Discussion Paper No. 9505 May 1995

Competition and the Competitiveness of Organizations and Nations

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Abstract

We show that increased breadth and/or depth of inter-firm competition among teams or partnerships leads to higher worker effort and thus to greater competitiveness. An industry with greater domestic competition will produce firms more competitive than its counterparts in other countries. This is apart from the birth and death process among competing firms. We also show that increased moral hazard and team size reduce effort and competitiveness.

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I would like to thank Philippine Center for Economic Development for financial support. Thanks also goes to T. Santos for excellent typing.

I. Introduction

The collapse of the former Soviet bloc economies and subsequent wholesale rejection of central planning was a triumph of the market allocation of resources. The market economy achieves efficiency chiefly through the birth and death of firms and the hiring and firing of factors and techniques. Survivors are those firms that adapt to and thrive in the ever shifting competitive cauldron. How survivors adapt and evolve is not an issue in the black box of firm employed in the imposing Arrow-Debreu edifice. It is, however, of great moment in the concept of the firm we owe to Coase (1937) and which has reincarnated in the new industrial organization in different guises either as principal-agent model, transactions cost theory, as a nexus of contracts, etc. Here, the firm is populated by agents with conflicting selfish interests that need to be aligned and opportunistic tendencies that have to be curbed for firm survival.

One issue of immediate possible disagreement among participating agents is how net revenue is to be allocated among various claims. The fairest basis for allocation is the individual contribution to total effort. Effort, however, is notoriously imperfectly observable except in some very extreme organization of production (piece rate, e.g.), and so moral hazard is a central problem in the new organization theory. In some cases where effort can be assigned, the institutional setting may prohibit firing of low effort agents if it cannot be established that this is not in accordance with the agent's capacity. Capacity is even more notoriously nonobservable. Thus, adverse selection is another central problem. Both problems are necessarily associated with the fundamental issue of the allocation of net revenue.

Firms deal with conflicting interests by devising compensation packages that minimize the role of moral hazard and/or adverse selection. Stock options align shareholders'and management's interests. Wyatt Company found that stock market performance of companies with CEOs having large stock ownership was distinctly better than that of companies with CEOs of less ownership (1995). Share-cropping avoids the nonobservable effort-related moral hazard inherent in straight wage contracts. Docility mechanisms (Simon 1991) raise worker willingness to adopt team goals as one's own. Intra-firm tournaments are devises to do the same (Nalebuff and Stiglitz, 1983). These are examples of "internal alignment mechanisms" employed by organizations to get all parties to work for the same end.

It is the position of this paper that a competitive market acts as an "external alignment mechanism" which minimizes conflicts and foster cohesion in organizations. The more competitive the market in which an organization has to survive (the greater the chance of organizational demise), the less moral hazard and/or adverse selection bear on the outcome or the more likely is cooperation attained. To fix ideas let us consider just two examples.

Attwood (1990) observes that cooperative sugar refineries in Maharastra, India, exhibit performances surprisingly comparable to privately owned firms. These refineries were neither planned nor managed by the government and are, rather than subsidized as one normally expects of these endeavors, penalized in terms of price. In contrast, cooperative sugar refineries in Northern India that are heavily protected and heavily subsidized are also very inefficient. While Maharastra sugar cooperative compete for sugarcane and for sales with private refineries in terms of price and are allowed to go bankrupt their Northern India counterparts do not and are immune from bankruptcy. Concludes Attwood: "In Maharastra, competition engenders cooperation among directors and shareholders--because both have a stake in outperforming other factories--while lack of competition in Northern India encourages directors to pursue their personal interests at the expense of the organization."

