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Título: **On the microeconomic ingredients of *competitiveness*: efficiency, competition and differentiation.**

Resumen: *En este papel estudiamos los ingredientes principales que se consideran generalmente bajo concepto de la competitividad: la eficacia conectó a los costes de producción, de competición como medida de comportamiento y de diferenciación de producto; también consideramos el papel de las economías de la escala incluso si se consideran generalmente como variable tecnológica que afecta todas las firmas simétricamente. Deseamos determinar los efectos de estos " ingredientes " o de las fuentes de la competitividad en las variables relevantes del mercado en el equilibrio: precios, salida y beneficios. Nos centramos en la perspectiva de las decisiones firmes individuales de los revestimientos sobre competitividad y estudiamos los efectos de un movimiento tan unilateral. El marco del análisis es un modelo general del oligopoly con asimetrías en eficacia, la competición y la diferenciación. Pues esperado la eficacia de aumento es siempre una buena estrategia para la firma. Al menos aumentando el grado de competición y/o de diferenciación no sea siempre buenas estrategias para las firmas*

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Abstract

In this paper we study the main ingredients which are usually considered under the concept of competitiveness: efficiency linked with the costs of production, competition as a measure of behaviour and product differentiation; we also consider the role of the economies of scale even if they are usually considered as a technological variable affecting all firms symmetrically. We want to determine the effects of these "ingredients" or sources of competitiveness on the relevant market variables at equilibrium: prices, output and profits. We focus on the perspective of the individual firm facing decisions on competitiveness and we study the effects of such a unilateral move. The frame of the analysis is a general oligopoly model with asymmetries in efficiency, competition and differentiation. As expected increasing efficiency is always a good strategy for the firm. However increasing the degree of competition and / or differentiation are not always good strategies for the firms. The concept of competitiveness is not monolithic even if markets are perfect competitive; if they are not, *competitiveness* is more a political concept than a technical one and should be treated carefully in academic circles.

Key words: competitiveness, efficiency, conjectural variation, oligopoly, product differentiation.

Introduction.

The *competitiveness* of an economy is usually defined in a macroeconomic context as a combination of elements leading to:

1. a good performance in the foreign markets, and

2. a good effect in the welfare of the country involved,

It is usually assumed that both things move together in the same direction when *competitiveness* improves. Moreover, good performance is usually measures by increase of sales due to an offer of "good" or "competitive" prices. Therefore an increase in competitiveness should always lead to better prices, larger quantities and more welfare.

Krugman (1994) was the central author of a debate opened in 1994 on the meaning and use of the concept of competitiveness. He argued that the concept of *competitiveness* was meaningless when applied to a national economy. His main argument is that "countries do not compete with each other the way corporations do". The main reason is that trade is not a zero sum game; if our trade partners do well on welfare, better for us also.

When firms compete with each other in a foreign market -any market is foreign for a firm in the sense that their employees are not their main customers- it is clear that there is a direct link between a good performance in the market and a good effect in the "welfare" of the firm or its owner (profits). That is why the concept of *competitiveness* seems to be meaningful for a single firm or corporation in the sense given by Krugman.

In this paper we want to study *competitiveness* from a microeconomic point of view. Some authors argue that the competitiveness of a country is just the result of "adding up" the competitiveness of all the production units. The main elements usually included under this sometimes ambiguous term are efficiency, competition and product differentiation. The paper develops an oligopoly model in which we assume the firms differ from one another by one or more of the following factors:

The cost function, specially the marginal cost. The cost functions may differ by some parameters in a family of standard cost functions (quadratic costs).

The degree of competitive or collusive behaviour. We will use the conjectural variations approach as a reduced form of a family of oligopoly models with any kind of behavioural asymmetries.

The demand faced by each firm due to the existence of some horizontal product differentiation. We will use a family of lineal demand functions. The extension of the results to a iso-elastic demand is immediate when there is not product differentiation. .

