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Review

Positioning strategies in case of oligopolistic competition: The case of telecommunications industry in Senegal

Babacar Ndiaye[1]* and Cheikh Thiaw[2]

[1]University of Ziguinchor, Senegal.
[2]University of Nice Sophia Antipolis, France.

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Innovation is the major instigator in competitive industry. The competition for innovation is traditionally analyzed within the framework of deterministic and stochastic models (Reinganum, 1989). Boone (2001), Fethke and Birch (1982) have respectively analyzed the standard models of competitive strategies in a duopoly and oligopoly industry. By focusing our analysis on deterministic models that is, the models without technological uncertainty, this paper attempts to interpret the model of Boone (2001) in order to determine the choice of positioning in a context of cumulative innovation. Thus, taking into account the case of the telecommunications' sector in Senegal, we try to understand the motivations of the incumbent firm (called first mover) to implement cumulative innovation in order to maintain its position in spite of the investments of entering firms (called follower).

Key words: Innovation, competition, deterministic models, telecommunications industry, Oligopoly.

INTRODUCTION

Competing by innovation is most of the time studied in literature through the concept of "*timing of innovation*". For a long time, analyzing this notion has required the mobilization of Theoretical and empirical models. Reinganum (1989) proposed a classification with two categories of models: models of patent races and auction models. With the first models, there is always a mechanism protecting the innovation which promotes research activity (that is, with a possibility of failure, and a possibility of requiring more expenditure and time than planned). In contrast, with the second model, result of R&D depends not only on the Investment effort which promotes the development activity, but also on a lack of technological uncertainty.

R&D activities are the key factors to achieve an innovation. From this classification, we try to identify the competition for innovation within an industry in oligopoly. Considering the typology of models described above, there are similarities between the model of patent races (resp. auction models) and stochastic models (resp. deterministic models). In order to represent the competition for innovation, we can identify the optimal date from which the innovation becomes available to the consumers. According to the type of models, this date is either certain or uncertain. In the first case, the model is deterministic, whereas in the second case the model is stochastic.

The fundamental difference between these two types of model is based on the fact that the success of the investment which is converted to an innovation is not always guaranteed. In deterministic models, the relation between the amount invested in R&D and the date of success of the innovation is fixed. In other words, the greater the effort in R&D, the nearer the date of success of the innovation.

This is due to the decreasing functional relationship between both variables. In contrast, in stochastic models the relation between the amount invested in R&D and the date of successful innovation is random or probabilistic. In this case, the date of success is a random variable whose distribution depends on the R and D effort.

*Corresponding author. E-mail: babacar3@yahoo.fr, cheikh.thiaw@gmail.com. Tel: +221 77 316 52 52, 04 93 95 42 28. Fax: +221 33 991 68 09, 04 93 65 37 98.

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Thus, the firm whose investment is the most important has a higher expectation of date of discovery. In both types of models, we consider in general, that the first firm which obtains innovation is considered as the winner. By focusing our study on deterministic models, the first aim of this paper is to identify the determinants of positioning strategy in the telecommunications' industry in Senegal, which has undergoes a recent liberalization.

In fact, during a long time, the growth of developing countries had been devoted to the development of three types of main industries: iron and steel industry (in order to cope with great needs of industrial equipments) and agriculture and health sectors (for satisfying their vital needs).

In Senegal, agriculture, fishing and phosphates'[1] industry had been for a long time the nerve center of the economy and had made it possible for the country to rise itself among the bests economies in Western Africa. But, more recently, with the perpetual decline of the fishing industry due in particular to the massive arrivals of large European and Asian fishing boats which come to seek fish in West Africa, the sector of tourism as promotes by APIX[2] plays also the role of the driving sector of the economy. So, it is only at the end of the nineties, then at the beginning of the year thousands that Senegalese authorities started to be aware of the importance of the telecommunication sector in the economical development, then start taking supporting initiatives to that sector. The most important of them was the liberalization of the sector in order to "boost" its growth and develop its correlative activities. Indeed, under the impulse of its push coming from western countries and the internal needs of the population, the networks' industry, and mainly the telecommunications', has become essential for an ascending and perpetual economic growth. Nowadays, the use of cell phones has spread extraordinarily, and subsequently leads to a development of innovative services adjusted to a rural context.