Of greater familiarity is the so-called Kibbutz-Kolkhoz paradox. Both the Israeli Kibbutz and the Russian Kolkhoz share the features of common ownership and exhaustive sharing. The Kibbutz, however, practices egalitarian sharing while the Kolkhoz practices (at least in theory) proportional sharing, i.e., the sharing of surplus on the basis of the sharing in total effort. We know that in the static setting, egalitarian sharing cannot be efficient (Holmstrom, 1982) while proportional sharing is efficient only for teams with CRS production functions (Fabella, 1988). The paradox is that the Kibbutz is generally regarded as efficient while the Kolkhoz is not! Guttman and Schnytzer (1990) proposed a strategic effort matching mechanisms which forces Pareto efficient effort under egalitarian sharing and decreasing returns to scale. This mechanism fits in the long tradition of supergame strategies that essentially replicates tit-for-tat. The same mechanism is, however, unable to force Pareto efficiency when sharing is proportional to effort. Thus, for them, the crucial difference is the sharing technology itself. Our own view is rather simple: the Kibbutz and the Kolkhoz existed in very different economic environments. The former exists in a market environment where Kibbutz oranges will not sell unless their price and quality combination is competitive. The Kolkhoz exists in an insulated world where everyone's job and well-being did not depend on efficiency. Our claim is that competition rather than sharing technology rendered the Kibbutz, not only more efficient than the Kolkhoz, but efficient enough to survive in a market economy.

These two examples suggest that the competition-efficiency nexus may not be confined to the dominant western industrial organization with clear delineation between principal and agent. In the two examples, there is no pure residual claimant or principal; all members are partners and firing of members is not standard procedure. For many Japanese industrial organizations, the distinction between principal and agent is also somewhat blurred. In the shop floor, workers working in teams do have limited decision making powers, perhaps encouraged along by a residual claim implicit in the widespread bonus scheme. Among large organizations, lifetime employment is also a long, although recently heavily tested tradition. In this paper, we will be confronted with the choice of which organizational vehicle to mount the analysis of the competition-efficiency nexus on. Partnerships are our preferred vehicle for three reasons: (i) Alchian and Demsetz (1992) claimed that partnerships because of imperfect observability and free riding tend to be inefficient and Holmstrom (1982) showed it; (ii) Grossman and Hart (1986) introduced the idea of residual rights that are noncontractible and on this basis Stiglitz (1991) proposed the view of the firm as a partnership between management that holds the residual rights over capital and labor that holds the residual rights of workers; (iii) perhaps the first attempt at unmasking this nexus done by Farrel and Lander (1989) used the partnership as the organizational vehicle; (iv) the growing recognition of the advantage of organizations which gives workers "a larger responsibility for organizing the production process" (*Made in America* by Dertouzos, Lester and Solow, 1989); (v) we are interested in how competition alters the behavior of agents with decision making roles.

Farrel and Lander (op cit.) took the bull by the horns by modelling how inter-team competition acts as a foil against intra-team opportunism based on moral hazard. This was a step beyond Hart (1983) who showed how greater competition allows shareholders (principals) more information about the environment in which the manager (agent) operates and thus reduces the noise responsible for the incentive problem. They showed that at symmetric Cournot-Nash (intra-team) equilibrium, effort rises with the competitiveness of the team's environment and with effort observability but falls with team size. The first result they describe as the "lifeboat principle". The competitiveness of the team's environment, defined as the partial of team revenue with respect to average team effort is a rather imprecise measure as this could respond positively to influences unrelated to competitive environment (e.g., an exclusive improvement in the team's technology which raises the team's competitiveness but perhaps lessens that of the environment). Farrel and Lander also view the rival team as a passive actor, hence their Cournot-Nash equilibrium is not fully a market equilibrium.

The perspective we adopt for this paper is that a competitive environment serves the same purpose of overcoming free riding in organizations that a tit-for-tat mechanism or the internal alignment mechanisms, or internal tournaments (Nalebuff and Stiglitz, 1983; Drago and Turnbull, 1992) do. In a team or partnership, there are two kinds of "fitness" confronting team members: "individual fitness" served by the selfish agent's share of the pie and by his concern for how the team output is allocated; and "organizational fitness" which is the capacity of the team to prevail in the market "survival of the fittest" environment. The individual's survival is assumed to be crucially linked with the team's survival so the competitive environment forces selfish agents to act more and more in the interest of team fitness.

