A note on competitive toughness: why it should be identified neither with product substitutability, nor (inversely) with concentration. Toward a unified theory of oligopoly.

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Abstract

Often the intensity of competition has been measured through proxies like the degree of product substitutability or as the inverse of the degree of concentration in an industry. Both visions are based on the implicit assumption that few competitors imply a less though competition, but puzzles arise as several counter-examples exist. Other puzzling issues arise from the lack of a unified approach to oligopolistic equilibria (e.g. Cournot vs Bertrand competition). In this paper the unified approach of competitive toughness proposed by D'Aspremont et al.(2007), offering a generalization of the traditional oligopoly theory encompassing all the possible oligopolistic regimes between the Cournot and the competitive outcome, is discussed, also with respect to its implication for economic growth and macro studies.

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1 Introduction

Often the intensity of competition has been measured through proxies like the degree of product substitutability or as the inverse of the degree of concentration in an industry. A higher degree of product substitutability would tend to expose more each producer to competition as the consumer can substitute relatively easily that product with another one which is cheaper and have similar characteristics. In the limit case of perfect competition the product has to be homogeneous, i.e. perfectly substitutable. When the product is not perfectly substitutable, the monopolistic competition theory predicts that each firm has some market power; when the degree of substitution is very low, and in the limit case where products in an industry can be considered as complementary, each firm has a large market power that is generally identified with a situation of low competition.

On the other hand, the degree of concentration has been generally identified as an inverse of the intensity of competition because the more are the firms the more they are supposed to behave as price takers, which is another of the peculiar features of the school-case of perfect competition. On the contrary, when only few firms are active on the market, then the relation price-quantity on the whole market is (at least partly) internalized. The presence of few firms could make collusive practices more easily sustainable thus lowering the competition on the market and making the beneficial effect of the first welfare theorem to be unrealized. In other words, the implicit presumption is that when only few firms are active, they face less competitive pressure and they can exploit a higher market power leading to pareto-inferior outcomes than the case of perfect competition.

Notice that the two visions are in a sense very similar: producer of goods which have scarce substitutes as well as producers who cover a large share of the market face few competitors, operate in situation of weak competition and enjoy profits from their considerable market power. Both visions are based on the implicit assumption that few competitors imply a less though competition.

However there are several puzzling counter-examples that induce to think that such direct identifications are unsatisfactory. For instance, the oligopoly theory predicts that when firms compete à la Bertrand, by choosing the price, even a duopoly would yield a very tough competition with an ultimate outcome very far from collusion. Moreover the very fact that basic oligopoly theories predict such different outcomes simply according to whether the competition occurs on quantity or on price is problematic as it creates a hiatus in theory suggesting that a unifying approach would be desirable. Another counter-example can be represented by the theory of contestable markets by Baumol, Panzar, and Willig (1982), where the presence of very few firms (even one) can be associated to an effectively tough competition if market's features (e.g. no sunk costs, free entrance) are such that potential entrants can undercut the incumbent and gain positive profits.

As far as the identification with the inverse of the degree of product substitutability is concerned, an effective counter-example is readily provided by the Cournot oligopoly where although the product is homogeneous the competition is rather soft and the equilibrium outcome is quite far from the one of perfect competition. On the other hand, the monopolistic competition theory predicts that despite the good are not perfect substitutes in the long run competition prevents any positive net profit. Again it seems that a direct identification of the degree of product substitutability with the intensity of competition is at least misleading.

Furthermore, if a dynamic perspective is taken, things become even more tricky. Is innovation (and hence economic growth) fostered with a large number of firm (and so a low degree of concentration) because they feel the pressure to innovate in order to "survive" on the market? Or it is when the concentration is high that more R&D can be funded through monopoly rents thus spurring economic growth? And again, is it actually correct the link between more firms and higher competition? In light of all that it seems clearly unappropriate to identify the intensity of competition either with the degree of product substitutability or with the inverse of the degree of concentration. Moreover it would be desirable to have a unified theory able to take into account in a unique framework the different implications suggested so far. Thus, as a corollary of the theoretical framework offered by the generalizations of oligopoly theory worked out by d'Aspremont, Dos Santos Ferreira and Gérard-Varet (2007a), in this short note we are going to show that there is no unambiguous answer to these questions, and that competitive toughness has important and contrasting effects which cannot be merely identified with the number of firms active on the market.