With deterministic models, there is no uncertainty and the concept of the commercial value of innovation will be introduced. This concept is defined as the highest bid that the firm is ready to offer for obtaining innovation.

The choice of focusing this research on the deterministic models is based on analytical considerations, meaning that the industrial application suggested according to the theoretical results obtained, depends only on the strategic position of a firm in accordance with the reaction of rival firms .Thus, the second aim of our article is to analyze the precarious or perennial position of the first firm that acquires innovation. In other words, we try to understand whether the company which is acquiring the innovation (the first mover) strengthens its leading position in time compared to the potential entering firm (follower), or if the latter can establishes a strategy of direct competition with the innovative firm. Answering to this question leads to identify the optimal date to introduce innovation in case of symmetrical firms, then in case of asymmetric firms. This distinction is related to the fact that if firms are symmetric, each is rewarded according to effort in R&D, whereas in other cases, firms are differentiated by their efficiencies in producing**,** and encouraging innovation is highlighted by the *replacement effect* (Arrow, 1962).In this context, the incentive of the firm to innovate is directly linked to the cost of R and D.

INTER-FIRM RELATIONS IN DETERMINISTIC MODELS

There is no uncertainty in the analysis of deterministic models and firms' strategies are to adopt quickly the innovation in order to maximize their profits (Jensen, 2001). Then, the question is to know which criteria enable to distinguish the firms most encouraged to invest in R&D? To answer to this question, a distinction is made between the case of symmetric firms and the case of asymmetric firms.

Case of symmetric firms

Generally, in this case, competition is formulized like a game in which, the availability date of the innovation depends on the degree of investment (Loury, 1979; Lee and Wilde, 1980; Beath and Katsoulakos Ulph, 1989). In these circumstances, we try to know if there is at least a firm which is willing to pay an effort in R&D higher than its rival firm's efforts, in order to obtain innovation. Usually, this effort is called the "commercial value of innovation" (Reinganum, 1989). As deterministic models have the same criteria as the models of bidding, therefore the commercial value of the innovation is an exogenous parameter defined as the maximum bidding that a firm is laid out to pay in order to obtain the innovation.

In order to present the case of symmetric firms, we take into account the Scherer's basic assumptions (1967) to justify the relationship between the date of innovation and the amount of investment. In a context of symmetric duopoly, the probability of achieving innovation is identical for each firm. Considering that at date 0 the firm invests in R and D an amount noted by x, it can get an innovation at the date t $(t \neq 0)$. In this case, the deterministic relation between x and t is: $t = T(x)$ with $T(x)$ the date on which the innovation is available. The basic assumptions of the function are the following**s**:

i) $T'(x) < 0$; ii) $T'(x) \geq 0$; iii) $\lim_{x \to 0} T(x) = \infty$ et $\lim_{x \to \infty} T(x) = 0$; iv) $\lim_{x \to 0} T'(x) = -\infty$ et $\lim_{x \to \infty} T'(x) = 0$.with.

Moreover, so that the function *t(x)* be deterministic, the

[1] 9th world phosphate producer

[2] APIX : Agence National Chargée de la Promotion des Investissements et des Grands Travaux (www.investinsenegal.com)

four previous assumptions must be verified. The first assumption means that the higher the amount of R&D, the closer the expected date of innovation.

Thus the relationship between $T(x)$ and x is decreasing. The second assumption means that an increase of x leads to a decrease of the date of obtaining innovation less than proportional. The third and fourth hypotheses are related to the existence of diminishing returns between $T(x)$ and x. This means that since there is no investment expenditure, it is impossible to obtain an innovation in finite horizon $\left(\lim_{x\to 0} = \infty; \lim_{x\to 0} T'(x) = -\infty\right)$. Meanwhile, in the presence of infinite capital expenditure the innovation is obtained.

The assumptions on $T(x)$ lead to focus on the form taken by the cost of expenditure on R and D. This cost is either fixed (Kamien and Schwartz, 1974) or variable (Scherer, 1967). In the first case, the relationship between the cost of R&D, noted C, and the expected date of obtaining innovation is an inverse relationship: $C(t) = T^{-1}(t) = \frac{1}{T(t)}$. The previous assumptions lead to establish a direct relationship between the form taken by fixed cost of R & D and the date to which innovation becomes available. Assumption i) leads to assumption i ') $C'(t) = \frac{1}{T'(t)} < 0$. Hypothesis ii) becomes hypothesis ii ') $C''(t) = \frac{T''(x)}{\left[T'(x)\right]^3} \geq 0.$ Assumption iii) becomes iii ') $\lim_{t\to 0} C(t) = \infty$ and $\lim_{t\to\infty} C(t) = 0$.