II. The Model

Consider a team of n members, $n \geq 2$. Every member i contributes effort level l_i to the production of some expected revenue via a technology F defined over $L = \Sigma l_i$. F is twice differentiable, nondecreasing, quasi-concave in L and homogeneous of degree $r > 0$. Thus, scale economies in production may exist. Effort is imperfectly observable (or is completely observable at some F - netted cost, i.e., F is net of monitoring cost). In contrast, individual member's capacity is not observable at all and is known only by the member concerned. Effort is completely voluntary once the allocation rule is set. Team members can't be fired for shirking which is hard to monitor because effort is imperfectly observable and member capacity is not observable. Allocation is therefore in accordance with Sen sharing, i.e., $s_i = (1 - \alpha)(li/L) + (\alpha/n)$, $0 < \alpha < 1$, $i = 1, 2, \ldots n$. The parameter α reflects the imperfect obsèrvability of effort as in Farrel and Lander. When effort is completely nonobservable $\alpha = 1$ as in Holmstrom (op cit.). When effort is nonobservable, allocation is egalitarian since $s_i = n^{-1}$. The allocation is exhaustive and a capitalist (true residual claimant) does not exist. Indeed, every worker is a principal. The team operates by a constitution centered around the allocation scheme based on $\alpha > 0$, the team's agreed upon correction for imperfect observability (and/or egalitarian bias). Every i's utility function is linear in $X_i = s_i F$ and separable in effort, i.e.,

$$U_i = X_i - V_i(l_i) \tag{1}$$

where $V_i(.)$ is the distutility of effort function which is nondecreasing and convex in l_i, $i = 1, 2, \ldots, n$ and homogeneous of degree $r > 0$. The utility function (i) is commonly used in the literature because of its simplicity, (e.g., Sen, 1966; Holmstrom, 1982). Interestingly, the condition $F' = V'$ also underlies the cooperative relation in a team as constituted. Suppose we define the team social welfare function $W = \Sigma U_i$ with U_i as in (1). We have $W = \Sigma X_i - \Sigma V_i(l_i) = F - \Sigma V_i(l_i)$. If the team can allocate effort and if this is costlessly observable, then N is maximized at $F' = V_i'$, $i = 1, 2, \ldots, n$. Thus, $F' = V_i'$ also defines the cooperative solution for the team (which is clearly Pareto efficient). The same will result if every member is team-spirited, i.e., ith concern is not his/her share but the team output F, i.e., $U_i = F - V_i(l_i)$ giving $F' = V_i'$. Thus, when we show that a team attains Pareto efficiency, the team also attains the cooperative solution. If i supplies l_i, he is credited not with (l_i/L) but with little less $[(1-\alpha)(l_i/L) + (\alpha/n)]$, $\alpha > 0$, in view of observability problem. The team observes only hours of work, say, but knows this to be on average an overestimation of actual effort exerted. Thus α as a correction for the imperfect observability of effort may penalize everyone for the effort shirking of a few. It may then encourage peer monitoring.

Although member firing is not allowed, the team itself could become extinct because the economic environment selects only the fittest among competing teams to survive. Darwinian natural selection obtains.

Definition: The contest environment is Tullock-Hirshleifer if (a) there are m+1 teams entered in a "survival of the fittest" contest and (b) the probability, P, that the "home" team (no label) wins is

$$P = e^{\beta}/(e^{\beta} + me_0^{\beta}), \ \beta > 0 \tag{2}$$

where $e = (\Sigma^{n} l_i/n)$, the average effort level of home team members and e_0 is the average effort level of the representative "rival" team and (c) if the "home" team wins, its total revenue is $(F + X)$ where the prize $X = \Sigma^{m} \delta Gj$, $0 < \delta < 1$, Gj is the gross revenue of rival team j and δ is the proportion of gross revenue on wager per team; if home team loses, its net revenue is $(F - \delta F)$.