The rest of this essay proceeds as follows. In Section 2 we discuss the approach of d'Aspremont, Dos Santos Ferreira and Gérard-Varet (2007a) and d'Aspremont and Dos Santos Ferreira (2007), according to which the degree of competition is an intrinsic features of the firms' choices, which cannot be uniquely identified with the number of competitors or the degree of market substitutability. Every competitive configuration (represented by the lagreangean multipliers on constraints faced by the firm) can be a self-enforcing oligopolistic equilibrium. Section 3 is more macro-oriented relating the kind and intensity of competition to R&D-activity which is acknowledged to be the engine of growth in the neo-Schumpeterian growth theory (see Aghion and Howitt (1998)). Finally in Section 4 some conclusive remarks can be found.

2 Oligopolistic Equilibria and Competitive Toughness

Following d'Aspremont, Dos Santos Ferreira and Gérard-Varet (2007a) we propose an approach that offers a generalization of the traditional oligopoly theory encompassing all the possible oligopolistic regimes between the Cournot and the competitive outcome. The main feature is that the regimes are naturally parameterized by a coefficient which is straightforwardly interpretable as the competition toughness of the market. In a further step, this competitive toughness can be seen as strategically chosen by the firms (d'Aspremont and Dos Santos Ferreira (2007)). In this way not only a unified framework to interpret the indeterminacy of oligopolistic equilibria is proposed, but it appears clearly that the degree of concentration alone cannot account exactly for the intensity of competition, whilst both the concentration and the competitive toughness concur to determine the degree of monopoly (measured by the Lerner index). This is highlighted in Subsection 2.1 where the product is assumed to be homogeneous. In Subsection 2.2 the analysis is extended to the case of composite product in order to show that the degree of substitutability is a distinct concept from the competitive toughness too; also in this case, the competitive toughness concurs with the degree of substitutability to determine the degree of monopoly.

2.1 Homogeneous Product

Suppose we have an industry where $n > 1$ firms produce a homogeneous good. Technology of firm i is described by an increasing cost function C_i without sunk costs ($C_i(0) = 0$). Firms play a simultaneous game where the strategies are contracts (p_i, q_i): each firm proposes to sell the quantity q_i at the price p_i, committing itself to match its price to the lower price charged by its competitors: $\underline{P}(p_i, p_{-i}) \equiv \min_j\{p_j\}$. Moreover, each firm takes into account the collective constraint that total output ($\bar{Q}(q_i, q_{-i}) \equiv \sum q_j$) cannot exceed total demand at the best price ($D(\underline{P})$), that is each firm feels constrained by its residual demand. This implies that payoffs are described as follows:

$$\Pi_i(p_i, q_i, p_{-i}, q_{-i}) = \underline{P}(p_i, p_{-i})q_i - C_i(q_i) \text{ if } \bar{Q}(q_i, q_{-i}) \leq D(\underline{P}(p_i, p_{-i})) \quad (1)$$

$$\Pi_i(p, q) = -C_i(q_i) \qquad \text{otherwise} \quad (2)$$

An oligopolistic equilibrium is then a $2n$-tuple (p^*, q^*) which is a Nash equilibrium of the game described above and satisfying the additional restriction $\bar{Q}(q^*) = D(\underline{P}(p^*))$.[1]

D'Aspremont, Dos Santos Ferreira and Gérard-Varet (2007a) show that the pair (p^*, q^*) is an oligopolistic equilibria iff each firm solves the program:

$$\max_{(p_i,q_i)\in\Re^2_+} \left\{ p_i q_i - C_i(q_i) : p_i \leq \min_{j\neq i} p_j^* \text{ and } p_i \leq D^{-1}(\bar{Q}(q_i, q_{-i}^*)) \right\} \quad (3)$$

The first constraint refers to the market share, and we denote its multiplier by λ_i; the second constraint is related to the market size: we denote its multiplier by ν_i. The two multipliers can be interpreted as the shadow values of relaxing marginally the competitive pressure coming from the constraints. By defining $\theta_i \equiv \frac{\lambda_i}{\lambda_i+\nu_i}$ one can obtain a measure of competitive toughness of firm i in the industry based on the weight of the multiplier on the market share relative to the one referred to the market size.

