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Indirect evolution vs. strategic delegation: a comparison of two approaches to explaining economic institutions

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Abstract

Two major methods of explaining economic institutions are compared for the case of a homogenous quadratic duopoly market. In the indirect evolutionary approach, sellers may evolve to care for sales, in addition to profit. In the strategic delegation approach, sellers may design incentives so that their agents care for sales. The two approaches model different phenomena, but both allow certain kinds of commitment. We investigate under what circumstances the two approaches lead to similar market outcomes. The results underscore the technical similarities as well as the conceptual differences between the two approaches. © 1999 Elsevier Science B.V. All rights reserved.

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1. Introduction

For a given institutional design, one often can derive results concerning the nature of strategic interaction by applying tools of game theory. However, the bulk

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of economic analysis does not address the question of why certain institutions prevail. This study compares two methods of explaining institutional designs, instead of assuming institutional design as exogenously given.

The first approach, to which we refer as *strategic delegation*, has a long standing tradition in the social sciences. People do not only decide within certain institutions, but they decide upon institutional design. A famous example is, for instance, the *contrat social* (Rousseau, 1762), which is often referred to when justifying constitutional design. Clearly, such a contract is only a fiction. There are, however, more realistic examples, for example when legal rules are changed by qualified majorities, for instance, by unanimous approval.

More specifically, let an *institutional design* be represented by the rules of a final subgame and assume that earlier choices in the game allow us to rule out certain subgames. The solution of the game not only determines behavior in final subgames, but also the choice of subgames, i.e., *institutional choice*. In the case of strategic delegation, the final subgame is characterized by the motivation structure of the interacting agents, and principals strategically design the incentives of their agents.

The second method we consider is the indirect evolutionary approach, in which an *evolutionarily stable institutional design* is derived via evolutionary rather than strategic considerations. More specifically, an indirect evolutionary analysis first determines the solution for any institutional arrangement, and then selects from various such structures in an *evolutionary model* with institutional design constellations as mutants.

We compare the two approaches of strategic delegation and indirect evolution for the case of a simple duopoly where sellers on a homogenous goods market might care about sales in addition to profits. Strategic delegation requires a team consisting of a principal and his agent, whereas under indirect evolution sellers may themselves evolve to develop an 'evolutionarily stable' concern for sales.

The two approaches are conceptually very different. Whereas under strategic delegation institutions are chosen, with the indirect evolutionary approach decision or game theory is restricted to predicting the choice behavior *within* a given institutional setup. Moreover, strategic delegation involves a richer social setting than does the indirect evolutionary approach, since strategic delegation includes agents who are absent in the other approach. For these reasons, one might suspect the two approaches will lead to very different results.

There is, however, also a similarity between the two approaches. 'Modeling evolution'—by specifying a (geno)type space and an evolutionary dynamics or a static evolutionary stability concept guaranteeing dynamic stability (see Hammerstein and Selten, 1994 as well as Weibull, 1995)—poses a challenge similar to that of 'modeling the overall game' in strategic delegation. In each case, a certain kind of *commitment* is involved. Under strategic delegation the principal may commit to a particular behavior by designing appropriate incentives; under indirect evolution the players' preferences are shaped by evolution, and these preferences may serve as commitment devices. [1] Therefore, one may be led to suspect that the two approaches should yield similar results.

We first investigate a benchmark model of indirect evolution in which sellers may evolve to care for sales in addition to profits. We show that a pure preference for profit maximization is not evolutionarily stable and that the market outcome is more competitive than with pure profit maximization. We then analyze a model of strategic delegation in which the class of feasible contracts is closely comparable to the mutant space under indirect evolution. We show that it generates the same market outcome as does the model of indirect evolution, despite the principals caring for profit only. This result indicates a way in which one may think of indirect evolution as corresponding to a special form of strategic delegation. In this sense, our analysis underscores the similarity between the two approaches.

However, if one thinks of 'natural' kinds of strategic delegation contracts that allow for an induced concern for sales, then other sets of feasible contracts may come to mind. We look at one such set. At first glance, one may suspect that the same result as before will come about, but we show that a different outcome obtains. This finding underscores the conceptual differences between the two approaches. If the mutant space of the evolutionary model is natural in that setting, while the alternative set of strategic delegation contracts is natural with strategic delegation, then the outcome is sensitive to whether the market institution is shaped by evolution or by design.