From these different hypotheses, we notice that the fixed cost of R&D and the date to which the innovation becomes available take, an identical form. In the second situation, the cost of R&D is variable, that is, measured in terms of flows of expenditure incurred until the date of innovation. Considering that the flow of expenditure is measured from the date 0 until *t* on which the innovation is available, therefore the function of the flow of expenditure at $\tau\left(\tau \in [0,t]\right)$ is given by $x = (\tau, t)$. This function is decreasing $\left(\frac{\partial x}{\partial t} < 0\right)$ and concave $\left(\frac{\partial^2 x}{\partial t^2} > 0\right)$. In these circumstances, Scherer (1967) demonstrates that if the discount rate is denoted by r, the function of expenditure flow between 0 and *t*, is $C(t) = \int_0^t x(\tau, t) e^{-rt} d\tau$.

Deterministic assumptions allow considering that when firms are symmetric within a duopoly case, there is at least one firm which invests more than its rival company, then gets the innovation. At this stage, the "*winner takes all*" mechanism is created and one of the firms obtains a positive income whereas the rival firm gets zero profit. Generally, when competition between symmetric firms is formalized as a game or tournament without iteration, a noncooperative equilibrium will be obtained (Dasgupta and Stiglitz, 1980; Reinganum, 1989). Obtaining a non-cooperative balance in a competition for innovation leads to a phenomenon called "*rent dissipation*" (Encaoua and Hollander, 2002; Encaoua and Ulph, 2004). This means that the winner gets innovation at a price such as the net present value is equal to zero. Consequently, the price at which the winner gets innovation prevents it absorbing all the available rent.

Cases of asymmetric firm

In the previous case within which firms are symmetric, the probability of obtaining innovation is the same for all firms and the commercial value of innovation was regarded as exogenous. In this paragraph, these two hypotheses are put aloof and now we consider the firms as asymmetric. A simple way to define an asymmetric firm is to consider that the unit production cost before innovation are not identical and that the commercial value of innovation depends on costs structure after innovation (Boone, 2001). In this context, firms are asymmetric in terms of production costs. To represent the case of asymmetric firms, a competition with incumbent firm and a potential entrant is proposed. The question is to know which firm has the most significant incentive to introduce innovation. We attempt to determine the most important incentive to innovate between the most efficient firm, i.e. the firm to which production cost before innovation is lower; and the less efficient firm, that is, the company to which the cost of production before innovation is higher.

Indeed, the most important incentive to innovate between firms leads to determine the identity of the firm which is willing to pay the commercial value of innovation. To determine the identity of this firm, we introduce the intensity of competition and take into account the model of Boone (2001) for justifying that the incentives to innovate between firms leads to obtain the commercial value of innovation.

In the considered case, firms' marginal production costs are different and noted by $c_i \quad (i = 1,2)$ with $c_1 < c_2$. Without uncertainty in the market, the cost of innovation, noted by c_0, allows to diminish the firms' production costs: from c_1 to c_0 for firm 1 and from c_2 to c_0 for firm 2. Profits of each firm depend on the costs of production before innovation and competing intensity denoted by θ. This relation is represented by $\pi(c, \theta)$. From these parameters, we can determine the firm which is ready to offer the highest commercial value of innovation for obtaining innovation with a cost c_0. For this perspective, we simply present the results of the

model based on the assumptions proposed by Boone (2001).

We consider two competitive[3] firms for a product such as firm 1 is more efficient than firm 2. As production cost after obtaining innovation is noted c_0, we have the following relation: $c_0 < c_1 < c_2$.