We concentrate in analysing the comparative statics of all these parameters which differentiate oligopolists by their degree of *competitiveness* measured in terms of costs, competition and demand, with an special attention put on the effects of the changes in the parameters on the prices, the market shares and the profits. It can be proved that all the elements included

under the heading of *competitiveness* potentially have effects of different sign on these main market variables considered; we are specially interested in testing to what extent these ingredients reduce the price, and increase the quantity sold and the profits; we try to present a more sophisticated view of competitiveness. We will also consider the role played by the existence of economies of scale.

The paper presents a theoretical approach to the concept of *competitiveness* trying to understand its true microeconomic meaning in an static framework. It follows a partial equilibrium approach which relevance covers not only the agricultural sectors but also other exporting or even non-exporting sectors. We focus on the concept of *competitiveness* from the point of view of the individual firm facing this *competitiveness* either from other national producers or from producers based in third countries.

Unilateral increases of efficiency have a positive effect on quantity and profits; on the contrary, unilateral increases of competition have a positive effect on quantity but an ambiguous effect on profits; unilateral changes in product differentiation have also an ambiguous effect on profits. Therefore all the ingredients of *competitiveness* do not have the same effect on the market outcome; some of the ingredients of individual *competitiveness*, which may have a positive effect on aggregate social welfare, may also have a negative effect on the firm's profits; firms may not have incentives to increase *competitiveness*.

The paper will be structured in seven sections. Section 2 is devoted to the description of the asymmetric oligopoly model considered and the market outcome, given a set of parameters. Section 3 studies the comparative statics of the efficiency in production. Section 4 concentrates on the degree of competition or collusion. Section 5 deals with the product differentiation in consumers' demand. Sections 6 concentrates on the economies of scale. We end with a section which put together all the conclusions.

The model

Let us consider the following oligopoly model for an industry with i=1, 2, ..., N denoting each oligopolist in the market. Cost and demand functions for each oligopolist are:

$$CT_i = f_i + c_i x_i + k_i x_i^2$$

$$p_i = u_i - b_i x_i - bX_{-i}$$

where x_i is the quantity produced by firm "i", p_i is the market price for the differentiated product of firm "i", and $X_{-i} = \sum_{j \neq i}^{N} x_j$.

We assume $u_i > c_i$. We will use the concept of conjectural variation as the standard definition $\lambda_i = dX_{-i}/dx_i \in [-1, N-1]$ measuring the behaviour of each firm.

We solve the system of equations given by the set of N first order conditions of profit maximisation. Results can be written in terms of an intermediate parameter defined as follows:

$$\sigma_i = \frac{1}{2\frac{k_i + b_i}{b} + \lambda_i - 1}; \quad \sigma = \sum_{i=1}^{N} \sigma_i$$

We will assume $\sigma_i > 0 \quad \forall i$, so that equilibrium quantities are positive when there is no costs nor demand difference among firms. We will use also the following weighted averages:

$$U = \frac{1}{\sigma}\sum_{i=1}^{N} \sigma_i u_i; \quad C = \frac{1}{\sigma}\sum_{i=1}^{N} \sigma_i c_i$$

The market outcome can be characterised by the following expressions:

$$X = \frac{\sigma}{1+\sigma}\frac{U-C}{b}$$

$$x_i = \frac{\sigma_i}{b}\left[u_i - c_i - \frac{\sigma}{1+\sigma}(U-C)\right]$$

$$p_i = u_i + (u_i - c_i)\,\sigma_i\left(1-\frac{b_i}{b}\right) + (U-C)\frac{\sigma}{1+\sigma}\left[\sigma_i\left(\frac{b_i}{b}-1\right)-1\right]$$

$$\pi_i = \left[u_i - c_i - \frac{\sigma}{1+\sigma}\bullet(U-C)\right]^2 \bullet \left[\frac{\sigma_1}{b} + \frac{\sigma_1^2}{b}\bullet\left(1-\frac{b_1}{b}\right) - k_1\bullet\frac{\sigma_1^2}{b^2}\right] - f_1$$

We will use these expressions in order to obtain comparative statics results in the next sections. We will concentrate on one firm, call it i=1, and most of the results are presented in terms of the following aggregate parameters for all the rest of firms, call this aggregate i=2. This trick implies working as if there were only two firm and it implies no loss of generality.

$$\sigma_2 = \sum_{i=2}^{N}\sigma_i \;;\quad u_2 = \frac{1}{\sigma_2}\sum_{i=2}^{N}\sigma_i u_i \;;\quad c_2 = \frac{1}{\sigma_2}\sum_{i=2}^{N}\sigma_i c_i$$

We will assume that the profits of all active firms cover at least all variable costs. This will be true if and only if:

$$b_i + k_i > -\lambda_1 \bullet b$$

Efficiency.