In Section 2, we specify the basic features of the market model we analyze throughout. In Section 3, we present the model of indirect evolution, and compare the outcome to the standard model. In Section 4, we consider strategic delegation when agents may be induced to care for sales, and show that with an appropriate restriction on the set of feasible contracts the same market outcome results as under indirect evolution. Section 5, studies strategic delegation with a different set of feasible contracts for inducing a concern for sales, and shows that the market outcome changes. In Section 6, we comment on how our results are affected if preference parameters/contracts are not observable. Section 7 concludes.

2. The market model

We consider a simple homogenous duopoly market à la Cournot (1838). Sellers $i = 1,2$ simultaneously choose their sales amounts $x_i \geq 0$. Assuming a linear

[1] This observation explains why applications of the indirect evolutionary approach sometimes prompt questions whether the indirect evolutionary approach is the same as the strategic delegation approach. The typical argument made is that in a social dilemma situation, due to the scope for individual opportunism, cooperative results can be assured by commitments (not to behave opportunistically) and that strategic delegation and indirect evolution provide just two stories how such commitments may result.

demand function and normalizing it appropriately allows us to write seller i's revenue as

$$x_i \cdot (1 - x_i - x_j) \quad \text{for } i = 1,2 \text{ and } i \neq j. \tag{2.1}$$

The market price is $(1 - x_i - x_j)$. We do not a priori exclude the possibility of negative prices, but such outcomes will in fact not be viable under either of the two approaches to be discussed. The costs of production are assumed to be given by

$$1/2\, c x_i^2 + C \text{ with } c, \quad C > 0. \tag{2.2}$$

According to the structural relationships (2.1) and (2.2), the market is symmetric. The profit $\pi_i(x_i, x_j)$ of seller $i = 1,2$ for sales amounts x_i and x_j with $i \neq j$ is determined by

$$\pi_i(x_i, x_j) = x_i(1 - x_i - x_j) - 1/2\, c x_i^2 - C. \tag{2.3}$$

Let us finally recall the usual results for this market. For $i = 1,2$, equilibrium sales, price and profits can be derived as

$$\tilde{x}_i = \frac{1}{3 + c} \tag{2.4}$$

$$\tilde{p} = \frac{1 + c}{3 + c} \tag{2.5}$$

$$\tilde{\pi}_i(\tilde{x}_i, \tilde{x}_j) = \frac{1 + \frac{c}{2}}{(3 + c)^2} - C. \tag{2.6}$$

3. Indirect evolution

The indirect evolutionary approach allows endogenous derivation of the rules of the game (see Güth and Yaari, 1992), and it can therefore be viewed as a way to generalize neo-classical theory which traditionally takes such rules to be exogenously determined. In direct evolutionary analysis or usual evolutionary game theory, one assumes behavior to be genetically determined (see Hammerstein and Selten, 1994 for a survey) or acquired phenotypically via learning or by cultural evolution (see, for instance, Boyd and Richerson, 1995). We, however, do not study the evolution of behavior directly. Rather a more basic feature of the game, in our case preferences, is the object of evolution. Rational behavior is taken for granted, but behavior may nevertheless be indirectly affected should preferences change. [2]

If in a bilateral encounter behavior may be guided by an additional incentive, one first solves all the games resulting from such incentives for both players. Using these results, one then defines an evolutionary model with the possible incentives as strategies or mutants, and derives the evolutionarily stable incentive constellation.

3.1. Incentives for sales

It is often claimed that sellers are not only interested in their profits, but also in their prestige as sellers (see for example Williamson, 1964). Such prestige can be measured by sales (quantity amounts). [3] In general, there may be many ways to include such a concern for the quantity sold. Here, we will rely on the most simple way of doing so, namely by specifying utilities

$$u_i(x_i, x_j) = \pi_i(x_i, x_j) + \beta_i x_i \tag{3.1}$$

where $\pi_i(x_i, x_j)$ is as defined by Eq. (2.3), and where $\beta_i \in \mathbb{R}$ is a constant which measures i's predisposition to care for sales. We refer to β_i as seller i's *concern for sales*. The main restriction of (3.1) is that it combines i's concerns for profits and sales in an additive way.