Remarks: (1) We call δ the "depth of competition" and m the "width of competition." We call β the contest mass effect parameter. When $\beta \le 1$, P is a concave function of e. When $\beta > 1$, P has an inflection point and becomes convex in e. (2) e is also the measure of the team's competitiveness. X could be the present value of revenue flow coming from capture of the market. Prize sharing can be easily accommodated.

The expected utility of member i in the home team is

$$EU_i = Ps_i(F + \Sigma^{m}\delta G_j) + (1 - P)(s_iF(1 - \delta)) - V(l_i), \tag{3}$$

which simplifies into:

$$EU_i = s_iF(P\delta + (1- \delta))$$

$$+ Ps_i(\Sigma^{m}\delta G_j) - V(l_i), \quad i = 1, 2, .. n. \tag{4}$$

Assuming Cournot-Nash behavior, the first order condition is

$$[P\delta + (1-\delta)][s_iF' + F(1-\alpha)[\Sigma^{n-1} l_i/(\Sigma^{n} l_j)^2]$$

$$+ s_i[F + X] \ (\partial P/\partial l_i)$$

$$+ (1-\alpha)P\delta\Sigma^{m} G_j(\partial s_i/\partial l_i) - V_i' = 0, \quad i = i, 2, \ldots n, \tag{5}$$

where F' and V_i' are first derivatives with respect to respective arguments. These can be solved for $\{l_i^*\}$, i = 1, 2, ..., n, Cournot-Nash effort levels. If we impose global symmetry (within the team and among teams), we have $l_i* = l_j* = l*$, $\forall_{i,j} = 1, 2, \ldots n$ and $F = G_j = G_k$, $\forall j,k$. Note that

$(\partial s_i/\partial l_i) = \sum^{n-1} l_j / [\sum^{m} l_i]^2$ and by symmetry becomes $(\partial s/\partial l) = [(n-1/n^2 l]$. Likewise, $(\partial P/\partial l_i) = [(\Sigma l_i/n)^\beta + m l_0^\beta](\beta/n)(\Sigma l_i/n)^{\beta-1} - (\Sigma l_i/n)^\beta [(\beta/n)(\Sigma l_i/n)^{\beta-1}] [(\Sigma l_i/n)^\beta + m l 0^\beta]^{-2}$. By symmetry, we have $(\partial P/\partial \ell) = [m(\beta/n)/(1+m)^2 n l]$. Condition (5) then simplifies into:

$$\cdot\{[(\delta/(1+m)) + (1-\delta)][(1/n) + (1-\alpha)(F/F'nl^*)(n-1)/n]$$
$$+ (1/n)\delta\beta m(F/F'nl^*)/(1+m)\}F'$$
$$+ (1-\alpha)(m/(1+m))(\delta/nr)(n-1)F' = V'. \tag{6}$$

But $r = F'nl^*/F$, so we finally have

$$\{[(\delta/(1+m)) + (1-\delta)][(1/n) + (1-\alpha)(n-1)/nr]$$
$$+ (1/nr)[\delta\beta m/(1+m)][\beta + (1-\alpha)(n-1)]\} F' = V'. \tag{7}$$

Letting $A = \{.\}$ in (7), we have simply

$$AF' = V'. \tag{8}$$

This can be solved for the Cournot-Nash global equilibrium effort level l^*. This equilibrium is self-enforcing. It is stable if $AF'' - V'' < 0$, i.e., V'' should be large since $F'' > 0$ is allowed. Note that the conditions $\delta = 0$, $\alpha = 0$ and $r = 1$ give $A = 1$ and $F' = V'$ which is the cooperative solution (Fabella, 1989). The condition $\delta = 0$, $0 < \alpha < 1$, $0 < r < 1$ gives $A = [(1/n + (n-1)/nr] = 1$ if and only if $r = 1 - \alpha$, the Sen condition (Sen, 1966) for Pareto optimum. Thus the closed team results are generated as special cases.

