IMPERFECT COMPETITION AND CORPORATE GOVERNANCE*

David Kelsey
Department of Economics
The University of Birmingham, England

Frank Milne
Department of Economics
Queens University, Canada.

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Abstract

This paper studies corporate governance when a firm faces imperfect competition. We derive firms' decisions from utility maximisation by individuals. This reduces the usual monopoly distortion. We find that corporate governance can effect the equilibrium in the product (or input) markets. This enables us to endogenise the objective function of the firm. If the firm cannot commit not to change its constitution, we find a Coase-like result where all market power is lost in the limit. The model can be used to examine the effects of encouraging stakeholder representation.

Address for Correspondence David Kelsey, Department of Economics, The University of Birmingham, Birmingham, B15 2TT, ENGLAND

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1 INTRODUCTION

1.1 Background

A central problem in corporate governance is to explain why firms are organised in the way they are. As Hansmann (1996) shows there are a wide range of firms in reality. These range from the small single owner/manager firm, through large corporations with separated shareholders, bondholders, boards and managers, to worker cooperatives, professional partnerships and hybrid organizations, which include non-profits such as hospitals, charitable organizations, schools and universities. From his discussion of the firm, he characterizes the myriad organizations that have evolved to deal with a wide range of organizational problems. In particular these arise where agents interact strategically in producing commodities or complex services. Factors such as the degree of competition in product and input markets and the presence of asymmetric information have a major influence on the nature of the firm.

Hansmann (1996) cites a number of examples where firms are owned either by those who purchase their outputs or those who supply inputs to the firm. He argues that, in most cases, this is to counter monopoly or monopsony power. This practice is very common among firms, which supply inputs to or buy produce from farms. (See also Refsell (1914).) In relatively remote rural areas, it is easier to establish a local monopoly. Likewise lawyers and accountants usually organise as partnerships. The reason for this is similar. The firm is a monopoly supplier of inputs which these

people need to work. Partnerships reduce the monopoly distortion.

In the present paper we consider how imperfect competition interacts with the objective function of the firm. For example, consider the labour market where firms hire specialised labour that is industry- and/or firm-specific. Our model allows a firm to take into account the strategic effect of hiring the particular type of labour on the reaction of other firms in the industry. In particular our results imply that the non-profit firm can pursue a more aggressive strategy in the labour market at the expense of profit maximising firms. Similar considerations apply if there is imperfect competition in the product market.

1.2 Modelling Firm's Decisions

In this paper, we consider an economy with monopoly or oligopoly. As we shall argue, there is a strong case against assuming profit maximisation when markets are distorted. However, it is not clear what the alternative should be. We model the firm as a collection of individuals, each of whom is maximising his/her utility. Decisions are made by a process of aggregating the preferences of a group of decision-makers within the firm.[1]

One approach, which has been used in the past, is to model decisions as being made by a majority vote of shareholders, see for instance Geraats and Haller (1998), Hart and Moore (1996) or Renstrom and Yalcin (1997). However one can object to shareholder voting models by arguing that, in practice, management have more influence than shareholders. To model this, we assume that the firm's decisions are

[1] Examples of such procedures would be the Nash bargaining solution used by Hart and Moore (1990), non-cooperative bargaining, de DeMeza and Lockwood (1998), Bolton and Xu (1999) or the voting models used by De Marzo (1993), Kelsey and Milne (1996) and Sadanand and Williamson (1991).

made by a group of individuals, which we shall refer to as the *control group*. For example, the control group could consist of the shareholders and senior management. As another example, consider a firm with no shareholders, but is a partnership. This case is common in legal, accounting, finance and professional firms, where the firm produces services that are a function of human capital, individual and team effort. However, to preserve generality, we shall not explicitly describe the criteria for membership of the control group.