Furthermore the degree of monopoly of firm i at equilibrium (p^*, q^*) - ex-

[1] This last requirement is introduced both to exclude rationing of consumers at equilibrium and to eliminate irrelevant equilibria.

pressed by means of Lerner index - can be written as function of θ_i:[2]

$$\frac{p_i^* - C_i'(q_i^*)}{p_i^*} = (1-\theta_i)\frac{q_i^*/\overline{Q}(q^*)}{\epsilon} \equiv \mu_i(\theta_i, \underline{P}(p^*), q^*), \tag{4}$$

where ϵ is the elasticity of demand with respect to price. The set of possible symmetric equilibria includes the Cournot solution ($\theta = 0$), the competitive equilibrium ($\theta = 1$), and all outcomes corresponding to intermediate values of θ, including the outcome corresponding to Bertrand competition.

It is readily seen that competitive toughness θ_i and market share $\frac{q_i^*}{\overline{Q}(q^*)}$ both play a role in determining the degree of monopoly but they cannot be identified. A higher toughness or inversely a lower market share reduce the mark-up but they are in principle different things, so that we can observe equilibria characterized by low mark-ups despite of high concentration in the market because of a tough competition among the firms. This is what occurs in the case of contestable markets where even if a firm owns large share of the market cannot enjoy high profits because the competition is enough tough. On the contrary we could observe a situation where many firms operate in the market, but the competitive toughness is low so that certain degree of monopoly can be sustained even if the product is perfectly homogeneous.

D'Aspremont and Dos Santos Ferreira (2007) then show that θ itself can be seen as the outcome of a strategic choice. More in details, each firm with probability $1-\theta_i$ respect its list price p_i and sells $\min\{q_i, D(p_i) - q_j\}$. With probability θ_i it behaves aggressively, supplying at the discount price $\min\{pi, p_j - \delta\}$ the whole quantity it can actually sell at that price.[3] It can be shown that the Lerner index at equilibrium is analogous to eq. (4) if $\delta \to 0$.

When the firms chooses θ_i in the preliminary stage, it takes into account that the expected profit is given by the product of degree of monopoly, market share and total expenditure in the industry. By being more aggressive the firm might increase the market share but the degree of monopoly is eroded (see eq. (4)) while the response of expenditure depends on demand elasticity

[2] With $p_i^* = \underline{P}(p^*)$ and $q_i^* > 0$, the expression in eq. (4) is obtained by dividing the marginal revenue by the price, multiplying and dividing for q_i^* and $\overline{Q}(q^*)$, and substituting the parameters for q_i^*. See d'Aspremont, Dos Santos Ferreira and Gérard-Varet (2007a) for further details.

[3] This captures the idea that competition entails not only a pacific side by which it brings the beneficial effect implied by the first welfare theorem but also a warlike side through the struggle for market shares.

(positive if demand is elastic). In such a set-up a higher market share could be associated with a tougher competition, resulting in lower mark-ups. On the contrary a compromising strategic (low θ) could be consistent with moderate market shares. Again this suggests how the intensity of competition should not be identified with the (inverse) of market concentration.

2.2 Composite Product

In this subsection we extend the analysis to the case of a composite good to show that also the degree of product substitutability cannot be used unambiguously to identify the intensity of competition. Moreover it turns out that a higher competitive toughness can have very different implications in terms of degree of monopoly according to the substitutability of intra-industry products relatives to extra-industry ones.

In order to focus on the demand over a certain group of goods x, let us assume that utility are quasi-linear: $U = u(x) + z$, with $x \in \mathbb{R}^n_+$ and $z \in \mathbb{R}_+$. The good z is the numeraire, whereas the vector of goods x yields a utility $u(x)$, which could exhibit different degrees of substitutability varying form the linear case to the Leontieff case. Denoting by p the price vector of goods x and by w the income, the following budget constraint applies: $px + z \leq w$. The consumer problem can decomposed into a first stage where is minimized the expenditure on the composite good provided a certain utility $\underline{u}$ is obtained (which defines the expenditure function: $e(p, \underline{u})$), then in the second stage U is maximized over $\underline{u}$ meeting the budget constraint on total spending: $e(p, \underline{u}) + z \leq w$. Let us denote by $\bar{D}(p)$ the solution in $\underline{u}$ to the consumer problem. Since the expenditure on the composite good depend on p, the overall consumer problem identifies demand as a function of prices: $D(p)$.