Moreover, Boone (2001) considers that there is necessarily one of the firms which obtains innovation. Respectively, the willingness for firm 1 and firm 2 to pay innovation is given by:

$$\Delta\pi_1(\theta) = \pi(c_0, c_2, \theta) - \pi(c_1, c_0, \theta) \quad (1) \text{ and}$$

$$\Delta\pi_2(\theta) = \pi(c_0, c_1, \theta) - \pi(c_2, c_0, \theta) \quad (2).$$

The comparison between equations (1) and (2) determines the most important incentive to innovate. Boone (2001) demonstrates that in case of situation in which there are only two active firms for innovating, the identity of the winner depends on the intensity of competition. For a low intensity of competition $(\theta = \theta^-)$ and a high intensity of competition $(\theta = \theta^+)$, the identity of the firm which is willing to pay the commercial value of innovation is not the same. In this way, two types of situations arise:

Firstly if $\theta > \theta^+$, the most efficient firm has an incentive to innovate higher than the less efficient firm. Secondly, if $\theta < \theta^-$, the less efficient firm is more incentive to innovate than the most efficient firm. In this latter case, firm 2 acquires innovation and the leadership position of firm 1 may suffer from it. Therefore, there is a direct competition between the two firms. However, for both firms, the incentives to innovate cannot be compared though if $\theta^- < \theta < \theta^+$.

The model of Boone (2001) shows that in the case of asymmetric duopoly, identity of the most incited firm to innovate depends on the value taken by the intensity of competition.

This intensity is estimated either shorter than the smallest value, or beyond the highest value characterizing the intensity of the competition. Moreover, this model shows that with an advantage for the most efficient firm to produce, an increase in the intensity of competition beyond the threshold of the maximum competing intensity considered, leads to the rise of the profit of this firm. Consequently, the most efficient firm has a competitive advantage over the less efficient firm. Taking into account the previous model, an interpretation with the telecommunications industry in Senegal can be proposed.

[3] Competition is considered to be dynamics in the sens that the reaction of the rival firm depends on the action of the first mover firm (Leiblein and Madsen, 2009).

INTERPRETATION: THE CASE OF THE TELECOMMUNICATIONS INDUSTRY IN SENEGAL

Evolution of the industry

The telecommunications industry in Senegal is an oligopolistic industry characterized by the presence of three firms on the market: The National Telecommunications Company of Senegal (Sonatel) with the label "Orange", Sentel under the brand "Tigo" and Expresso using the brand Sudatel.

Created in 1985 through the merger of the Post Office and Telecommunications and TeleSenegal, Sonatel's group is the incumbent in telecommunications sector. Becoming a limited company in 1997 by its alliance with France Telecom which holds 42.33% of asset, Sonatel has taken advantage of its monopoly position to establish and develop a large telephony network before the opening of the market to competition. Today, France Telecom's brand tends to become the name of the group (Orange).

After the privatization of Sonatel in 1997, the willingness of the Senegalese government was to open the telecommunications sector toward competition. In 1999, the group Millicom International Cellular (MIC) became the second operator of senegalese mobile. MIC, represented under the brand SENTEL, holds 75% of its subsidiary's assets. At the beginning of its activities, SENTEL was more known under the trademark "Hello". But, with great a concern for innovation and the industry dynamics, the brand "Hello" was replaced by "Tigo" in 2005. Since that period, the group's policy consists in innovating and diversifying its offers in order to respond to the increasing consumers demand.

While still remaining in the dynamics of the market's opening to competition, a third operating license was attributed in 2007 to the Sudanese Company of Telephony: SUDATEL. The company's brand is Expresso "Senegal." Since the starting of its activities in 2009, Sudatel tempts to fill the gap separating it from the two previous operators by providing massive contributions in terms of innovation. In that way, the company has proposed for the first time in Senegal, a new standard for third generation phone, which by definition is based on UMTS (Universal Mobile Telecommunications Systems). This represents an absolute break with the GSM (Global System for Mobile communication).