III. Effort and Competitiveness

In this section, we focus on the effects of changes in the degree of competition on Cournot-Nash equilibrium effort. The following will be useful:

Lemma 1: Let ϵ be any influence on A but not on F' or V'. Then $(dl^*/d\epsilon) \gtreqless 0$ iff $(\partial A/\partial\epsilon) \gtreqless 0$.

Proof: (if) Totally differentiating (8) and solving for $(dl^*/d\epsilon)$ gives us $[\partial(AF' - V')/\partial\ell^*]^{-1}[-F'(\partial A/\partial\epsilon)]$. But if (8) is necessary maximum condition, $\partial(AF'-V')/\partial\ell^* < 0$. (only if) Obvious. Q.E.D.

Remark: The parameters m, β, δ qualify but not r and n. n is explicitly in F' and implicitly so is r.

Theorem 1: $(d\ell^*/d\delta) \gtreqless 0$ iff $\beta \gtreqless r$.

Proof: (if) We sign $(\partial A/\partial\delta)$. This is:

$$[m/(1+m)]\ \{-[(1/n) - (1-\alpha)(n-1)/nr]$$

$$+ [(\beta/nr) + (1-\alpha)(n-1)/nr].$$

Simplying we have

$$[m/(1+m)nr][\beta - r] \gtreqless 0$$

if the condition holds. (only if). Suppose $(\partial A/\partial\delta) > (<) 0$. Reasoning backwards gives the condition with $>(<) 0$. By Lemma 1, $(d\ell^*/d\delta) \gtreqless 0$ if $(\partial A/\partial\delta) \gtreqless 0$. QED.

The rise in the penalty for losing (δ rising) involves greater (less) effort level by team members depending on the contest technology parameter β and scale economy of production r. Since $e^* = \ell^*$ under global symmetry, the following is obvious:

<u>Corollary 1</u>: $(de^*/d\delta) \gtreqless 0$ iff $\beta \gtreqless r$.

Since e^* is the average effort of each team, the team becomes more competitive with the rise in δ. But in a globally symmetric economy, e^* is the index of competitiveness of the whole economy itself. Thus, the whole economy becomes more competitive as δ rises if $\beta > r$. Two economies, home and foreign, that are everywhere identical except for the depth (breadth) of competition $\delta(m)$, i.e., $\delta_h > \delta_f$, will mean that home economy will outcompete the foreign economy. This clearly has an implication in trade theory. We will return to this later.

<u>Theorem 2</u>: (i) $(d\ell^*/dn) < 0$ if either (a) $r = 1$, $\beta = 1$ or (b) $r < 1$ and β, $r > (1-\alpha)$.

Proof: Differentiating (AF') with respect to n gives $[AF''\ell^* + F'(dA/dn)] = (F'A/n)[r-1 + (dA/dn)(n/A)]$ since by the homogeneity of F, $(r-1)F' = F''n\ell^*$. But (dA/dn) is $[(\delta/(1+m)) + (1-\delta)][(1-\alpha-r)/n^2r] + [\delta m/(1+m)][(1-\alpha-\beta)/n^2r]$ which is negative or zero if $r, \beta \geq 1-\alpha$. Thus, $(d\ell^*/dn) = -(F'A/n)[r-1 + (dA/dn)(n/A)]/(\partial(AF' - V')/d\ell) < 0$. Clearly $(\partial(AF' - V')/\partial\ell^*) < 0$ for maximum. The result follows immediately. Q.E.D.

Effort falls with team size if production and the win probability are CRS. This is why team type organizations and partnerships are generally small.

