The Use Of Qualitative Research To Develop A Computational Model For Dynamic Entry Deterrence In An Emerging Market

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Abstract

This paper applies game theoretic analysis to shed new light on the dynamics of market share within a contemporary, real life, entry deterrence situation. The study evaluates the market share where new entry has just occurred and considers the resulting interaction between prices, volume of business and cash flow. Insights are gained into the success or otherwise of Government intervention in the National Health Service (NHS) market from a business economics perspective. Qualitative and quantitative methods have been used to develop a mathematical framework for the analysis of strategic entry deterrence. Insights gained from Selten's well known chain store game and a related model proposed by Waagstein are used to highlight the critical importance of enhancing a stock of knowledge and goodwill through strategic investment in information technology based service development.

This study builds on previous work that proposed a method to evaluate the strategic investment profile that minimises the total investment required for dynamic entry deterrence. We extend current theories and develop a mathematical framework for evaluating market share through the application of findings from a qualitative case analysis of a single NHS pathology laboratory. The effect of a new entrant is modelled as a perturbation of a pre-existing stable Nash-Cournot equilibrium in an oligopoly-type market and is influenced by market forces subject to Government regulation.

The framework emphasises the importance of using qualitative research in order to identify the elemental parameters for the particular organisation under study. Credibility for the resulting

refined model is gained because its assumptions are grounded in critical empirical analysis. The evidence from case analysis suggests that managers are influenced more by potential competition from the threat of new entrants from the private sector, than by actual competition among existing providers of pathology services. Contrary to expectations, economic analysis shows that the likely impact of Government regulation of NHS prices would tend to be that if there is an increase in the volume of business the total cash flow and average prices would increase. However, within our case study region, the Government has achieved its overall objective of improving quality at value for money prices. The major conclusion arising from this research is that Government initiatives do not succeed in promoting competition in markets where existing NHS providers are operating efficiently.

Keywords: Game theory, Dynamic entry deterrence, Qualitative and quantitative methods, Market share

1. Introduction

This paper extends previous work adapting the entry deterrence model of Waagstein (1983) reported in Lee et al. (1998). Game theoretic analysis is used to understand more about the dynamics of market share within a contemporary, real life, entry deterrence situation. We investigate the effectiveness of the Government led reforms of the National Health Service (NHS) to determine whether an economic benefit does result to the patients, who remain the ultimate consumers of health care but with little or no economic influence. The Government led initiatives were designed to remove the institutional barriers which formerly prevented private sector involvement in the NHS in order to promote competition and improve the services provided as well as the choice available to patients. We draw on the findings of a case study analysis of Edale Pathology[1], henceforth referred to as provider *E*, and its market that we have identified to have the key characteristics of the general United Kingdom (UK) National Health Service market (Lee et al., 1998).

[1] This is a pseudonym for the pathology department of the NHS trust hospital with whom we collaborated in this work; it wishes to remain anonymous since our conclusions have had a direct impact on its business strategy and, as such, would be of value to competitors.

The paper notes in Section 2 the closely regulated nature of the market for NHS providers of pathology services and the initiatives employed to introduce competitive pressures to improve efficiency. The research approach is explained in Section 3. This is followed in Section 4 by a brief description of the case study situation and the potential for entry into provider *E*'s market by a private sector provider of pathology services. The impact of entry would be to create a duopoly situation. The economic analysis in Section 5 is used to help demonstrate that the characteristics of the emerging market greatly influence both the likely entry and the reactions in the market if entry takes place. Government attempts to stimulate competition are analysed by examining the marketplace post-entry. Results indicate that, contrary to expectations, a new entrant would still face significant economic difficulties in entering the market and that these would tend to cause an increase in average prices.

2. Motivation for a Market in the NHS

Successive reorganisations during the 1980s and 1990s have influenced the structure and the management of health services from primary to secondary or hospital health care in the UK National Health Service. This paper focuses on the implementation of the NHS and Community Care Act, introduced in 1990 with the aim of reforming the management and structure of patient care in the NHS and creating an internal market for the provision of secondary health care in England and Wales. As a result of the Act, institutional barriers to private sector involvement were removed and the provision of health care began to be arranged through a system of contracts. Knowledge of the structure and management of the provision of health care prior to the recent structural reforms is necessary in order to understand the motivation to create a market in the NHS and to apply market principles.