At present there is no widely accepted theory of the internal structure of the firm (for recent surveys of the governance literature see Shleifer and Vishny (1997), Allen and Gale (2000) and Tirole (2001)). For this reason we use an abstract model. We make, what we believe to be the mild assumption, that the firm's procedures respect unanimous preferences within the control group. Such rules would include, inter alia, those which give a major role for management. Note that many familiar forms of governance can be seen as special cases, for instance producer cooperatives, consumer cooperatives, including worker representatives on the board (as in Germany) and many types of non-profit organisation. Despite the generality, our model is able to make a number of predictions concerning equilibrium behaviour and to throw some light on policy questions.

In a discussion of firm structures, Hansmann (1996) provides many examples of firms that are cooperatives, partnerships and non-corporate forms. Some are complex non-profit forms, where the services provided appear to require subtle forms of organisation. Hence it is desirable that any model of the firm should be flexible in abstracting from details that are specific to particular situations and should deal instead with the decision-making process in a general way.

Some theories of the firm use bargaining models to determine the relative power

of different individuals. By varying the bargaining game, it is possible to induce different outcomes to the management-control mechanism or game. Although some of these games have some semblance to reality, we feel they are highly stylized. We prefer to abstract from the details of the bargaining process and simply assume that whatever the bargaining or management game, the process leads to an efficient outcome. If one believes that in certain situations, that the outcome is inefficient, then it would be important to explain the source of the inefficiency. One could think of our model as the outcome of a process to design an efficient mechanism. If this is infeasible then we are dealing with inefficient mechanisms. As this is an open theoretical question, we simply by-pass it by assuming an efficient mechanism exists and explore the consequences of that assumption. We briefly discuss how our results would be affected by inefficient mechanisms in the conclusion, (see also Tirole (1999)).

1.3 Corporate Governance and Imperfect Competition

Consider a firm that is the sole producer of a particular good. Assume that there is consumer representation in the control group. We argue that the firm will produce a greater quantity and sell at a lower price than a conventional profit maximising monopolist. A small price reduction will result in a second order loss of profits but a first order gain in their consumer surplus. We also investigate the effect of stakeholder representation on price and quantity decisions.

In oligopolistic industries there is a similar effect of the firm's governance on price. In addition, the choice of the firm's constitution can affect the strategic interaction in markets. Consider a firm in a Cournot oligopoly. Starting at the profit-maximising level, a decrease in price will lower profits but raise consumer surplus. Different individuals will trade-off these two effects in different ways depending on their share-

holdings and consumption patterns. Suppose a firm gives more weight in its decision procedures to those who have a relatively greater preference for low prices. Then, ceteris paribus, the firm will charge lower prices and produce more output. This will cause rivals to reduce their output thus possibly giving the firm a strategic advantage in the market. Hence increasing influence of consumers on decision-making will, up to a point, increase profits.[2]

The above argument implies that there is an optimal form of corporate governance, which can be derived from considerations of the firm's position in input or product markets. Consider an entrepreneur who designs the constitution of the firm with a view to selling it to outside investors. Then there is an optimal constitution of the firm which will maximise its value. This will only be compatible with profit maximisation in exceptional circumstances. We investigate how the optimal constitution varies with the number of firms. The deviation from profit maximisation is greatest when the number of firms is small and tends to zero as it becomes very large.

Similar arguments can be used if the firm faces imperfectly competitive input markets. In this case it would be desirable to increase the power of those with a relatively high preference for raising the input price. In professions such as law, medicine and education, it is common for some or all suppliers of labour to have more influence than in conventional investor-owned firms. These firms typically require highly specialised labour and face thin markets for this labour.[3] Clearly with such small numbers competition is not possible.

[2]This is related to arguments made by Vickers (1985), Fershtman and Judd (1987), Sklivas (1987) who argue that owners have incentives to hire managers who have incentive contracts that reward according to a weighted average of profits and revenues. This makes managers more aggressive, which can raise profits in Cournot oligopoly.

[3]For instance in the UK, there are only 9 paediatric rheumatologists.