The first step of our indirect evolutionary analysis requires us to determine the market results for all (β_1, β_2) constellations, not necessarily with $\beta_1 = \beta_2$. With the help of these results, we then define an evolutionary game with mutants/strategies β_1 and β_2. The success of a mutant is measured by the profit it makes. [4] Determining an evolutionarily stable mutant thus answers the question whether and to what extent sellers evolve in such a way that they care for sales in addition to profits.

[2] For the same type of (duopoly) market environment, Bester and Güth (1998) analyzed whether altruism is evolutionarily stable whereas Güth and Huck (1997) allow for all possible quadratic profit functions and show that monopolistic competition (in the sense of neglecting mutual dependency) can be stable.

[3] Since profits are usually private information whereas sales are often widely known, it is much more likely that the prestige of a seller depends on sales rather than on profits. Larger sales often require large production amounts and thereby an increased or more stable use of the labor force, suggesting that a concern for sales might result from more basic interests.

[4] For genetical evolution this, is rather obvious: The material success is monotonically related to reproductive success in the sense of the expected number of offspring. In case of cultural evolution (Boyd and Richerson, 1995), the justification is that adaptation should depend on interpersonally observable success measures like profit, and not on individual satisfaction measures which cannot be observed by others and do not matter for them.

3.2. Market interaction with a direct concern for sales

Our model has been chosen to simplify the derivation of market equilibria. From

$$\frac{\partial}{\partial x_i} u_i(x_i, x_j) = 1 + \beta_i - (2 + c) x_i - x_j = 0 \tag{3.2}$$

and

$$\frac{\partial^2}{\partial x_i^2} u_i(x_i, x_j) = -(2 + c) < 0 \tag{3.3}$$

for $i = 1,2$ and $j \neq i$, one derives equilibrium sales amounts as functions of (β_1, β_2):

$$x_i^* = x_i^*(\beta_i, \beta_j) = \frac{1 + c - \beta_j + (2 + c)\beta_i}{(1 + c)(3 + c)}. \tag{3.4}$$

Note that we use x_i^* both to refer to a specific optimum choice of x_i for given preference parameters, and to refer to the function describing this connection. In many cases below, we make an analogous use of notation because this simplifies the presentation greatly.

3.3. The evolutionary model

If one inserts the solution (3.4) into the profit function (2.3) one can derive each firm's profit as a function of (β_1, β_2) and obtain for $i = 1,2$ with $j \neq i$

$$\pi_i^*(\beta_i, \beta_j) = x_i^*(1 - x_i^* - x_j^*) - 1/2\, c(x_i^*)^2 - C. \tag{3.5}$$

Eq. (3.5) is a profit function expressing market success as a function of the possible incentives for sales. We refer to Eq. (3.5) as the seller i's reproductive success from the incentive constellation (β_i, β_j).

By

$$\Gamma = (M, \pi_i^*) \tag{3.6}$$

with M (the mutant space) equal to $\mathbb{R}$ (the set of real numbers), and π_i^* defined by Eq. (3.5) for all possible incentive constellations $\beta_i, \beta_j \in M$ we have defined an evolutionary model whose evolutionarily stable strategies we now wish to determine.

3.4. The evolutionarily stable concern for sales

An evolutionarily stable concern for sales can be defined as an evolutionarily stable strategy (ESS) of the evolutionary model defined in (3.5). Thus, β^* is an ESS if

$$\pi_i^*(\beta^*, \beta^*) \geq \pi_i^*(\beta, \beta^*) \quad \forall \beta \in M \tag{3.7}$$

and if

$$\pi_i^*(\beta^*,\beta) > \pi_i^*(\beta,\beta) \quad \forall \beta \in M \text{ such that } \pi_i^*(\beta^*,\beta^*) = \pi_i^*(\beta,\beta^*). \tag{3.8}$$

For the case at hand, it suffices to look at condition (3.7), since the best reply is unique in every symmetric equilibrium (β^*,β^*) of the symmetric evolutionary model Γ.