The NHS was founded in July 1948 as a result of the National Health Services Act 1946. It placed a duty on the Secretary of State to establish a comprehensive health service designed to secure improvement in the mental and physical health of the people of the UK and the prevention, diagnosis and treatment of illness. General medical practitioners (GPs) and practice nurses, dentists, pharmacists and opticians provide the main point of contact with the NHS for the majority of people in terms of primary care. Hospitals are the main providers of secondary health care and a system of regional bodies was created to administer the network of providers and to manage and

control resources. The structure of the NHS before the recent reforms was established by the Health Services Act of 1980 and introduced in 1982 and has been well documented by Honigsbaum (1993). The control and funding structures in operation during the 1980s have come into much criticism in the literature, particularly from researchers at the Centre for Policy Studies. Letwin and Redwood (1988) described the NHS system as a 'bureaucratic monster' which neglected patients' interests and allocated resources irrationally. Goldsmith and Willets (1988) found poor management and long hospital waiting lists in the NHS to be the consequence of the large size of the organisation and the absence of competition between its constituent parts. Earlier work by Enthoven (1985) had suggested that NHS efficiency could be enhanced if health authorities and hospitals traded with one another, buying and selling clinical services to create additional revenue. However in view of the high levels of public support for the principles of a comprehensive, universal and tax-funded health system (Bosanquet, 1988) the Government recognised that wholesale privatisation was politically unacceptable (Klein, 1989). A restructuring of the NHS based on the application of market principles to the supply of health care services within a state-financed system was the Government's preferred route forward. In this way, the demand for health care provision could also play a part where, previously, just the supply of health care resources had been taken into account.

The NHS and Community Care Act 1990 (Department of Health, 1990) created a market in the NHS and reformed the structure and management of the provision of patient care. The Act resulted in regional and district health authorities becoming more streamlined, whilst a system of contracts was arranged for the provision of health care. In this way, one body, the purchaser, is responsible for obtaining the appropriate health care services for its population from a second body, the provider. The providers must compete amongst themselves to secure contracts from the purchasers in order to recover costs and to meet financial performance targets set by the NHS Management Executive. In order to stimulate competition among the various providers, the way in which funding is allocated to the hospitals and general practices was revised. The Act enabled general practices to apply for fundholding status. This was a major new development in the NHS, making the general practitioner (GP) a purchaser of health care services. It gave GPs and their patients the ability to exercise greater freedom of choice, within the limitations of the resources available (Department of Health, 1989b).

A fundholding general practice became responsible for its own NHS budget for a specified range of goods and services and its performance is now monitored by the family health services authorities on behalf of regional health authorities. In addition to becoming fundholders, GPs were subjected to a change in their contract following the Government's introduction of the 1990 GP Contract (Department of Health, 1989a). This legislation was intended to stimulate competition via payment and incentive schemes designed to make GPs and their general practices financially dependent on the range and volume of services they offer (Department of Health, 1996). For example, the new contract allowed an increase in the proportion of GP's income determined by the number of patients on their lists ('capitation' fees) with enhanced capitation payments for elderly patients.

Turning now to the providers of secondary health care, these are principally the NHS hospitals. Their role is to deliver quality health care in return for agreed charges. They were formally managed by a health authority. The NHS Community Care Act 1990 enabled hospitals to become independent of health authorities control as self-governing NHS Trusts, each with its own board of directors and the freedom to organise its own affairs, subject only to the legal framework and the contracts it has negotiated with purchasers. The main financial duties of an NHS Trust hospital are: to break even; to earn a six percent return on its capital and to operate within the External Financing Limit (EFL) set by the Secretary of State. In addition, cross-subsidy between services is not allowed and prices charged should reflect costs. Costs of services are calculated using a full cost method. By making NHS Trust hospitals financially dependent upon GP referrals, hospitals are expected to compete with each other to secure contracts in order to survive and meet their financial targets.