We have found that the firm can improve its market position by strategically choosing its constitution. Suppose that the firm does not just choose its constitution once but is able to revise it at any future time. In this case, we obtain a result similar to the Coase conjecture. Consider a firm which is initially profit maximising. The firm will be tempted to change its constitution to increase sales and profits. However the new control group will wish to further amend the constitution to appear more aggressive than it really is. Hence there could potentially be a whole series of expansions of the control group. The result of this process is that the firm will finish by losing all market power and producing the competitive level of output.

1.4 Dynamics of Non-Profit Maximising Firms

It has been argued that co-operatives will tend to be unstable see for instance, Farrell (1985). Consider a monopoly, which is selling below the profit-maximising price, since shareholders are also consumers. Farrell argues that a raider (who is not a consumer) could buy up shares at the current value and then make a profit by increasing the product price to the profit maximising level, thereby increasing the value of his/her shares. This argument relies on a free-riding problem. Each existing shareholder will ignore the effect of his/her decision on the product price and hence will sell to a higher offer by the raider. However we believe that this argument needs to be modified, since there is a similar free-riding problem with respect to the stockmarket value of the firm, see for instance Grossman and Hart (1980). Once the latter effect is taken into account, we argue that reducing price below the profit maximising level will not make a monopolist particularly vulnerable to take-over.

Organisation of the Paper Section 2 explains our model of firm decisions. Its use is illustrated by considering the price and quantity decisions of a uniform pricing monopolist in section 3. The effect of the firm's objective function on strategic interaction in markets is considered in section 4. The case where the firm is allowed to make multiple revisions to its constitution is modelled in section 5. The more general model where the firm interacts strategically with a number of rivals is considered in section 6. In section 7 we consider whether a non-profit firm is vulnerable to takeover. Section 8 summarises our conclusions. The appendix contains proofs of those results not proved in the text.

2 FIRMS

Economists usually assume that firms maximise profits. However the firm's objective function should be a derived concept. A firm is a collection of individuals, shareholders, managers, workers, customers etc. The firm's choices come about as a result of maximising behaviour by these individuals. The usual justification for assuming profit maximisation is the Fisher Separation Theorem (see Milne (1974), Milne (1981)), which says that if there are no externalities, the firm has no market power and financial markets are complete, all shareholders will wish to maximise the value of the firm.

In the presence of market distortions, it is not typically the case that owners will wish firms to maximise profits. The Fisher Separation Theorem does not apply if there is imperfect competition, since in that case, a change in the firm's production plan will affect prices as well as shareholders' wealth. Firstly, different shareholders will make different trade-offs between more profits and lower prices. Hence, there

will be disagreement between different shareholders about the policy of the firm. Secondly, typically, no shareholder will wish to maximise profits. Indeed the concept of profit maximisation is not well defined. Since the firm's decisions can change relative prices, there is more than one price system which can be used to measure profits. Other market distortions such as incomplete markets[4] or externalities will create similar problems for the objective function of the firm.

Figure 1:

As argued above, in the presence of market distortions, shareholder unanimity cannot be guaranteed. Figure 1 indicates the problem for a monopolist. The diagram shows the production set for a monopolist who can produce two goods X_1 and X_2. Since the firm has monopoly power, the prices will depend on the firm's trade. The diagram shows two possible production vectors for the firm. These will give rise to two different price systems. As can be seen from the diagram, individuals A and B

[4]Similar issues are discussed in the context of incomplete markets in Kelsey and Milne (1996).

have opposite preferences over the two production plans.

Despite this, it is still the case that there are decisions on which all members of the control group will agree. For instance, we show that a firm, which has a monopoly, will charge less than the profit maximising price. Thus conventional profit-maximising models may have overstated the size of the distortions due to monopoly.

It has been suggested that in addition to shareholders, other parties affected by a firm's activities should be given influence in the firm's decisions. These would include *inter alia* representatives of workers, customers and the local community. This paper is able to throw some light on this proposal. Suppose a firm has monopoly power, which cannot be removed by other means. Our model implies that up to a point, increasing customer influence on decisions will reduce distortions. Moreover it could affect competition in the product market. Similarly increasing worker influence can be beneficial if a firm has monopsony power.

