ($R^1 + C^2$), being Pr = relation between agricultural cost (sugar cane) and total cost. In this case Pr = 59,95 %.

Graphical 1 - Variation of Sugar Cane Cost/ Total Cost (%)



9. Conclusion

When balancing the return rates, and separating the three production systems, through stratification and significant sampling, it was concluded that if the inclination of the cost curve of the system of agricultural production will be greater that the inclination of the marginal cost curve of the system of industrial production (omitting the transportation to the plant), and the prices of the industrial products rate are transferred to the constant agricultural production system (agricultural cost / industrial cost), the proportional profit of the agricultural production system increases. The opposite occurs when prices are lowered.

When considering the transportation curve, when prices increase, they can also, depending on the inclination of the curve, proportionally lower the profit of the industrial production system proportionally to the profit of the agricultural production system.

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