The Government's commitment to promoting competition in the provision of health care was one of the motives behind the 1991 White Paper, 'Competing for Quality' (HM Treasury, 1991). This initiative emphasised the concept of market testing services as a means of improving quality whilst maintaining good value for money. The NHS Executive in 1995 re-emphasised the significant role played by market testing and also the contracting process between NHS purchasers and their choice of providers in the improvement of cost efficiency and quality of service for patients (NHS Executive, 1995a). Further evidence of the Government's plan to increase the involvement of the private sector in the provision of public services was provided by the launch of the 'Private Finance Initiative' (PFI) in November 1992 and documented in the NHS Management Executive, 1993.

'The initiative gives the NHS access to private sector skills and expertise, as well as a new source of finance for capital infrastructure investment. … Since its launch, the NHS Executive has been promoting the initiative to secure best value for money and transferring substantial risk to the private sector.' (NHS Executive, 1995b).

The attraction of private finance into the NHS is particularly appealing to all parties. It is a vast market that is well established and the provision of healthcare is well understood. For an NHS Trust hospital, private capital is welcome as it does not count towards its external financing limit. The relative success of the Government initiatives outlined here is now evaluated using qualitative research to develop a game theoretic model of strategic entry deterrence.

3. Research Approach

At the time of this investigation, little had been published on the operating process of the NHS market and literature searches revealed no evidence on either the nature and source of potential entrants or on ways of deterring entry in this sector. The main challenge was to assess the contemporary phenomenon; to find out what was happening and attempt to explain it. The investigation sought to structure a previously unstructured[2] and dynamic situation (rather than to solve a well-structured problem) by a process involving participation as an important component. Access to provider *E*'s internal data allowed a qualitative approach to the investigation that acknowledged the importance of the internal structure and the rich context of the problem situation studied. Also, it registered the conflicts and interactions inherent in the problem. Case study investigation has established a framework for the analysis of entry deterrence within an emerging market for NHS pathology services (Lee et al., 1999). The framework emphasises the importance of using qualitative research in order to identify the elemental parameters for the particular organisation under study.

As a result of Government initiatives to encourage competition in the NHS, provider *E*, a provider of a public service with a near monopoly in its geographical locality is concerned at the threat of entry from a newcomer from the private sector to its existing market. Initial analysis of the problem situation

[2] 'This paper adopts the understanding of unstructured as Mintzberg, Raisinghani and Theoret (1976, p. 246) referring to "decision processes that have not been encountered in quite the same form and for which no predetermined and explicit set of ordered responses exist in the organization".

established that there were issues of conflict to be understood which suggested that game theory could be employed. Game theory is recognised as the only orthodox operational research approach which incorporates the conflict dimension (Rosenhead, 1989). If the conflict inherent in the entry deterrence situation could be understood together with knowledge of barriers to entry then there was a possibility to develop a framework to analyse this real life situation. Research into barriers to entry is well documented in the literature but is mainly concerned with industries in established, rather than emerging, competitive markets. Such applications were explored, however, as possible precedents to guide action. The strategic nature of the decision to deter entry gave the opportunity to test the value of the well-known work of Selten 'The Chain Store Paradox' (1978) on game theory for analysing the data and structuring the problem. Furthermore, Selten's work also indicated that quantification was a possibility. Selten's game theoretic perspective describes the nature of strategic competition as an established firm and the potential competitor being in a situation of interdependent decision making. The conclusion from Selten's toy-game, that the decision to deter entry is not an outcome of a model of entry deterrence, is confirmed in the case study. The senior managers of the NHS pathology department concerned had made the behavioural decision to deter entry at the outset. The importance of making pre-play irrevocable commitments, deemed necessary by Selten to make a threat to deter entry credible, was also confirmed. Furthermore, irreversible actions were found to have the same effect. The range of barriers and related types of investment available to provider *E* were found to be limited. For example, the often quoted, investment in capacity was not an option for provider *E* because of the unnecessary continuing costs associated with generating spare capacity and the reported need for rationalisation within the pathology service sector (Audit Commission, 1991).