We model the firm as a collection of individuals, shareholders, managers, workers and possibly customers and other stakeholders. Our aim is to relate the firm's objective function to optimising behaviour by these individuals. The decisions of firm f are assumed to be made by a group of individuals $C^f \subset \{1, ..., H\}$, which we shall refer to as the *control group* of firm f. The firm's preferences are assumed to be a function of the preferences of the control group. We do not assume the firm's preferences are complete or transitive, thus avoiding social choice problems. Note that we do not exclude the possibility that individuals, who are not shareholders (e.g. managers), are able to influence the firm's preferences. We shall not model the internal decision making of the control group explicitly but simply assume that whatever procedure is used, respects unanimity. Hence, our results do not depend very sensitively on the composition of the control group.

Assumption 2.1 *The firm's decision procedure respects unanimous preferences of the control group in the sense that if all members of the control group prefer policy a to policy b with at least one strict preference, then the firm will not choose policy b.*

Assumption 2.2 *For* $\tilde{f} \neq \hat{f}$, $C^{\tilde{f}} \cap C^{\hat{f}} = \emptyset$.

This says that there is no overlap between the control groups of different firms. We make this assumption to avoid issues of collusion, which are beyond the scope of the present paper.

There is a large literature on the theory of the firm, its objectives and implications for its organization.[5] Some of this literature assumes a particular objective and explores its implications for product or factor markets when competing with other firms that are profit maximizing.[6] Another related literature tries to derive the firm's objective as an endogenous implication of a game between players who are either producers or customers of inputs and outputs of the firm. Often the game is described as either a bargaining game or as some non-cooperative game between interested parties to a firm-like organisation. This literature can be characterised as setting up a particular model of the firm that emphasises a particular relationship e.g. human capital acquisition, firm financing or the acquisition of a specific physical asset that gives a player an advantage in bargaining or acting strategically with other players in determining the actions of the firm. (see, for instance, Hart (1995), Rajan and Zingales (2000) for a sample).

[5] See Hart (1995), Shleifer and Vishny (1997), Allen and Gale (2000) for a sample of recent surveys.

[6] See Vickers (1985), Fershtman and Judd (1987), Sklivas (1987), Askildsen, Ireland, and Law (1988), Ireland and Stewart (1995) for a sample.

3 MONOPOLY

In this section we study the implications of our model of the firm for monopolies. Recall that a profit-maximising monopolist will price according to the inverse elasticity rule, which says that the mark-up of price over marginal cost is inversely proportional to the elasticity of demand.

3.1 Price Decisions

Consider a firm which is the sole producer of good x. Let $c(x)$ denote the cost of producing quantity x. Let $D(p)$ denote the demand when the price of monopoly goods is p. The monopolist's profits are given by $\pi = pD(p) - c(x)$.

Notation 3.1 *We shall assume, without loss of generality, that the control group of the monopolist is* $\{h : 1 \leqslant h \leqslant M\}$.

Assume that members of the control group have quasi-linear utility functions $u^h = \theta^h \pi + v^h(p)$ for $1 \leqslant h \leqslant M$. Since the monopolist implements unanimous preferences of the control group, the optimal point can be obtained by maximising a weighted sum, $\sum_{h=1}^{M} \lambda^h u^h$, of the utilities of control group members for some non-negative weights λ^h. We may normalise the λ's by requiring $\sum_{h=1}^{M} \lambda^h \theta^h = 1$.[7]

A non profit maximising firm chooses p to maximise:
$\sum_{h=1}^{M} \lambda^h u^h = \sum_{h=1}^{M} \lambda^h [\theta^h (pD(p) - c(D(p))) + v^h(p)]$. Differentiating with respect to p we obtain, $D(p) + p\frac{dD}{dp} - \frac{dc}{dx}\frac{dD}{dp} + \sum_{h=1}^{M} \lambda^h \frac{dv^h}{dp} = 0$. By Roy's identity $\frac{dv^h}{dp} = -x^h$,