There are upper and lower limits to the variation of the parameter of efficiency c_i . These limits are obtained from the lowest value of the market share (zero) and the highest value of the share (one). This results in the following relevant interval:

$$c_1 \in \left[c_1^{min}, c_1^{max}\right] = \left[\frac{c_2(1+\sigma_1)-U}{\sigma_1} + \frac{1+\sigma}{\sigma_2}(u_1-U), \frac{c_2\sigma_2+u_1}{1+\sigma_2} + \frac{\sigma}{1+\sigma_2}(u_1-U)\right]$$

It is proved the following result:

$$\frac{\partial p_1}{\partial c_1} > 0 \Leftrightarrow b_1 > \frac{\sigma_2}{1+\sigma_2}b$$

This means that the effect of c_1 (minimum marginal cost of firm 1, measuring inefficiency) on the price is positive whenever the product differentiation parameter b_1 is larger than a level below b. Remind $b_1 = b$ means no product differentiation. It seems reasonable to assume this condition must hold.

The following results can be proved:

$$\frac{\partial X}{\partial c_1} < 0 \;;\quad \frac{\partial q_1}{\partial c_1} < 0 \;;\quad \frac{\partial x_1}{\partial c_1} < 0 \;;\quad \frac{\partial x_2}{\partial c_1} > 0$$

This means that increases in efficiency always have a positive effect on total and individual output and on the market share of the firm.

Whenever $(b_1 + k_1)$ does not differ too much from "b" the sign of the derivative is the expected one:

$$\frac{\partial \pi_1}{\partial c_1} < 0 \Leftrightarrow b_1 + k_1 > \lambda_1 \bullet b$$

Which is true whenever profits cover variable costs as assumed.

These results can be summarized in Figure 1.

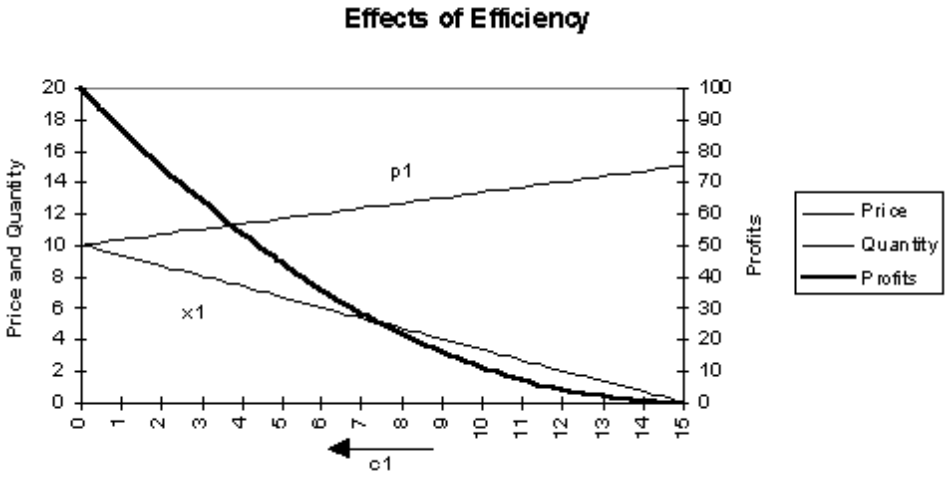

Figure 1: Effects of Efficiency in the case: $u_1=u_2=20$; $c_2=10$; $b_1=b=1$; $k_1=0$; $s_1=1$; $s_2=1$.

Efficiency has always the effects which we have assigned to competitiveness.