Detailed case analysis highlighted that the effect of new investment would not be instantaneous and thus a dynamic model is more useful for the analysis of entry deterrence. Waagstein's (1983) formulation of a dynamic model of entry deterrence was introduced and its main assumptions and the concept of using a stock of knowledge and goodwill generated by investment to deter entry highlighted. It was this model that related the understanding of the real life problem to game theory. The mathematical representation of the case study analysis required further interviewing, discussion, document searches and so on, which in turn extended the understanding of the phenomenon. The research approach has similarities to Rasmusen's (1994) notion of 'careful empiricism' leading to 'exemplifying theory'. However, a consequence of using a case study approach is to recognise that the

deterrent investment considered appropriate for provider *E* might not be appropriate either for other pathology laboratories or for entry deterrence in other industry.

Waagstein's (1983) formulation of a dynamic framework provided the foundation to construct a quantitative model of a game played prior to entry. An earlier paper by the current authors, (Lee et al., 1998, p. 306) argued that 'the assumptions of Waagstein's theoretical model can be modified in natural ways to apply to the case studied'. However, the treatment of market share was limited and no consideration had been given to market share after entry had taken place. Waagstein mentions that the market share that the incumbent provider might expect a new entrant to gain 'should be determined endogenously ... in the post-entry game'. This is an important aspect of the overall study, although, at the present time, there is little actual experience on which to base a model of this game. There are, however, some features of the current case that assist in determining a market share parameter for the purposes of decision support to the incumbent provider *E*. The following two sections extend this analysis.

4. Case Study and Analysis

Provider *E*, the pathology department based at the Edale Hospital NHS Trust, is a non-profit organisation and the main pathology service provider for Edale, serving a population of 500,000 people. Nearly 80% of the people in the area are currently served by fundholding GP Practices. As a health area, Edale has the second largest number of GP fundholders in the UK. Provider *E* has seven NHS pathology laboratories on its border and a private sector laboratory situated within its locality. The latter's main market is private hospital work and the majority of microbiology work contracted to this laboratory is referred (sub-contracted) to provider *E*. The private sector laboratory shows no evidence of marketing activities to gain contracts with the local NHS purchasers and hence is not regarded by the managers of provider *E* as one of their competitors. Three of the neighbouring NHS pathology laboratories provide services for the local population at the geographical boundary and thus they have contracts with provider *E*'s health authority. There was no access to data relating to the actual value of contracts, but provider *E*'s managers confirmed that the contracts reflect historical connections rather than being the result of competitive activity since the NHS market was created. However, estimates show that provider *E* contributed approximately 77% of the total supply of pathology services to the local market.

We have analysed the competitive environment relating to provider *E* according to Porter's (1980) five forces, namely rivalry among the existing competitors; bargaining power of suppliers; bargaining power of purchasers; threat of substitutes; and threat of new entrants. The examination of the strength of each of these five forces found little competitive pressure from the first four. Indeed, there is a benign state of actual competition. The managers of one of provider *E*'s neighbouring NHS pathology laboratories explicitly demonstrated the desire to avoid competitive conflict thereby maintaining the stable equilibrium relating to the existing market share. Based on our case analysis, we concluded that NHS pathology laboratories do not expect rivalry with other NHS providers in their own locality even though Government initiatives encourage competition in the marketplace. Thus it is reasonable to assume that the neighbouring NHS providers maintain a Nash-Cournot equilibrium.

However, Porter's (1980) fifth force, the threat of new entrants, is significant. There are potential new entrants from the private sector who are interested in becoming providers of NHS pathology services. The case analysis showed that the most likely potential entrant to provider *E*'s region is a private sector laboratory. Entry is unlikely to be directly into provider *E*'s existing market because it is an efficient and competitively priced provider of customer oriented pathology services (The Clinical Benchmarking Limited, 1996a, b). The threat arises from neighbouring provider *F* being an inefficient, relatively high priced provider with spare capacity.