[7] This normalisation is possible provided $\sum_{h=1}^{M} \lambda^h \theta^h \neq 0$. If this were not satisfied, the claimants of the firm's profit stream would be given no influence over the firm's decisions. We shall not consider this case further, as we believe it to be of little economic interest.

hence, the first order condition may be written as:

$$\frac{\left(p - \frac{dc}{dx}\right)}{p} = \frac{1}{\eta}\left(1 - \sum_{h=1}^{M} \lambda^h \frac{x^h}{x}\right), \tag{1}$$

where η is the elasticity of demand. As can be seen, the price is given by a modified version of the inverse elasticity rule. If the firm has a single owner-manager, individual i, this can be further simplified to

$$\frac{\left(p - \frac{dc}{dx}\right)}{p} = \frac{1}{\eta}\left(1 - \frac{x^i}{x}\right). \tag{2}$$

If the owner consumes *all* of the firm's output then the price will be equal to marginal cost, while if (s)he consume none of the output this reduces to the usual pricing formula. In general, the optimal price is between marginal cost and the profit maximising level. If the elasticity of demand is constant, then price is lower the greater the owner's consumption of the monopoly good.

If the control group has multiple members, price is not necessarily equal to marginal cost, even if they consume all of the firm's output. The price will also depend on the relative bargaining power of different members of the control group. Those with relatively large shareholdings and lower consumption will want higher prices. Other things equal, the price will be lower, the greater the weight given to members of the control group with higher consumption.[8]

[8]The problem of a monopolist with some consumers in the control group has been previously considered by Farrell (1985), who assumed unanimity as the firm's decision rule or Hart and Moore (1996) and Renstrom and Yalcin (1997), who used the median voter rule. Our results are more general since we do not restrict attention to a specific decision procedure. However, due to the generality of the model, we do not obtain conditions for Pareto optimality, unlike the earlier papers.

3.2 Stakeholder Representation

In policy debates on corporate governance, it has been argued that firms should not just be run in the interests of shareholders. It is desirable to give other stakeholders representation in firms' decisions. Our model can be used to examine this proposal. We interpret a stakeholder to be an individual who owns no shares but is a worker or consumer. Consider the case where there are two individuals in the control group. Individual 1 is the sole owner. Individual 2 is a "stakeholder" who has no ownership share but may nevertheless have influence on decisions.

Our normalisation of the λ's implies that $\lambda^1 = 1, 0 \leqslant \lambda^2 < \infty$. Under these assumptions, (1) becomes,

$$\frac{p_m - \frac{\partial c}{\partial x_m}}{p_m} = \frac{1}{\eta}\left[1 - \frac{x^1}{x} - \lambda^2 \frac{x^2}{x}\right]. \tag{3}$$

Increasing the influence of stakeholders would correspond to increasing λ^2. By equation (3) this will lower the price of the monopoly good. Hence if competition is impossible, a firm with some stakeholder representation would be preferable to a profit-maximising monopolist. However, if the power of stakeholders is made too great, price could be reduced below marginal cost, which would be inefficient. In this case stakeholders would be using their influence to make inefficient transfers from the owners to themselves.

Assume $x_m^1 + x_m^2 = x_m$ i.e. there are no consumers other than the owners and the stakeholders. A social planner would aim to set price equal to marginal cost, i.e. $p_m = \frac{\partial c}{\partial x_m}$. By equation (3) this implies $1 - \frac{x^1}{x} - \lambda^2 \frac{x^2}{x} = 0$, which can be solved to give $\lambda^2 = 1$. This implies the firm should maximise the unweighted sum of utility of shareholders and stakeholders. This could be implemented in practice, by voting over price and giving an equal number of votes to shareholders and stakeholders. In

this case, the median voter's preference would be for setting price equal to marginal cost.