From

$$\frac{\partial}{\partial \beta_i}\pi_i^*(\beta_i,\beta_j) = 0 \tag{3.9}$$

$$\frac{\partial^2}{\partial \beta_i^2}\pi_i^*(\beta_i,\beta_j) < 0 \tag{3.10}$$

as well as from $\beta_i = \beta_j$, one obtains

$$\beta^* = \beta^*(c) = \frac{1}{5+5c+c^2}. \tag{3.11}$$

Note that $\beta^* > 0$. A pure preference for profit maximizing behavior, i.e., $\beta_i = 0$, is not promoted by evolutionary forces. Only for extremely large values of c will the market evolve in such a way that sellers do not care for sales directly. When $c \to 0$ the parameter $\beta^*(c)$, expressing a direct concern for sales in the sense of the utility function (3.1), increases to $1/5$.

3.5. The market outcome under indirect evolution

The market outcome under indirect evolution can be determined by inserting $\beta^* = \beta_i = \beta_j$ into Eq. (3.4). For $i = 1,2$, equilibrium sales, price and profits can be derived as

$$x_i^* = \frac{1+\beta^*}{3+c} = \frac{6+5c+c^2}{(3+c)(5+5c+c^2)} \tag{3.12}$$

$$p^* = \frac{3+5c+c^2+c(5+5c+c^2)}{(3+c)(5+5c+c^2)} \tag{3.13}$$

$$\pi_i^*(x_i^*,x_j^*) = p^* x_i^* - \frac{c}{2}(x_i^*)^2 - C. \tag{3.14}$$

We now compare the sales given here with those obtained in the standard Cournot model of Section 2. From (3.12) and (2.4), we derive

$$\frac{x_i^*}{\tilde{x}_i} = \frac{6+5c+c^2}{5+5c+c^2} \tag{3.15}$$

showing that the market results from indirect evolution are more competitive than in the standard Cournot model. This relation will, furthermore, increase when c

becomes smaller and disappears when $c \to \infty$. It is straightforward to show that the price and the profit levels (3.13–14) under indirect evolution are lower than in the standard Cournot model (2.5–6).

We summarize the findings of Section 3 as follows.

Theorem 1. *If in a symmetric market with profits (2.3), sellers can develop incentives of the form (3.1) and if the incentives of both sellers are commonly known, the only evolutionarily stable direct concern for sales is β^*, defined by Eq. (3.11). The market outcome, given by (3.12–14), will be more competitive than in the standard Cournot model.*

4. Strategic delegation

In this section, we investigate the consequences of letting sellers induce a concern for sales via strategic delegation, restricting the set of feasible contracts so as to correspond closely to the mutant space of the previous section. We show that the same market outcome as under indirect evolution results.

Strategic delegation relies on a richer social structure of the market than indirect evolution. The two seller firms $i,j = 1,2$ with $i \neq j$ are now to be represented by two teams $(P_i,\ A_i)$ and $(P_j,\ A_j)$ of principals P_i and P_j and their respective agents. Strategic delegation [5] typically takes the form that first, the two principals propose contracts which then, if accepted by the agents, guide behavior in the market. From now on, we presume that agents always accept their contracts, but that these contracts must net each agent zero payoff in the end (in subgame perfect equilibrium). By rigging the model appropriately, this can be justified by assuming outside options of zero worth for the agents, and presuming that each principal makes a take-it-or-leave-it offer to his agent. Since agents will make zero payoff, whatever profit is generated in the market goes to the principals. This facilitates a clear-cut comparison between the outcomes under strategic delegation and indirect evolution.

Suppose each principal i is restricted to propose a contract of the form

$$(G_i, \beta_i) \qquad \text{with } G_i, \beta_i \in \mathbb{R} \tag{4.1}$$

that determines agent i's payoff as

$$u_i(x_i, x_j) = G_i + x_i(1 - x_i - x_j) + \beta_i x_i - 1/2\, c x_i^2 - C. \tag{4.2}$$

We refer to G_i, a direct transfer from the principal to the agent (which may be negative), as agent A_i's *salary*. This transfer has no effect on the agent's

[5] Different aspects of strategic delegation have been analyzed by Fershtman and Judd (1987), Fershtman and Kalai (in press), Fershtman et al. (1991), Green (1990), Katz (1991), Rotemberg (1994), Caillaud et al. (1995), Gal-Or (1996) and Baik and Kim (1997). For an experimental study, see Fershtman and Gneezy (1996).

incentives, but it puts all the bargaining power in the hands of the principal. Since the agent can earn only zero outside the firm, the principal can reap all profits available, just like in the evolutionary model where no agent was present. We refer to β_i as A_i's *sales incentives*. Whereas under indirect evolution the sellers could evolve so as to care for sales in addition to profits, now principals can induce similar concerns for sales in their agents by appropriate choices of β_i.