Firms maximize profits by choosing $(p_i, q_i) \in \mathbb{R}^2_+$. The profits are defined as follows:

$$\begin{aligned} \Pi_i(p_i, q_i, p_{-i}, q_{-i}) &= \min\{p_i, \psi_i(p_{-i}, q_i, q_{-i})\} q_i - C_i(q_i) \qquad (5) \\ &\qquad \text{if } u(q_i, q_{-1}) \leq \bar{D}(p_i, p_{-i}) \\ &= -C_i(q_i) \qquad \text{otherwise} \qquad (6) \end{aligned}$$

where the best price ψ_i is the solution to: $p_i = \partial_u e(p_i, p_{-i}, u(q_i, q_{-i})) \partial_i u(q_i, q_{-i})$. An oligopolistic equilibrium is a Nash equilibrium of the oligopolistic game which satisfies also the requirement that the utility derived by the equilibrium quantity matches the level of utility the consumers desire at the equilibrium prices: $u(q^*) = \bar{D}(p^*)$.

D'Aspremont, Dos Santos Ferreira and Gérard-Varet (2007a) show that the same set of equilibria can be obtained through an auxiliary game where the pay-off is denoted by:
$\Pi_i = (p_i, q_i, p_{-i}, q_{-i}) = p_i q_i - C_i(q_i)$, subject to the following constraints:

$$\frac{q_i}{H_i(p_i, p_{-i}, u(q_i, q_{-i}))} \leq 1 \tag{7}$$

$$\frac{e(p_i, p_{-i}, u(q_i, q_{-i}))}{B(p_i, p_{-i})} \leq 1 \tag{8}$$

where H denotes the hicksian demand and B the optimal expenditure on the composite good. If one of the constraint is not met profits are simply equal to $-C_i(q_i)$. Provided no-rationing requirements are satisfied,[4] the equilibrium of such a game are the same of the oligopolistic game. Denoting by λ_i and ν_i the lagrangean multipliers associated with constrains (7) and (8), they can be normalized by defining: $\theta_i = \frac{\lambda_i}{\lambda_i + \nu_i}$. Again this θ_i can be interpreted as an index of competitive toughness measuring the relative importance of the competition within the industry relative to the importance of the industry size. Similarly than in Section 2.1, θ can be also seen as measuring the relative weight of the constraint on the market share (7) with respect to that on the market size (8).

In the case of homothetic utility, if we denote equilibrium values of the budget share of good i by α_i^*, the elasticity of the hicksian demand with respect to q_i by ϵ_i^*, the elasticity of substitution of good i by s_i^*, the elasticity of demand to the industry via good i by σ_i^*, the Lerner index at equilibrium reads:

$$\mu_i^* = \frac{\theta_i(1 - \epsilon_i^*) + (1 - \theta_i)\alpha_i^*}{\theta_i(1 - \epsilon_i^*)s_i^* + (1 - \theta_i)\alpha_i^*\sigma_i^*} \tag{9}$$

which can be seen as an harmonic mean of $1/s_i^*$ and $1/\sigma_i^*$. Again this solution encompasses several cases of oligopolistic equilibria, from the one characterized by the minimum competitive toughness ($\theta = 0$, i.e. collusion) to the maximum competitive toughness ($\theta_i = 1$, i.e. monopolistic competition),

[4] The rationing requirement is in this case: $q_i^* = H_i(p^*, u(q^*)) = X_i(p^*, B(p^*))$, $i = 1, \ldots, N$.

including in between the same outcome of Cournot and Bertrand competitions.[5] Equation (9) disentangles the effect of competitive toughness from those related to product substitutability.

In order to get more intuitive insights, we focus on the case of quadratic utility and symmetric equilibrium. Then the Lerner index is:

$$\mu^* = \frac{\beta - 1}{\beta + \frac{\theta(1-\alpha)s + (1-\theta)\alpha}{\theta(1-\alpha) + (1-\theta)\alpha}} \tag{10}$$

where s denotes the ratio of intra versus inter-sectoral substitutability, and $\alpha = 1/n \in (0, 1/2)$ denotes the degree of concentration, finally β is related to the market size. Eq. 10 is very useful because, despite it represents a particular case, it gives insights on the different elements concurring to determine the degree of monopoly: the degree of concentration, the product substitutability and the tough attitude by the firms. By taking derivatives one can see that μ is unambiguously decreasing in s, implying that industry characterized by high degree of substitutability within the sector features ceteris paribus lower degree of monopoly. The effect of the degree of concentration α and the competitive toughness θ is nevertheless ambiguous. In particular we have:

$$\frac{\partial \mu}{\partial \theta} > 0 \quad \text{iff} \quad s < 1 \tag{11}$$

$$\frac{\partial \mu}{\partial \alpha} > 0 \quad \text{iff} \quad s > 1 \tag{12}$$