3.3 Monopsony

Our theory so far has emphasised imperfect competition in the product market and the involvement of consumers in firms' decisions. However similar reasoning applies if some input markets are imperfectly competitive . This would provide a justification for giving input suppliers a special role in decisions. The most common examples are where the firm is owned by suppliers of a particular form of labour.

It is not uncommon for firms to face imperfect competition in the labour market. The market for labour is often thin. It has been argued that the labour market is in many cases a market for teams of workers not individual workers. This strengthens our point, since the market for teams of workers is less likely to be competitive. These results are not specific to the labour market. They would also apply if other input markets are imperfectly competitive. Another example is farm marketing cooperatives, which buy the output of farms on imperfectly competitive markets.

Consider a firm which produces a single output for a competitive market, and has a subset of inputs that are bought on competitive markets and the remainder are bought on imperfectly competitive markets. Assume that the firm faces an input supply function $S(w)$. Profits are given by $\pi = p.g(S(w)) - wS(w)$, where p is the price of output, w is the input price vector and g is the production function.

We can apply similar reasoning to that used in the monopoly case. Hence we can reinterpret the monopoly first order conditions replacing monopoly with monopsony and demand elasticity with supply elasticity. In the special case where there is only one monopsony input, which is owned by the sole owner of the firm, then the input

quantity will be efficient. Conversely, if the suppliers of the input are excluded from the decision process then, as usual, we will obtain an inefficient low input price. In the more general case, where there is more than one owner, the price of the input will be between the competitive level and the monopsony level, depending upon the influence of suppliers in the control group. In other words, the monopsony distortion is moderated by the influence of suppliers, and in turn the inefficiency is moderated by including the supplier of the monopsony input.

When there is more than one monopsony input, the situation is only a little more complicated. Now the quantity of each monopsony input will be determined by the generalised monopsony pricing rule. Notice that other things equal, the more elastic the supply then the closer the pricing rule approximates the competitive rule and the less importance there is in including the supplier in the control group. In the limit where the supply is perfectly elastic, the supplier plays no effective role in the control decision. Conversely, the more inelastic the supply, the more important the supplier is in affecting the production and input pricing rule.

4 COURNOT OLIGOPOLY

We now consider oligopolistic markets. Most of our analysis of monopoly can be extended to this case. If those in charge of the firm are, in part, consumers the price will be below the profit maximising level. The results concerning stakeholder representation can also be extended to oligopoly. In addition the constitution of the firm affects strategic interaction in markets. Giving greater representation to individuals who are relatively high consumers of the product is a means to committing to a high output. This is an advantage in Cournot oligopoly. In effect it converts a

Cournot oligopolist into a Stackleberg leader. Hence if there are distortions in the labour and/or product markets, other forms of corporate governance may be superior to conventional profit-maximising firms.

We can endogenise the constitution of the firm by assuming that it is designed by an entrepreneur to maximise the value of the firm. Only in exceptional circumstances would (s)he would choose profit maximisation. Alternatively assume the constitution of the firm is designed by a social planner. This gives a second way to endogenise the objective function of the firm. This analysis could have policy implications for the design of corporate law.

4.1 Model

Consider a Cournot oligopoly with n firms, which can produce at constant marginal and average cost c. For simplicity we assume a linear inverse demand curve $p = 1 - \sum_{i=1}^{n} x_i$, where x_i denotes the output of firm i.

We assume that there are two types of individuals, type A and type B. Type A individuals do not consume the industry's output and $u^A = \theta^A \pi^A$.[9] Type B individuals care both about income and consumption of the output. Consequently they have (indirect) utility functions $u^B = \theta^B \pi^B + v^B(p_x)$.

We consider the case where the firm has a control group which consists of two members. One of type A and one of type B. The type A individual is assumed to own all of the equity. Thus the utility of the type A (resp. B) individual may be written as $u^A = \pi^A = [p_x - c] x^A$, (resp. $u^B = v^B(p_x)$). The same individual is not represented in the control group of more than one firm. Our normalisation of the λ's

[9] Since there is no uncertainty, there is no serious loss of generality in assuming that the utility of type A individuals is linear in income.

implies $\lambda^A = 1$, $0 \leqslant \lambda^B \leqslant \infty$.