Principal P_i is motivated to extract as much payment as possible from his agent's activity, and hence to choose (G_i, β_i) so as to maximize

$$R_i = -G_i - \beta_i x_i. \tag{4.3}$$

We solve the model for a subgame perfect equilibrium using backwards induction: For given choices of contracts, each agent i will choose sales so as to maximize (4.2). The relevant conditions match those given in (3.2) and (3.3), so the sales decision will be as given by (3.4).

In any subgame perfect equilibrium, each principal takes this behavior as given and choose a contract (G_i, β_i) which is optimal given the other principal's choice of contract. First, G_i should be chosen so that (4.2) is equal to zero. Substituting from (3.4) in (4.2), and then substituting the optimal value for G_i in (4.3) shows that (4.3) can be replaced by (3.5). Hence, each principal's choice of β_i must be given by (3.9) and (3.10) for each $i = 1,2$. Careful inspection of (3.9) and (3.10) reveals that there cannot be any asymmetric equilibria (β_1^*, β_2^*) with $\beta_1^* \neq \beta_2^*$. The subgame perfect equilibrium choices of β_i^* are unique and given by β^* as given in (3.11). The following theorem summarizes these findings.

Theorem 2. *Strategic delegation in the form of (4.1–2) results in contracts (G^*, β^*) with sales incentives β^*, defined by Eq. (3.11). Sales, prices, and profits will be given by (3.12–14). Hence, the same market outcome results as under indirect evolution.*

5. Strategic delegation with a different set of feasible contracts

The set of strategic delegation contracts that are feasible under (4.1–2) tightly correspond to the mutant space allowed under the indirect evolution approach of Section 3. Hence, the results of Section 4 indicate a way in which one may think of indirect evolutionary as corresponding to a particular form of strategic delegation. However, strategic delegation that allows for a concern for sales to be induced may take many forms not allowed in Section 4. In this section, we consider another set of feasible contracts which may seem natural. At first glance, one may think that the same market outcome as in Section 4 will obtain. We show that this is not the case though. This finding underscores the conceptual differences between the indirect evolutionary approach and the approach of strategic delegation. While there are technical similarities between the two approaches that under certain circumstances lead to similar outcomes, when each approach is set up and motivated independently, there is no reason to believe they lead to the same outcome.

Suppose each principal i is restricted to propose a contract of the form

$$(G_i, \beta_i) \qquad \text{with } G_i, \beta_i \in \mathbb{R} \tag{5.1}$$

with payoff to agent i given as

$$u_i(x_i, x_j) = G_i + \beta_i x_i - 1/2\, c x_i^2 - C. \tag{5.2}$$

Espressions (5.1–2) differs from (4.1–2) in that the agents do not care at all about revenue. As with (4.1–2), principals may develop a concern for sales via their agents.

To determine the results of strategic delegation, one simply has to solve the two-stage game for the subgame perfect equilibrium (which again is unique). First, principals choose contracts as described in (5.1) and then, knowing both contracts, each agent $i = 1,2$ chooses x_i to maximize (5.2). When choosing a contract (G_i, β_i) principal P_i maximizes

$$R_i = x_i(1 - x_i - x_j) - G_i - \beta_i x_i. \tag{5.3}$$

It can be easily seen that the agents face independent maximization tasks. More specifically, the payoff $u_i(x_i, x_j)$ depends only on x_i and not at all on x_j. Maximization of $u_i(x_i, x_j)$ as defined by (5.2) by choice of x_i yields

$$x_i^+ = \beta_i / c \quad \text{for } i = 1,2. \tag{5.4}$$

Principal P_i will choose G_i such that the agent's payoff will be zero. Inserting (5.4) into Eq. (5.2) and setting $u_i = 0$ yields

$$G_i^+ = G_i^+(\beta_i) = C - \frac{\beta_i^2}{2c} \quad \text{for } i = 1,2. \tag{5.5}$$