Positioning strategies

Positioning strategies illustrated in this paragraph are based on the results obtained from the model presented by Boone (2001). We are highlighting a comparison between each operator's offers by considering only the situation in which firms are asymmetric because of variation in the investment capacities which exist between the incumbent and entering firms. With this intention, we confront the market share between Orange, Tigo and

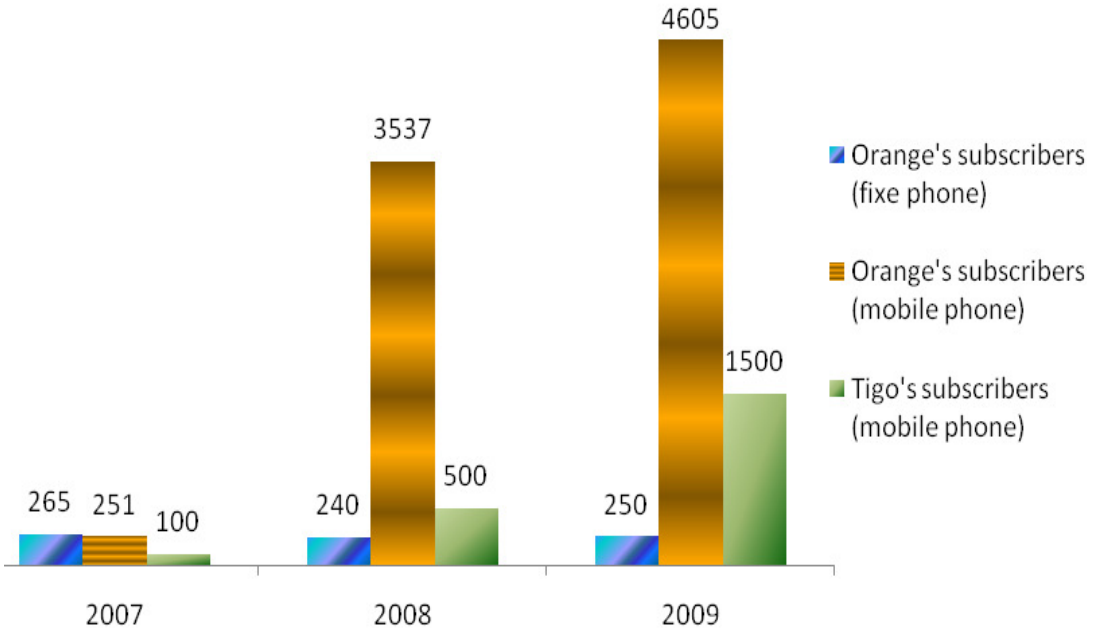

Figure 1. Subscribers of Orange and Tigo (in thousands).

Expresso by taking into account the investment strategies. This makes it possible to consider cost difference of production existing between the most efficient firm (incumbent) and the less efficient company or firms.

In terms of innovation incentive, the crucial point of positioning strategy which we are dealing with in this paper, consists of verifying the "*replacement effect*" between the incumbent and entering firms. Explanations relative to this question leads to consider the market segments on which each operator is present, then to apprehend the diversification of the products offered in terms of innovation. Thus, the question is why firm diversify their products taking into account the rival firms products?

Generally, the different market segments on which operate industrial sector of telecommunications are: mobile telephony, fixed telephony, the Internet access services using conventional lines (ADSL) and the cellular connection to the Internet (WAP). The distribution of these different market segments presented in 1 let notice a double observation. Firstly, the incumbent (Sonatel) is present on all market segments and offers in addition to traditional services, various innovative services which are beyond the operation of the telecommunications market. The reason of this fact is in particular, the advantage acquired before the opening of the market to competition. Secondly, the last entrant, Expresso Senegal, is also present on all market segments. This is due to the fact that, contrary to SENTEL, SUDATEL has mobilized a significant investment in order to promote his label. Moreover, it is the only operator equipped with a third-generation license (3G). However, owing to economic issues in this market segment, the tendency is towards a change in competitors' strategies Undoubtedly, that SUDATEL to keep a length in advance compared to the incumbent on the next-generation technologies. Concerning the offers proposed in the market by the three firms, there is permanently an aggressive promotion policy. For instance, with prepaid cards, Orange offers regularly promotions which exceed 50% Orange on all recharging cards. As for Expresso, it offers 100% bonus and Tigo proposes unlimited calls to favorite numbers and/or reduces price for calls towards customers within the TIGO network. These promotional offers allow each operator to advocate its brand image through a marketing policy closer to consumers needs.

From the standpoint of positioning strategies of the different firms, Orange still leads a length with regard to its competitors in market segments where demand is greatest, mainly, mobile telephony and home Internet access.