As in the previous section, the decisions of the firm may be represented as maximising $u^A + \lambda_i^B u^B$, after normalisation. We write λ_i for λ_i^B. We consider the following 2-stage game. In the first period, the owners choose λ_i to maximise the value of the firm. In the second stage the firms compete in quantities Cournot-style. We look for a subgame perfect equilibrium of the 2-stage game.

Proposition 4.1 *In an $n-$firm oligopoly the reaction function of firm i is given by*

$$x_i = \frac{1 - c + \lambda_i x^B - \left(\sum_{j \neq i} x_j\right)}{2}. \tag{4}$$

Proof. Firm i maximises: $\psi^i = u^A + \lambda_i u^B = \left[1 - c - \sum_{j=1}^n x_j\right] x_i + \lambda_i v^B \left(1 - c - \sum_{j=1}^n x_j\right)$. The first order condition for optimal choice of x_i is: $1 - c - \sum_{j=1}^n x_j - x_i - \lambda_i v^{B\prime} = 0$. By Roy's identity $v^{B\prime} = -x^B$, hence, $1 - c - \sum_{j=1}^n x_j - x_i - \lambda_i x^B = 0$.[10] The result follows. ■

The higher λ_i the greater the influence given to individual B. The proposition implies that, ceteris paribus, an increase in λ_i will increase x_i. This makes firm i more aggressive, which is advantageous in a game of strategic substitutes. Firms with a larger value of λ_i will produce higher output in equilibrium. A possible example of this can be found Refsell (1914), who shows that cooperative grain elevators expanded their output significantly at the expense of their for-profit rivals in the period 1903-1913.

Proposition 4.2 *Let ℓ_n denote the value of λ_i in a symmetric subgame perfect equilibrium with n firms. Then ℓ_n is given by*

$$\ell_n = \frac{(n-1)(1-c)}{(n^2+1)\, x^B}.$$

[10] We assume that the firm takes x^B as given when choosing its output.

This shows that the optimal value of λ tends to 0 as n tends to infinity. The more competitive the market is, the closer firms should stick to profit maximisation.

Given that n is restricted to take integer values, the maximum value of ℓ_n occurs at $n = 2$ or 3. Thereafter ℓ_n is strictly decreasing in n. The analysis requires $n \geqslant 2$ to be economically meaningful. This is intuitive, as n increases the market distortion decreases, thus there is less scope for strategic behaviour. Hence the strategic effect of the firm's governance is likely to be greatest when the number of firms is small and declines as the market becomes more competitive.

These results generalise. Whenever Cournot oligopoly is a game of strategic substitutes, profit can be raised by giving some influence to consumers. Our results do not depend crucially on assumptions about the preferences of the different individuals. Similar results could be proved if a firm were owned by a number of individuals who have different preferences between consumption and profits. By adjusting the decision weights of these individuals, the firm can commit to a more or less aggressive policy in the product market. This is demonstrated by the results in section 6, in which a more general form of preferences is used.

The model in some respects resembles a prisoner's dilemma. Each firm on its own will raise profit by increasing λ_i. However if all firms do this simultaneously they will receive lower profits than in the original situation. However the total gain in consumer surplus will exceed the loss in profits. Hence there would still be an incentive for consumers to make these changes.[11]

[11] Dierker and Grodal (1996) have a result which is almost the reverse of this. They show that under Bertrand competition owners have higher utility if they delegate the running of the firm to a manger with an incentive to maximise profits than if they directly run the firm themselves.

4.2 Optimal Constitution of the Firm

In this section we consider two ways to endogenise the constitution of the firm. Specifically we consider a constitution which is optimal from the point of view of a social planner or an entrepreneur who wishes to maximise the value of the firm. The model is similar to that in the previous section.