Degree of competition

The conjectural variable λ_1 defines the degree of collusion in each oligopolist behaviour. Since this parameter enters the solution equations only through the intermediate parameter σ_1, and $\frac{\partial \sigma_1}{\partial \lambda_1} < 0$, we can obtain the comparative statics of σ_1 and interpret them as the comparative statics of unilateral increases on the degree of competitive behaviour. In order to guarantee that the market shares are between zero and one we need to assume:

$$\sigma_2 \leq \frac{u_1 - c_1}{(u_2 - c_2) - (u_1 - c_1)} \quad \text{if} > 0$$

$$\sigma_1 \leq \frac{u_2 - c_2}{(u_1 - c_1) - (u_2 - c_2)} \quad \text{if} > 0$$

It can be proved that:

$$\frac{\partial \Phi_1}{\partial \sigma_1} < 0 \Leftrightarrow b_1 > \frac{\sigma_2}{1 + \sigma_2} b$$

Which we have assumed that holds.

It can be proved the following results:

$$\frac{\partial K}{\partial \sigma_1} > 0 \;;\; \frac{\partial s_1}{\partial \sigma_1} > 0 \;;\; \frac{\partial x_1}{\partial \sigma_1} > 0 \;;\; \frac{\partial x_2}{\partial \sigma_1} < 0$$

That is, an increase in the degree of competitive behaviour always increases the total and the individual output and the market share.

The effect of competition on profits is ambiguous:

$$\frac{\partial \pi_1}{\partial \sigma_1} > 0 \Leftrightarrow \sigma_1 < \frac{b(1+\sigma_2)}{2(1+\sigma_2)(b_1+k_1-b)+b} = \sigma_1^f \Leftrightarrow \lambda_1 > -\frac{\sigma_2}{1+\sigma_2}$$

This means that more unilateral competitive behaviour increases profits until we arrive to a point we could call σ_1^f. At this level of competitive behaviour, more competition has no effects on profits. At higher levels of competitive behaviour the effect of more competition is a reduction in profits. We can summarise this idea in Figure 2:

Figure 2: Profits and Competition in the case: $u_1=u_2=20$; $c_1=c_2=10$; $b_1=b=1$; $k_1=0$; values for $s_2=(0{,}5; 1; 2; 9)$.

The effects of a higher degree of competition on the individual firm can be better understood from Figure 3.

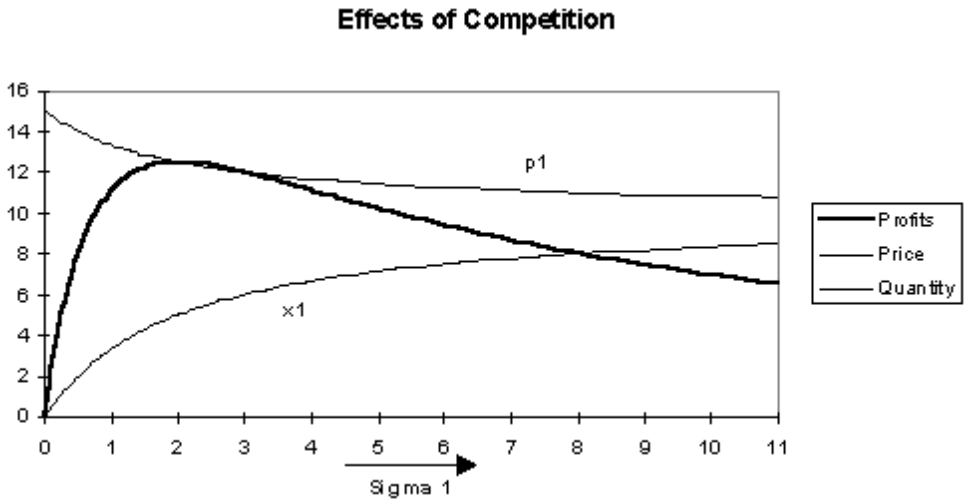

Figure 3: Effects of Competition in the case: $u_1=u_2=20$; $c_1=c_2=10$; $b_1=b=1$; $k_1=0$; $s_2=1$.