The most likely route of threat to provider *E*'s market will be a take-over of provider *F* by a private sector laboratory. Once in place, the entrant, *P*, would need to expand its market in order to maximise the return on its investment. There would be real competition for contracts with GP fundholders, especially at the geographical boundary and even competition from hospital contracts in provider *E*'s home city. This would mean that the seriously competing laboratories are *E* and *P*, that is, two providers of pathology services offering the same (homogeneous) or functionally similar (a low level of differentiation) laboratory based testing services. These laboratories are potentially vying for the same purchasers. This anticipated situation between *E* and *P* is termed a duopoly and is a special case of an oligopoly-type market.

The strength of the force 'threat of new entrants' required an analysis of barriers to entry prevailing in the market. Our analysis was based on the sources of barriers to entry identified by Bain (1967)

and Porter (1980). The full analysis can be found in Lee (1999, pp. 164-173). We concluded that only one of the identified sources of barriers to entry has the potential to be active within the market, namely 'customer service and product differences'. This has been identified as being a weakness for NHS pathology laboratories. National surveys and reviews (Audit Commission, 1991; NHS Executive, 1995c) have stressed the need for significant service improvements in customer service. The service offered[3] by provider *E* is comparable to those of a private sector laboratory, both in terms of the quality of analytical/substantive service, measured by national and local External Quality Assessment schemes, and non-analytical/peripheral services, measured by customer surveys. However, based on our case analysis, we concluded that provider *E* had still not achieved an active barrier to entry. Any actual or perceived differences in service offer alone were unlikely to be sufficient to deter entry. Therefore further investment would be required in order to create a credible deterrent. In the short term, the best possibility of creating a barrier was by investing in customer oriented peripheral services in order to differentiate the 'service offer' from those of potential rivals. Following extensive consultation with the managers of incumbent provider *E*, Lee (1999, pp. 197-220) found that investment in information technology based peripheral services has the greatest potential for deterrence. Within the circumstances of case study, it enhanced goodwill between purchaser and provider and the capital sums involved are typically lower than other areas of deterrent investment. Therefore information technology is considered to be the key area where strategic investment can be made most effectively. By investing in this area the managers of incumbent provider *E* are, by irreversible action, committing themselves to a credible threat to deter a new entrant, *P*, making incursions into their existing market.

Incumbent providers faced with the threat of new entrants have the choice of one of three responses; do nothing, accommodate or deter entry. Within the case study, the business objective of incumbent provider *E* is to remain in the market and to maintain its market share. If incumbent provider *E* had done nothing then an entrant could have encroached on its market share whilst the choice to accommodate entry would have led to loss of business and higher unit costs and eventually undermined its competitiveness in the marketplace. Potential competition from a new

[3] The pathology service offer consists of two elements, namely analytical/substantive service and non-analytical/peripheral services. Example of the latter include: clinical interface; interpretation of test results; advice on test applicability; approachability; contactability; quality of advice; fast turnaround time; efficient transport systems; direct computer links; and provision of a phlebotomy service (Lee, 1999, pp. 77-79).

entrant is most likely to threaten the prospect of securing historical workloads and to retain existing market share. The managers of incumbent provider *E* were right to be concerned about potential competition from a new entrant and wished to adopt an aggressive approach. They have made a business decision to deter any threats to their existing markets. This decision was made prior to any entry deterrence game. Our field research supports Selten's (1978) necessary condition of the need to communicate irrevocable commitment for strategic entry deterrence. The managers of incumbent provider *E* were already seeking to further enhance their 'service offer' by:

managing relationships between purchaser and provider,
securing knowledge of customers' needs,
attuning the service offer to their customers' needs, in particular the peripheral services.

The level and timing of any investment of resources in order to deter entry has been the subject of a previous paper which refined and adapted Waagstein's (1983) theoretical model, (see Lee et al., (1998)). Research extending the application of the quantitative model is ongoing.