<u>Theorem 3</u>: Increased egalitarianism in the pay structure (separation of effort and reward due to reduced observability of effort) reduces effort, i.e., $(dl^*/d\alpha) < 0$, and thus market competitiveness.

Proof: We have $(\delta A/\delta\alpha) = [\delta/(1+m) + (1-\delta)][-(n-1)/nr] + (1/nr)[\delta m/(1+m)][-(n-1)] < 0$. By Lemma 1, $(dl^*/d\alpha) < 0$. Q.E.D.

Given the same competition and penalty for losing, increased egalitarianism (due to reduced observability of effort) reduces system-wide effort. We also have the following:

Theorem 4: $(d\ell^*)/dr) > 0$, if $r \geq 1$ i.e., effort rises with a rise in r if production exhibits increasing or constant returns.

Proof: Because of the homogeneity of F, we have $rF = F'nl$. Thus, the first order condition becomes $[ArF/nl^*] - V' = 0$. $\partial[ArF/nl^*]/\partial r = [AF/nl][(\partial A/\partial r)(r/A) + 1]$. If this is positive, by reasoning similar to Lemma 1, $d\ell^*/dr > 0$. Now

$$[\partial A/\partial r][r/A] = \{[\delta/(1+m)+(1-\delta)][(1-\alpha)((n-1)/n)(-1/r^2)$$

$$+ (1/n)[\delta\beta m/(1+m)][\beta+(1-\alpha)n-1](-1/r^2)\}[r/A]$$

and by inspection $|(\partial A/\partial r)r| < A$ for $r \geq 1$. Therefore, $|(\partial A/\partial r)(r/A)| < 1$ for all $r \geq 1$. Thus, $d\ell^*/dr > 0$. Q.E.D.

Now the higher is r, the more productive is the team technology. Thus, effort rises with technology-based productivity and, a priori, the competitiveness of the team. Finally we have:

Theorem 5: $(d\ell^*/dm) \gtreqless 0$ iff $\beta \gtreqless r$.

Proof: (if) $(\partial A/\partial m)$ equals $(-\delta(1+m)^{-2})(H_1) + (H_2[1+m)^{-2}]$ where $H_1 = [(1/n)+(1-n)(n-1)/nr]$ and $H_2 = (n^{-1} + (1-n)(n-1)$. Thus we have

$$[-(1+m)^{-2}/nr]\{r+(1-\alpha)(n-1) - \beta + (1-\alpha)(n-1)\} \gtreqless 0$$

if the condition holds. (only if) Suppose $(d\ell^*/dm) \gtreqless 0$. The condition is regained by retracing the steps. Q.E.D.

As one would expect, the condition governing response to m is identical to the condition governing response to δ: $(\beta \gtreqless r)$. The higher is δ, m and r and the smaller is α, the more likely is there to be an increase in ℓ^* and thus in team competitiveness as m rises.

IV. Organizations

We motivated our enquiry by observing that certain organizational structures, notably cooperative ones, seem to operate more efficiently in more competitive environment. This is Attwood's reading of the pronounced efficiency difference between Maharastra and Northern India cooperative sugar refineries. This is our reading of why the Israeli Kibbutz seem to thrive while the Russian Kolkhoz went the other way. What we have shown is that external competition does indeed stimulate greater effort among agents who have a stake in the survival of the firm. These firms tend to blur the distinction between principal and agent. This stake in firm survival is spelled out by the condition that agents cannot jump ship nor can they be fired without considerable cost in terms of employee morale. This condition generates the environment for "shared fate" (A. Morita) or the "lifeboat principle" (Farrel and Lander). Large Japanese organizations appear to exhibit this feature (lifetime employment). Bruising domestic competition in the Japanese market seem to produce precisely the response we envision here. Stories of engineering teams suddenly cancelling long planned vacation because a rival company launched a new hot product are common. Karoshi (death due to voluntary overwork) is also an issue in the Japanese society.