The former partial derivative shows that increasing competitive toughness would increase the degree of monopoly only in industries where goods are relatively less substitutable. The intuition behind this result is as follows: a more aggressive conduct by the firm could work either through decreasing price in order to get a larger market share, either through increasing price to increment the degree of monopoly. Clearly, the latter strategy is profitable only provided that the goods are sufficiently unresponsive to changes in prices, which is the case of an industry characterized by complementary goods. Therefore a higher degree of monopoly can be consistent both with a low competitive toughness (the case of high degree of substitutability) or

[5] Notice that the extreme outcome of collusive solution can be obtained also for $\epsilon^* = 1$, whereas the monopolistic competition outcome can be implied also by a low α_i^*.

with a high competitive toughness (the case of complementarity). It appears clearly that inferring the intensity of competition from the degree of substitutability would be misleading. Consider for example the case of high substitution: measuring competitive toughness by the degree of product substitutability would lead to conclude that the market is characterized by a very tough competition and low mark-up, whereas it may well be possible that mark-up are not negligible because the competitive toughness is low.

3 Implications for Economic Growth

In the previous section it has been remarked that competitive toughness refers essentially to conduct of firms and hence should not be identified neither with the degree of concentration nor with the degree of substitution, which are more structural characteristics of an industry. Now, it is interesting to relate the impact of competitive toughness on degree of monopoly with the implications for long run growth. In particular which is the the effect of increasing toughness on economic growth?

Among the so-called New Growth Theory, neo-Schumpeterian models[6] have highlighted the crucial role of R&D investment to spur economic growth. This idea which can be traced back to Schumpeter (1942) raises the issue of whether high or low competition is more favorable to invest on R&D. On one side, one can claim that a competitive environment forces the firms to perform more R&D giving them high incentives to outstrip their competitors (see Arrow (1962)); on the other side the basin of monopoly rents can be used to fund higher R&D. Moreover, based on the common assumption that the degree of competition is higher with more firms, models with very different implications have been proposed: in probabilistic set-up, more firms are associated with a higher overall frequency of innovation (Reingaum (1989)), but in deterministic set-up, the presence of many firms could lower the incentive to innovate (Dasgupta and Stiglitz (1980)). Actually we have seen that high competition does not necessarily come with many firms: on the contrary it may well be the case that a tough competition forces firms to leave the market with the surviving firms not necessarily able to charge high mark-up. All these considerations suggest that the impact of competitive toughness on

[6] See Aghion and Howitt (1998).

R&D might be ambiguous.

Following d'Aspremont, Dos Santos Ferreira and Gérard-Varet (2007b), we sketch a model of strategic R&D, which uses the concept of oligopolistic equilibria of Section 2. In an overlapping generation framework, two-periods-lived firms compete first in R&D and then in production. In the first period they are symmetric, then in the second period, according to the probabilistic outcome of R&D, they compete in an oligopolistic regime. Provided the relative cost advantage of successful firms is not too high[7], unsuccessful firms are not necessarily wiped out from the market.

Solving backwards, the maximization of profits in the second stage is subject to constraints on market share and market size, in a similar fashion as the problem in eq. (3). Normalizing the lagrangean multipliers associated with those constraints, the index of competitive toughness θ_i can be obtained as described in Section 2, and the resulting Lerner index is as in eq. 4. Notice anyway that now firms differ with respect to their costs depending on the outcome of R&D. Let us assume that $C_i = C(\chi_i)$, where $\chi_i = 1$ if firm i succeeded, $\chi = \sigma \in (0,1)$ if firm i despite not suceeding can benefit from spillovers, and $\chi = 0$ in case no success and no spillovers occur. Clearly: $C(1) < C(\sigma) < C(0)$.

Assuming that all firms have a symmetric competitive conduct (i.e. $\theta_i = \theta \; \forall i$), it is possible to write the profit of firm i as:

$$\Pi_i(\chi_i, n, N, \theta) = (1-\theta) \;\; m(\chi_i, n, N, \theta)^2 \tag{13}$$

The function $m(\chi_i, n, N, \theta)$ denotes the resulting market share of firm i as dependent on the firm-specific costs, the number of innovators n, the total number of firms N, and the parameter characterizing the competitive toughness of the oligopolistic equilibrium θ. At the first stage, the decision of how much investing on R&D depends on the expected incremental gain of being an innovator, that is:

$$G(n, N, \theta) = \Pi_i(1, n+1, N, \theta) - \Pi_i(\sigma, n, N, \theta) \tag{14}$$