Inserting (5.4) and (5.5), all these values, into (5.3) results in

$$R_i^+(\beta_i, \beta_j) = \frac{\beta_i}{c^2}(c - \beta_i - \beta_j) - \frac{\beta_i^2}{2c} - C \tag{5.6}$$

for $i, j = 1,2$ and $i \neq j$. Since due to the definition of $G_i^+(\beta_i)$, participation of the agent is guaranteed, principal P_i can design an optimal contract (G_i, β_i) by maximizing $R_i^+(\beta_i, \beta_j)$ with respect to β_i. From

$$\frac{\partial}{\partial \beta_i} R_i^+(\beta_i, \beta_j) = \frac{1}{c^2}(c - 2\beta_i - \beta_j) - \frac{\beta_i}{c} = 0 \tag{5.7}$$

and

$$\frac{\partial^2}{\partial \beta_i^2} R_i^+ (\beta_i, \beta_j) = \frac{-2}{c^2} - \frac{1}{c} < 0, \tag{5.8}$$

one obtains

$$(2+c)\beta_i = c - \beta_j \tag{5.9}$$

for $i,j = 1,2$ and $i \neq j$. Letting $\beta^+ = \beta_1 = \beta_2$, we get

$$\beta^+ = \beta^+(c) = c/(3+c). \tag{5.10}$$

Thus, with $c > 0$, each principal P_i, who is restricted to contracts of the form (5.1–2), will choose a positive incentive parameter β^+. Inserting $\beta + = \beta_i = \beta_j$ into Eq. (5.4) reveals that the market outcome is the same as in Section 2.

$$x_i^+ = \frac{1}{3+c} \tag{5.11}$$

$$p^+ = \frac{1+c}{3+c} \tag{5.12}$$

$$R_i^+ (x_i^+, x_j^+) = \frac{1 + \frac{c}{2}}{(3+c)^2} - C. \tag{5.13}$$

It may or may not surprise the reader that strategic delegation under (5.1–2) leads to the same outcome as the usual Cournot model. [6] To see why, note that each principal can influence only his own agent's choice of sales (see (5.4)). Therefore, in equilibrium each principal chooses sales incentives so as to induce his agent to choose the sales amount which is a best reply to the sales amount of his competitor. [7] Unlike in Section 4, where each principal influenced both agents' choices of sales (see (3.4)), there is no commitment value to doing differently. This does not mean, however, that strategic delegation 'does not matter'. Suppose that only principal P_i could use strategic delegation according to (5.1–2), while the other producer was left on his own (like the firms in Section 2). First, P_i announces a contract, then his agent and the other producer simultaneously choose sales amounts. In this case one can show that in equilibrium P_i enjoys the same advantage as would a Stackelberg leader.

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[6] In this respect, our results here differ from many classical results on strategic delegation (Fershtman and Judd, 1987 and others). Again this is because different sets of possible strategic delegation contracts are used.

[7] It may seem odd that principals $i = 1,2$ do not order their agents directly to sell x_i^+. A reason could be that principals do not observe sales amounts (if customers pay β_i per unit to the agent, the principal would deduce from his profit R_i the sales x_i only when x_j would be known). Many principal-agent models (see for example Holmström, 1979) assume that production is stochastic and that only agents learn about actual output levels.

6. Privately known types

Our analysis has so far assumed that the relevant 'type' parameters (β_i, β_j) are commonly known when sales decisions are made. A very different informational assumption would be that these parameters are private information (each i knows only his own β_i in the indirect evolutionary approach, each principal P_i and agent A_i knows only the contract he has signed in the strategic delegation case). In the following, we briefly comment on how our results are affected in this case.