Competiton has the expected effects on price and quantity, coinciding with those assumed for *competitiveness*; the effect on profits is undetermined except if we assume the enviroment is perfect competitive ($\sigma_2 \to \infty$) which makes competition increasing profits.

Differentiation

There are two parameters related with product differentiation. Parameter b_1 affects the slope of demand. Parameter u_1 affects the position of demand, expanding or contracting the function with no change in the slope.

"Demand's slope" differentiation b_1

The following result can be proved:

$$\frac{\partial p_1}{\partial b_1} > 0 \Leftrightarrow \sigma_1 > \frac{b(1+\sigma_2)}{2(1+\sigma_2)(b_1-b)+b}$$

Therefore the derivative can be either positive or negative depending on the degree of competition and the value of other parameters..

The following results hold:

$$\frac{\partial X}{\partial b_1} < 0 \; ; \; \frac{\partial q_1}{\partial b_1} < 0 \; ; \; \frac{\partial x_1}{\partial b_1} < 0 \; ; \; \frac{\partial x_2}{\partial b_1} > 0$$

The effect of differentiation on profits is also ambiguous:

$$\frac{\partial \pi_1}{\partial b_1} < 0 \Leftrightarrow b_1 + k_1 > -\frac{1}{2}\left[\frac{\sigma_2}{1+\sigma_2} + 3 \cdot \lambda_1\right] \cdot b$$

Therefore this result is similar to that found for the degree of competitive behaviour. Differentiating the product can increase profits, but it can also reduce them, depending on the starting point of the oligopolist. If the degree of competition is low (l_1 large) the sign is always negative; if it is large (l_1 low) both signs are possible. In this second case, differenciating is profitable to certain extent, but the increase in profits comes from lower quantities at higher prices, which is not the profile assumed for an increase in *competitiveness*.These results are represented in Figures 4 and 5.

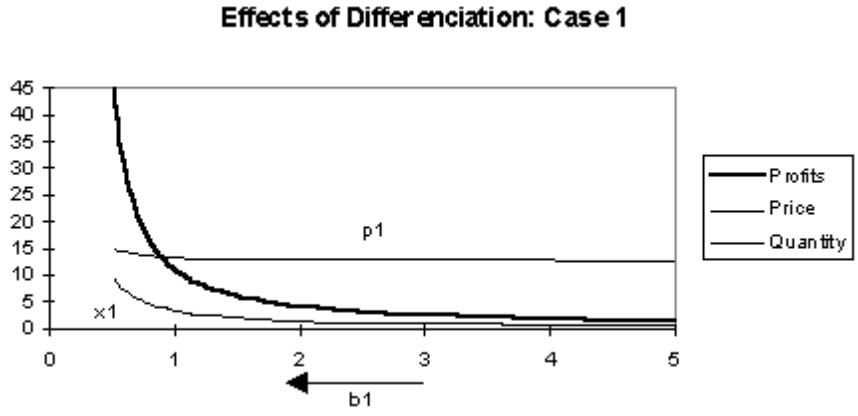

Figure 4: Effects of Differentiation in the case $u_1=u_2=20$; $c_1=c_2=10$; $k_1=0$; $s_2=1$; $l_1=0$; $b=1$.