Thus, the replacement effect principle demonstrated in the previous section is not verified in cumulative innovation industries such as telecommunications'. In other words, when innovation is the only competitive factor which differentiates competing firms, the incumbent firm has a greater incentive to innovate than potential entrants. This is illustrated in Figure 1 from 2007 to 2009. On the basis of market shares, Orange Mobile has at its disposal a significant advance towards its rivals. In this way, at the end of 2009, the market shares of Orange Mobile and Tigo were respectively 67 and 32%. As well, since the release of its services, Expresso launches itself slightly into the market shares conquest. However, there is presently a higher intensity of competition. The dynamics in the market shares' evolution shows that even if

Tigo showed an increase of its Market shares between 2008 (26%) and 2009 (32%), we notice yet an increase in Orange Mobile's market shares due to massive arrival of new customers. Consequently, competition is characterized by a high level because of the aggressive promotion policies with services innovations increasingly important.

CONCLUSION

According to deterministic models, competition between firms is either symmetrical or asymmetrical. The first case expresses a non cooperative equilibrium which leads to the dissipation of the firms' innovative rent. Investment strategies of firms are independent and there is inevitably at least one firm which acquires innovation. In these conditions, the innovative firm (first mover) gains an advantage over the follower firm. Therefore, even if firms have equal opportunity for acquiring innovation, the innovative firm tends to reinforce its leading position. In contrast, when firms are asymmetric, there is initially a competitive advantage for at least one of the firms. In this case, when firms are differentiated by production costs before the innovation, and that the competing intensity is taken into account, the most efficient firm strengthens its leading position when a certain high level of competition is reached. The first mover firm has a higher incentive to innovate. The outcome of this case in the Senegalese telecommunications industry brings to light that the incumbent (Sonatel) retains its leading position despite investment efforts of competing firms. Conversely, when the level of competition is low, the less efficient firm has a higher incentive to acquire innovation. In this case, there is a direct competition between the follower and the incumbent firm.

Moreover, the interpretation of Boone's model in the case of Senegalese telecommunications industry stresses also that the negative relationship between effort in R&D and the date of obtaining the innovation is verified. Indeed, only the innovating firm has the benefits of almost all of the outputs of the innovation. Thus, the catch up mechanism is late or absent. In order to overcome this constraint and thus promote competition, Stewart (1983) proposed a model with which the hypothesis of "winner takes all profit" is released, but the negative relation between effort in R&D and the date of obtaining an innovation remains maintained. Taking into account cumulative innovations enables to illustrate this scenario.

REFERENCES

Arrow KJ (1962). Economic welfare and the allocation of resources for innovation. In Nelson. Editor. The Rate and Direction of Inventive Activity.

Beath J, Katsoulacos Y, Ulph D (1989). Strategic R&D and policy. Econ. J., 99: 74-83.

Dasgupta P, Stiglitz J (1980). Industrial structure and the nature of innovative activity. Econ. J., 90: 266-293.

Encaoua D, Hollander A (2002). Competition policy and innovation. Ox. Rev. Econ. Pol., 18: 63-79.

Encaoua D, Ulph D (2004). Catching-up or leapfrogging: the effects of competition on innovation and growth. Cahiers de la MSE. EUREQua.

Fethke GC, Birch JJ (1982). Rivalry and the timing of innovation. J. Econ. Lit., 13: 272-279.

Jensen R (2001). Strategic Intrafirm Innovation Adoption and Diffusion. Sout. Econ. J., 68(1): 120-132.

Kamien MI, Schwartz NL (1974). Patent life and R&D rivalry. Amer. Econ. Rev., 64: 183-187.

Kamien MI, Schwartz NL (1976). On the degree of rivalry for maximum innovative activity. Q. J. Econ., pp. 245-260.

Lee T, Wilde LL (1980). Market structure and innovation: a reformulation. Q. J. Econ., 94: 429-436.

Loury GC (1979). Market structure and innovation. Q. J. Econ., 93: 395-410.

Reinganum JF (1989). The timing of innovation: research, development, and diffusion. Hand Ind. Organ., 14: 850-908.

Scherer FM (1967). Research and development resource allocation under rivalry. Q. J. Econ., 81: 359-394.

Stewart MB (1983). Non-cooperative oligopoly and pre-emptive innovation without winner-take-all. Q. J. Econ., 681-694.