Eq. (13) and (14) show the twofold effect of θ: on one hand, it squeezes profits trough reducing mark-up, and hence also the scale of gains by successful invention; on the other hand θ increases the difference incremental

[7]This requires a small innovation step or large spillovers.

gain in the market share in case of successful invention: $m(1, n+1, N, \theta)^2 - m(\sigma, n, N, \theta)^2$, which means that by being more aggressive a successful firm could achieve a larger market share. Hence the model is able to capture two contrasting effects of competitive toughness: the profit-squeezing one and the concentration-enhancing one.

Moreover the importance of the latter effect clearly depends on the relative advantage (i.e. the reduction in cost) of a successful firm with respect to the case where the firm could benefit anyway from spillovers. Provided that this relative advantage is neither too big to eliminate from the market unsuccessful firms,[8] nor too low so that the incremental gain from being an innovator is important,[9] then the relation between θ and G is inversely U-shaped, implying an enhancing effect of the competitive toughness on R&D at low level of competitive effort, and a decreasing effect at high level of competitive intensity. In other words, at low level of θ the concentration effects prevails, whilst at high level of θ the mark-up squeezing one prevails; there is an interior value of θ which maximizes the incentive to innovate.

This model provides a unitary framework to account for contrasting effects of an increase in competitive toughness on innovation, which can be seen as the engine of long run growth. The ultimate outcome depends on which effect prevails. The model suggests that the level of competition, the economic relevance of innovation, and the likelihood of succeeding in research are important in this respect. Moreover this analysis suggests that when we take a dynamic perspective identifying inversely the degree of monopoly with the intensity of competition could be even more misleading since increasing competitive toughness entails a concentration effect through the race for gaining market shares.

4 Conclusive Remarks

Intensity of competition, degree of product substitutability and degree of concentration are in principle distinct concepts that concur to determine the degree of monopoly in an industry. The identification of competitive toughness with product substitutability or (inversely) with the degree of concentration

[8]This requires the relative change in cost to be moderate

[9]This requires the probability of success to be low.

is improper and hence unable to account for different outcomes which can be observed in oligopolistic markets. On a more theoretical ground another problem in handling oligopoly is that small changes in assumptions could imply very different outcomes (e.g. Bertrand vs Cournot competition), thus failing to provide a unifying theoretical approach. By taking the competitive toughness as a distinct concept, possibly determined by the firms as a strategic choice, we have seen that the gap in the previous theories can be filled and that several facts can be explained within a comprehensive framework.

In particular we have seen that in the case of homogeneous good the degree of concentration does not imply as such a lower competitive toughness. Then we extended the analysis to the composite good case to focus on the degree of product substitutability. Again we have seen that competitive toughness and degree of substitution concur to determine the degree of monopoly but none of them implies the other. Finally a dynamic perspective has been adopted in order to account for possible impact on economic growth. We have seen that the relation between competitive toughness and the incentive to innovate entails two contrasting effects, one that tends to enhance the market share and hence concentration, and another one that tends to erode profits. This analysis shows that increasing competitive toughness may result dynamically in a higher degree of concentration which, under certain conditions, could also be innovation-enhancing.

The results highlighted so far have interesting implications. For instance, clarifying that the degree of competitive toughness does not coincide with the degree of substitution or the degree of concentration, it can be pointed out how the degree of monopoly is the outcome of several factors. While some of them are structural (as indeed one can think the substitution or the concentration are) depending on technological or institutional features, others are essentially related to the conduct of the agents, with a clear example represented by competitive toughness. Whereas structural parameters are unlikely to vary systematically with the business cycle, the isolation of conduct parameter allows for a consistent way to introduce counter-cyclical mark-ups into the oligopoly theory, an issue which originated at least in the Thirties (see d'Aspremont, Dos Santos Ferreira and Gérard-Varet (2005)).[10] Moreover the business cycle itself may be influenced by the interaction of

[10] A simple way to do it is by letting θ vary with pro-cyclically for a sufficiently high intra-sectoral substitutability.

firms' competitive behavior if firms respond to exogenous shocks by adapting their competitive toughness. As different competitive toughness can give rise to multiple oligopolistic equilibria, the way is opened for the occurrence of multiple steady states and equilibrium indeterminacy in the medium-long run which seems to be one of the intrinsic features of oligopolistic markets in reality.

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