The sustained popularity of team structure among Western industrial organizations ordinarily steeped in the principal-agent tradition attests to the grudging recognition that giving workers a stake in the outcome of their outfit or firm has organizational value-added. This was amply supported by *Made in America* now known as the "MIT Report" (Dertouzos, Lester and Solow, 1989). This recognition was forced by the increasing globalization of competition. Thus competition not only makes worker-principals more committed; it also makes organizations themselves seek out and adopt worker-principal arrangements which respond better to competition. As competition marches on, we expect to see more and more worker-principal arrangements.

V. Competitiveness of Nations

Under global symmetry $e^* = \ell^*$ and e^* is also the average effort in the industry of m teams. Thus, either e^* or ℓ^* constitute the competitiveness of the industry. If this industry exists in the home economy and other economies have their own otherwise identical counterparts of this industry (say, electronics), then various economies may be ranked on the basis of their respected industry competitiveness e_h^*. On the basis of previous results we have:

> Corollary 2: In autarky, the home economy's competitiveness vis-a-vis the world in a relevant industry, ceteris paribus, (i) rises with the width (m) and/or depth (δ) of home economy's internal competition if $\beta > r$; (ii) rises with the returns to scale in the home industry and (iii) falls with the rise in moral hazard (or egalitarianism) in this industry or with a rise in team size when production and contest technology exhibit constant returns to scale.

It is of interest that again the industrial organization that fosters this competition-induced competitiveness emphasizes the decision making aspect of economic agents within a team or partnership framework, i.e., with workers-as-principals. Also worthy of note is that there is a barrier to inter-firm mobility of economic agents. This ensures that agent survival or well-being is tied up with firm survival. The closest actual case of this nexus is among the large Japanese manufacturing organizations which operate in very competitive Japanese market. One may object that the Japanese economy is very egalitarian which seems to conflict with Corollary (2iii). The egalitarianism in Corollary (2iii) as in the whole paper involves a greater part of an individual's share being independent of actual effort. The contrary appears true in Japanese firms. Effort is highly valued, perhaps more so than in other economies and advancement is jealously guarded to be effort-based. Low income inequality in the Japanese economy has nothing to do with the marxist egalitarianism in the workplace. It has rather to do with progressive taxation, fiscal spending and initial asset distribution. Thus, the contradiction does not exist.

One way competitiveness can get expressed in domestic terms of trade is via the usual Rybsczynski mechanism. Increased ℓ^* given the same implied prices of factors and prices of the commodities is analogous to an increase in the supply of labor endowment, capital being constant. This leads to a rise in the production of the labor-intensive commodity. With homothetic consumption pattern, this leads to a reduction in the relative price of the commodity under autarky. Increased ℓ^* may also come in the form of greater use of talent or human capital which will lead to comparative advantage in skill intensive goods.

VI. Conclusion

In this paper, the industry consists of m teams or partnerships competing for a prize financed via an exaction on gross revenue. Effort is only partially observable so the pay structure is partly effort-based and partly egalitarian (a la Sen sharing) where the extent of egalitarianism reflects the team perception of the associated moral hazard problem. Team members choose effort levels voluntarily. The contest structure adopts a Tullock-Hirshleifer win-probability defined over the average efforts of the teams involved. The team production technology allows for increasing returns to scale which in team organizations, ordinarily leads to effort undersupply.

We show that at Cournot-Nash equilibrium with global symmetry--among members as well as teams--effort rises with a rise in the breadth (number of teams) and/or depth (size of wages) or competition if contest technology exceeds production technology returns to scale. If the condition is reversed, member effort retreats with a rise in competition. The threat in this case provokes retreat. Thus, there is a threshold between the "attack-retreat" tandem at which standstill is individually optimal. Effort falls with increased moral hazard and increased team size but rises with production technology returns to scale.

Since average team effort is also the industry average effort under global symmetry, increased domestic competition relative to the rest of the world leads to greater domestic competitiveness relative to the rest of the world.

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