This section has described the likely route of entry and the most likely approach for a new entrant to capture provider *E*'s market share. It assumes that an entrant would act rationally and strive to maximise the return on its investment. Other scenarios were available but within the case analysis, this was considered the most practical and cost-effective route for an entrant. The following section evaluates in economic terms the market parameter derived and adapted from Waagstein's early work. This economic analysis provides insights into the post entry volume of business and cash flows. This in turn allows conclusions to be drawn about the likelihood of success of Government initiatives to promote competition within the NHS environment.

5. Economic Analysis of Market Share

This section provides a simple analysis in economic terms of the market share which provider *E* and potential entrant *P* would obtain if, after entry, their existing, separate, markets are combined and single market prices prevail. The algebra is simplified by assuming constant prices and costs over the period but similar results can be obtained when prices and costs are functions of time.

At the present time, before any entry has taken place, provider *E* has about 70 per cent of the two markets combined and prices about 20 per cent lower than provider *F*. By assuming single prices prevail in a combined market after entry, there will be economic pressure for a potential entrant *P* to reduce *F*'s prices and the economic opportunity for provider *E* to increase its prices. The outcome of this can be seen by considering the effect of entry on the price of and demand for a single test.

Before entry, the cash flow per annum to each of the providers for a test is given by

$$C_E = \theta_E + \eta_E \tau_E = \eta_E \pi_E \qquad (1)$$

$$C_F = \theta_F + \eta_F \tau_F = \eta_F \pi_F \qquad (2)$$

where θ_E and θ_F are the fixed and τ_E and τ_F the variable costs for providers *E* and *F* respectively. We will put $\tau = \tau_E = \tau_F$ since it is reasonable to assume that the variable costs are equal. The numbers of the test carried out per annum and prices charged by the two providers before entry are denoted by η_E, η_F, π_E and π_F. The crucial requirement within the NHS that prices reflect costs is captured in the second pair of equalities in (1) and (2).

Denote the total number of tests per annum in the joint market after entry by η. The conventional economic assumption that competition increases activity implies that

$$\eta \ ? \ \eta_E + \eta_F$$

Suppose the price per test in the joint market is π and market share of the new entrant is μ. Then provider *E*'s cash flow per annum after entry is:

$$\gamma_E = (1-\mu)\eta\pi = \theta_E + (1-\mu)\eta\tau \qquad (3)$$

and new entrant *P*'s cash flow per annum is

$$\gamma_P = \mu\eta\pi \ ? \ \theta_F + \mu\eta\tau \qquad (4)$$

Notice that in (4) we do not assume that the private sector provider *P* is constrained by the NHS requirement that prices reflect costs.

From equations (1) and (2)

$$\theta_E = \eta_E(\pi_E - \tau)$$
$$\theta_F = \eta_F(\pi_F - \tau)$$

so equations (3) and (4) yield

$$(1-\mu)\eta\pi = \eta_E(\pi_E - \tau) + (1-\mu)\eta\tau \qquad (5)$$
$$\mu\eta\pi \;?\; \eta_F(\pi_F - \tau) + \mu\eta\tau \qquad (6)$$

Adding equations (5) and (6) now yield

$$\eta(\pi - \tau) \;?\; \eta_E\pi_E + \eta_F\pi_F - \tau(\eta_E + \eta_F)$$

and so $\eta\pi$, the total post–entry cash flow from the combined market, satisfies

$$\eta\pi \;?\; \eta_E\pi_E + \eta_F\pi_F - \pi_F(\eta - \eta_E - \eta_F)$$

An estimate of the post–entry price is given by

$$\pi \;?\; (\eta_E\pi_E + \eta_F\pi_F)/\eta + \tau[1 - (\eta_E + \eta_F)/\eta]$$

From this simple algebraic analysis it appears that

- the total cash flow from the combined post-entry market is at least as great as the sum of the cash flows from the separate pre-entry markets
- the post entry price per test is at least as great as the weighted average of the pre-entry prices.