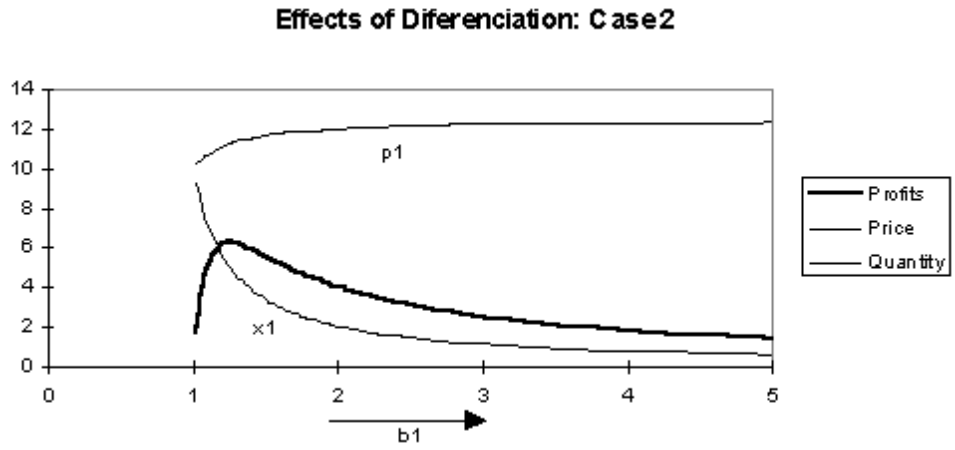

Figure 5: Effects of Differentiation in the case $u_1=u_2=20$; $c_1=c_2=10$; $k_1=0$; $s_2=1$; $l_1=-1$; b=1.

Begining from no differenciation (b=1 in Figures 4 and 5), profiting differenciation leads always to higher prices. When the enviroment es perfect competitve ($\sigma_2 \to \infty$), Case 2 arises, leading to an optimal differenciation with more rigid demand and higher prices. This profile does not fit with that of *competitiveness*.

"Demand's size" differentiation u_1

We obtain the following results:

$$\frac{\partial \hat{p}_1}{\partial u_1} > 0 \Leftrightarrow b_1 > -\lambda_1 \bullet b$$

$$\frac{\partial X}{\partial u_1} > 0 \; ; \; \frac{\partial \hat{s}_1}{\partial u_1} > 0 \; ; \; \frac{\partial \hat{x}_1}{\partial u_1} > 0 \; ; \; \frac{\partial \hat{x}_2}{\partial u_1} > 0$$

$$\frac{\partial \pi_1}{\partial u_1} > 0 \Leftrightarrow b_1 + k_1 > -\lambda_1 \bullet b$$

This kind of differentiation by expanding demand will generate higher quantities and higher profits whenever variable costs are covered by income as assumed for production to be carried out in the short run. Prices can rise or fall depending on the values of the parameters. The signs of the comperative statics in this case does not change when assuming $\sigma_2 \to \infty$.

Economies of scale

Short run des-economies k_1

Short run des-economies of scale can be measure by parameter k_1 . The corresponding comparative statics results can easily be obtained from section 4 since k_1 enters the equilibrium expressions only through s_1:

$$\frac{\partial \hat{p}_1}{\partial k_1} > 0 \Leftrightarrow b_1 > \frac{\sigma_2}{1+\sigma_2} b$$

Which we have assumed that holds.

We can also obtain the following results:

$$\frac{\partial X}{\partial k_1} < 0 \; ; \; \frac{\partial s_1}{\partial k_1} < 0 \; ; \; \frac{\partial x_1}{\partial k_1} < 0 \; ; \; \frac{\partial x_2}{\partial k_1} > 0$$

That is, an increase in the slope of supply always reduces the total and the individual output and the market share.

The effect of k_1 on profits depend on the parameters:

$$\frac{\partial \pi_1}{\partial k_1} < 0 \Leftrightarrow \lambda_1 > -\frac{1}{3}\left[\frac{\sigma_2}{1+\sigma_2} + 2 \bullet \frac{b_1 + k_1}{b}\right]$$

All these results are represented in Figure 6 (low competition by firm 1) and Figure 7 (high competition).