In the indirect evolutionary approach, suppose that the seller's beliefs concerning the other firm's $\beta \in M$ are determined by the true distribution in the population. This is a standard case with private information (see e.g., Güth, 1995). Then, (see Güth and Peleg, 1997 for a general analysis) only $\beta^* = 0$ can be evolutionarily stable. The reason is that if a particular seller i's type would change only i would react. It follows that only a best reply in terms of market success (i.e., with no independent weight for sales) can be evolutionarily stable. $\beta^* = 0$ is best against $\beta^* = 0$ and thus evolutionarily stable. [8]

For strategic delegation a similar extension of our analysis to privately known types yields the same results. If a principal cannot publicly announce the incentives of his agent, incentives guaranteeing best replies in terms of market success are clearly best. Thus, also in this case the standard Cournot outcome results. [9]

7. Conclusion

To explain institutions, one can refer to a pre-institutional decision stage where players decide strategically about the future institutional set up. An example of this kind of strategic delegation is the well-known, nevertheless fictitious, contrat social, but also the stage of mechanism choice in the theory of mechanism design which assumes that certain individuals can decide about the mechanisms to be applied later.

An alternative approach is that of (indirect) evolution. In the spirit of 'purposive' or 'spontaneous' social formations of Hayek (1952) (Chapter 1.VIII), no

[8] Here, of course, we implicitly rely on the usual assumption (in evolutionary game theory) that sellers interact only once in the market. If 'before reproducing' the same sellers would repeatedly sell on the market, former sales choices might signal one's own β-incentive. That is, private information could be revealed. Conceivably it may then be important to have other incentives than $\beta = 0$. Just as in the case where incentives are commonly known, the other firm's behavior may change.

[9] Compare Güth and Kliemt (1994) who (in a different economic context) apply an indirect evolutionary approach and discuss also informational assumptions which are intermediate to the polar cases where types are common knowledge and private information, respectively.

one intentionally designs the future set up.[10] The precise structure is rather determined by the relative success of the alternative designs in the given institutional environment. This reveals an essential difference of the two approaches. Whereas the first approach needs an all encompassing game model the second one does not require this, as the strategic choice of future rules is replaced by modeling the evolution of such rules.

In the specific context of a simple duopoly market, where sellers might care about sales in addition to profit, we have scrutinized the argument that these conceptually very different approaches yield the same outcome. A preconception why this may happen can be based on the observation that both approaches allow for certain kinds of commitment regarding future behavior. In the case of strategic delegation such commitments take the form of chosen incentive contracts, under indirect evolution they correspond to preferences which have evolved over time. The results leading up to Theorem 2 show that with a tight correspondence between the mutant space of the indirect evolutionary approach and the set of feasible contracts in the strategic delegation approach, indeed the two approaches lead to the same outcome. This results illustrates a technical similarity between the two approaches, and that the indirect evolutionary approach may be thought of in terms of a particular form of strategic delegation.

However, if one starts out in a framework of strategic delegation with inducement of sales concerns, also other sets of feasible contracts may appear natural. With such contracts, the results concerning strategic delegation may change. This underscores the conceptual differences between indirect evolution and strategic delegation. If a particular mutant space is natural in an evolutionary setting, while a differently motivated set of contracts is natural under strategic delegation, then the economic outcome may be sensitive to whether the market institution is shaped by evolution or by design.

In closing, we note that the indirect evolutionary approach has a shorter history in economic research than does strategic delegation. In our view the indirect evolutionary analysis deserves more attention, as it offers a new and innovative perspective to explaining economic institutions. Like strategic delegation, the approach does not deny that decision makers are rational. Unlike strategic delegation it does not require an all encompassing game model which has to specify for example the incentives, the information conditions, and the strategic possibilities of those who decide about the future institutional set up. One does not

[10] We are grateful to the editor Arye Hillman for suggesting that we refer to Hayek, who we believe would be intrigued by the indirect evolutionary approach. Hayek (1952) writes: ‘‘Many of the greatest things man has achieved are not the result of of consciously directed thought’’ (p. 84). He credits Adam Smith and Carl Menger with similar ideas and approvingly cites Menger: ‘‘how it is possible that instituitions . . . can arise without a common will aiming at their creation is . . . perhaps the most significant problem of the social sciences’’ (p. 83).

have to model a pre-institutional decision stage, but rather the evolution of economic institutions.

The fact that strategic delegation and indirect evolution are conceptually different suggests, however, that these are in no way competing approaches. Rather the two shed independent light on how economic institutions can be explained. In principle, the two approaches can even be employed together, for example by assuming a market with strategic delegation and by deriving the evolutionarily stable rules of strategic delegation (principal and agent may, for instance, develop a feeling of corporate identity which could be captured by mutual altruism as by Bester and Güth, 1998).

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