In each case, equality holds if and only if $\eta_E + \eta_F = \eta$ — that is, there is no increase in activity as a result of competition — and the cash flow to the new entrant is just sufficient to cover costs —— that is, what it would be within the NHS pricing structure. To estimate μ, the market share that the new entrant needs to gain in order to recover costs in the combined market, notice that

$(1-\mu)\eta(\pi - \tau) = \theta_E$ from (3)

$\mu\eta(\pi - \tau)$? θ_F from (4)

Dividing these gives

$$\frac{(1-\mu)}{\mu} \leq \frac{\theta_E}{\theta_F}$$

so

$$\frac{1}{\mu} = \frac{(1-\mu)}{\mu} + 1 \leq \frac{\theta_E}{\theta_F} + 1 = (\theta_E + \theta_F)\theta_F$$

Thus

μ ? $\theta_F/(\theta_E + \theta_F)$

which says that the new entrant needs to gain a market share proportionate to provider *F*'s fixed costs in order to recover costs in the combined market.

However, this purely economic analysis is somewhat unrealistic from provider *E*'s point of view as it is not permitted to increase prices unless and until costs increase. This disadvantages a newcomer. At present if provider *E* took a larger share of the joint market, which it would if price were the only or main factor influencing a purchaser's choice of provider, then its fixed costs would be shared over a larger number of tests and its unit price would decrease.

The newcomer would thus have a smaller share of the market and a lower price per test with which to compete. These pricing restrictions together with the benign state of competition amongst NHS laboratories make entry unattractive since the economic market price of tests is greater than that allowed by the accounting rules. At the point of entry, provider *P* must invest to reduce the fixed costs inherited from the inefficient provider *F* and be comparable to those of provider *E* if entry is to be economically viable. In addition, investment would be required to enhance service quality in order to match that of provider *E*.

6. Evaluation

In this paper we have been able to reflect on a post entry game and, particularly by means of the algebraic analysis in Section 5, arrive at some unexpected, and maybe controversial, conclusions. However, it should be recognised that this goes beyond the case study approach on which our previous work was based (Lee et al., 1998).

Furthermore, there is still only one case where the provision of NHS pathology services has been taken over by an independent provider, (Ewings and Sykes, 1995). It is, therefore, worthwhile reflecting on the methodology we have adopted in order to arrive at these conclusions and on the reasons for giving them credibility.

In our previous paper (Lee et al., 1998) we concentrated on the optimal pre-entry strategy for provider *E*. In this case we were not able to study the phenomenon we were modelling. Nevertheless, the credibility of the work was derived from the insight provided by the qualitative analysis rather than from the accuracy of the quantitative conclusions. However, we are confident that our perception of the salient features of the case is sufficiently accurate that the mathematical modelling uses appropriate constructs. Furthermore, to use the mathematical results to determine the extent to which provider *E* has achieved its objectives also requires sound qualitative understanding. Fudenberg and Tirole (1987, p.176) note that amongst the benefits of modelling are that:

- 'It imposes some discipline on theoretical thinking.'

- ‘The researcher learns as much from constructing the model as from solving it because in constructing the model one is lead to examine its realism.’

It is noteworthy that the collaborating managers also learnt from the process of constructing a model based on game theory (not results from ‘solving the model’) that investments should be considered in strategic as well as operational terms. Indeed, business decisions have already been made based on the insight gained. (Edale Pathology, 1997).

As a corollary, we have also been able to indicate how the Government’s overall objective of improving quality at value for money prices has been achieved in this case. To paraphrase paragraph five of EL (95) 29 (NHS Executive, 1995a), the threat of competition

‘has been successful in changing and improving the way in which (pathology) services are delivered … More efficient working practices have been developed and services have become more sensitive and responsive to local circumstances and needs.’

The main point is that it is the perceived threat of competition that has achieved this, rather than actual competition or devices such as market testing.

What also emerges from our analysis is that by developing more efficient working practices and a more sensitive and responsive service, provider *E* has also achieved its particular business objective of deterring competition from new entrants. It may be concluded that the patient, the ultimate consumer of health care, also gains an economic benefit in terms of improved turnaround time and more competitive pricing.

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