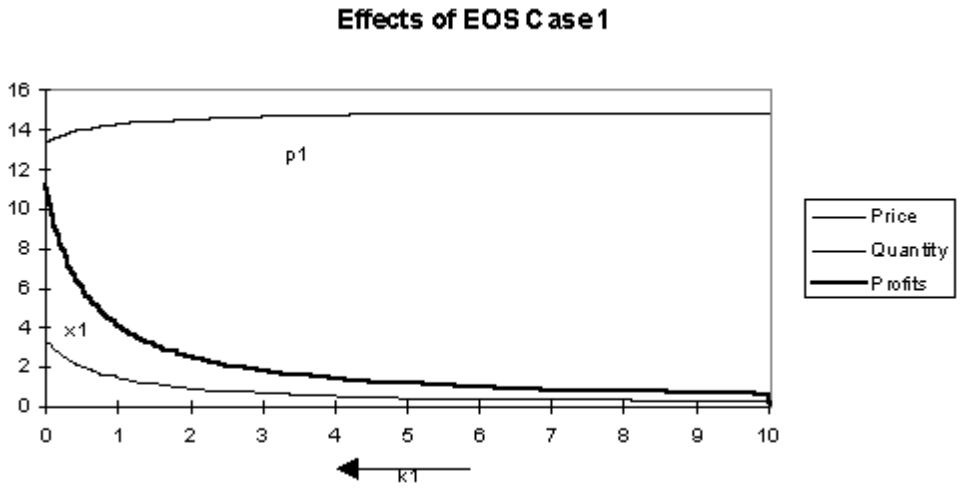

Figure 6: Effects of short run EOS in the case $u_1=u_2=20$; $c_1=c_2=10$; $s_2=1$; $l_1=0$; $b_1=1$; $b=1$.

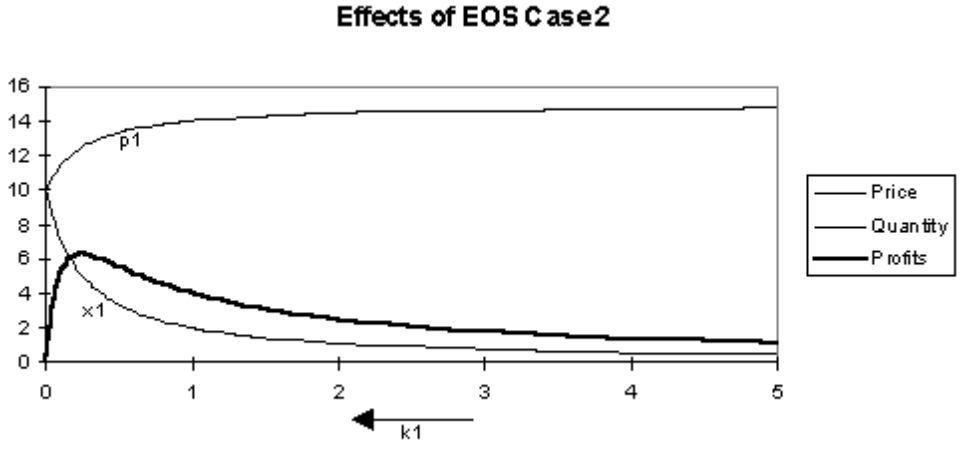

Figure 7: Effects of short run EOS in the case $u_1=u_2=20$; $c_1=c_2=10$; $s_2=1$; $l_1=-1$; $b_1=1$; $b=1$.

When the rivals behave as perfect competitive ($\sigma_2 \to \infty$), the first case arises: reducing k_1 generates a lower price and a higher quantiy and profits; this is exactly what *competitiveness* is assumed to do.

Long run economies f_1

There are also long run economies of scale coming from the fixed costs f_1 . We should measure this effects considering a long run equilibrium with free entry. If there is an increase in the fixed cost of firm 1 alone, its price and quantity will not change, but its profits will decline and in the long run the firm could leave the market if profits become negative.

Let us assume larger fixed costs affect also other firms, and we start from the marginal condition for the equilibrium as the zero profit condition for the marginal firm. It is obvious that starting from such a long run equilibrium, a larger fixed cost f_1 will reduce the number of firms in the market and therefore, it will reduce σ_2 . Assuming this is the only way the economies of scale have an effect on long run equilibrium, leads to the following results:

$$\frac{\partial \Phi_1}{\partial f_1} > 0 \Leftrightarrow b_1 < \frac{1+\sigma_1}{\sigma_1} b$$

which is true under the assumption of covering variable costs.

$$\frac{\partial K}{\partial f_1} < 0 \quad ; \quad \frac{\partial \pi_1}{\partial f_1} > 0 \quad ; \quad \frac{\partial x_1}{\partial f_1} > 0$$

The effects of profits will be likely negative.

Conclusions.

In Table 1 the effects of the main microeconomic ingredients of Competitiveness are analysed from the results in the sections above. An increase in Competitiveness it is supposed to reduce the price, and increase the quantity and the profits. Only the efficiency has this profile of effects. Competition, differentiation and economies of scale have different profiles.

Competition, and short run EOS may have under certain circumstances the profile of effects usually assigned to *competitiveness*. On the contrary differentiation and long run EOS can never have such a profile, so better dropping them from the concept of *competitiveness*; droping differenciation from the concept of *competitiveness* is a significant result.

In Table 1 we present the signs of the effecs of different potential ingredients of *competitiveness* on price, quantity and profits. The signs of the effect of efficency and competition would be the same if the demand curve was isoelastic, whenever we assume cosntant marginal costs and no differenciation.

TABLE 1

Microeconomic Ingredients of *Competitiveness* with Imperfect Competition

	Price	Quantity	Profits	
COMPETITIVENESS	ê	é	é	

	Price	Quantity	Profits	*Competitiveness*
EFFICIENCY (∇c_1)	ê	é	é	4
COMPETITION ($\nabla \lambda_1$)	ê	é	ì — î	6
DIFFERENTIATION Slope ($^{\Delta b_1}$)	low comp. high ê é	ê	low comp. high ê ì — î b_1<b better b_1>b	6
Size ($^{\Delta a_1}$)	é / ê	é	é	6
EOS Ñ s.r. des-EOS ($^{\nabla k_1}$)	ê	é	low comp. high ê ì — î	6
Ñ l.r. EOS ($^{\nabla f_i}$)	ê	ê	é	6

Table 2 presents the same effects of the different ingredients of *competitiveness* when the other agents in the market behave in a perfect competitive way ($^{\sigma_2 \to \infty}$). Under this assumption competition, and s.r. EOS have the *competitiveness* profile. The "slope" differentiation has not such a profile, more rigid demand being preferred by the firms.

TABLE 2

Microeconomic Ingredients of *Competitiveness* with Perfectly Competitive rivals

$\sigma_2 \to \infty$

	Price	Quantity	Profits	
COMPETITIVENESS	ê	é	é	
	Price	Quantity	Profits	*Competitiveness*
EFFICIENCY (∇c_1)	ê	é	é	4
COMPETITION ($\nabla \lambda_1$)	ê	é	é	4

DIFFERENTIATION Slope (Δb_1)	é	ê	ì — î better b_1>b	6
Size (Δa_1)	é / ê	é	é	6
EOS Ñ s.r. des-EOS (∇k_1)	ê	é	é	4
Ñ l.r. EOS (∇f_i)	ê	ê	é	6

Let me say a word on the economies of scale, which are also elements of the cost function. It is true that the long run EOS cannot have the profile of *competitiveness.* However the direction of the changes in EOS leading to higher profits are always reducing s.r. des-economies and reducing l.r. economies: firms prefer no EOS. This results is related with a dynamic ingredient of *competitiveness* that cannot be dealt in our static model: flexibility. The element nearest to this concept in our model is the reduction of both economies and des-economies of scale.

The question to be answered is if it has any sense to introduce these three ingredients -efficiency, competition, and s.r. EOS- inside a single concept called *competitiveness*. Including all aspects of *competitiveness* under this heading could have some economic sense for the individual firm only in one of the following two alternative cases:

Their effects on the market outcome -price, quantity and profits- have the same sign.

There is no doubt about the existence of an strong correlation among them.

This last alternative seems not to be observed as a general feature of the markets; the first alternative is in general not true except when the markets are perfect competitive. Only under this assumption all ingredients of competitiveness move market outcome in the same direction and the concept seems to have a clear and not misleading meaning. Including differentiation under the concept of *competitiveness* seems to be misleading.

The use of the concept of *competitiveness* has a political purpose trying to force certain behaviours by the economic agents. Even if all potential ingredients of *competitiveness* may be good for the economy as a whole, some of them can have negative effects on the firms profits. That is why a move towards "more *competitiveness*" can sometimes find strong resistance in many sectors.

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