4.2.1 Social Planner

Suppose that the constitution of the firm is chosen by the social planner to maximise the sum of consumer and producer surplus. We assume that for each firm f the λ_f is chosen by the social planner. Let λ_n^* denote the social planner's optimal value of λ_f in an $n-$firm industry. The social planner is not however able to intervene directly in the markets to make them more competitive or to set prices.

Proposition 4.3 *If the constitution of the firms are chosen to maximise total surplus* $\lambda_n^* = \frac{1-c}{nx_1^2}$.

Proof. Consider a symmetric equilibrium with n firms. Each firm has $\lambda^f = \lambda_n^*$ and produces output x_n^*. From equation (10), $x_n^* = \frac{1}{n}\left(1 - c - x_n^* + \lambda_n^* x_1^2\right)$. Solving,

$$(n+1)\, x_n^* = 1 - c + \lambda_n^* x_1^2. \tag{5}$$

As usual, the social planner will choose to produce where price equals marginal cost, hence, $x_n^* = \frac{1-c}{n}$. Substituting into (5), we obtain $\frac{n+1}{n}(1-c) = 1 - c + \lambda_n^* x_1^2$ or $\frac{1}{n}(1-c) = \lambda_n^* x_1^2$, from which the result follows. ■

Assume all consumers are represented in the firm, then $x_1^2 = \frac{1-c}{n}$. Substituting into equation (5) we find $\lambda_n^* = 1$. This implies that shareholders and stakeholders should be given equal influence over the firm's decisions. Recall we found a similar re-

sult for a monopoly. From the social planner's point of view, the optimal constitution does not depend on the number of firms in the industry.

4.2.2 Entrepreneur

Now suppose that an entrepreneur designs the constitution of the firm to maximise the value at which he can sell it. If the organisation is sold as a profit maximising firm the price achieved will only be the Cournot oligopoly profits. Higher profits can be made by selling the firm if it has the optimal degree of consumer representation. In this case the entrepreneur will receive the profits of a Stackleberg leader.

Equally if the problem is not one of designing a constitution from scratch, then in a Cournot duopoly, a firm can increase its profits to the Stackleberg level by giving representation to consumers. The market for corporate control may have a similar effect. If the firm did not initially have the optimal form of corporate governance then an outsider could profitably buy up the shares and reorganise the firm. Subsequently the firm could be re-sold at a profit.

4.3 Input Markets

Now consider the case where the firm faces competition from a small number of other purchasers on input markets. We shall obtain results which are broadly similar to our analysis of oligopoly. If firms compete in quantities Cournot-style in the labour market, then the firm's strategic position may be improved by giving workers or their representatives influence in decision-making. We believe that imperfect competition may be more important in input markets than in output markets. This is because labour markets are often highly specialised both by skill and by location. Note that it is more common to give influence in firms' decisions to suppliers of inputs than

to customers. In these circumstances, it may be in the interest of the firm's owners to *give* shares to workers or other individuals with an interest in increasing labour demand. (Assuming that these individuals could be prevented from re-selling the shares.)[12]

5 EQUILIBRIUM CONSTITUTION OF THE FIRM

As argued in previous sections, if the founder of a firm wishes to maximise profit it is in his/her interest to choose the constitution of the firm strategically. This is equally true when the other firms do not maximise profit. Whenever the rival firms have a downward sloping reaction function, profit can be increased by adopting a constitution, which commits the firm to behaving more aggressively. Likewise, the result does not depend crucially on the original objective of the firm. For instance, suppose a consumer cooperative aims to maximise a weighted average of consumer surplus and profits. Such a firm could better achieve its objective by committing to a more aggressive strategy. This would up to a point raise profits and increase consumer surplus because of the strategic effect on other firms' output. Thus increasing the cooperative's objective, provided it gives some weight to profits. More generally as long as the current control group gives positive weight to profits, it is in their interest to adopt a constitution which commits the firm to behaving more aggressively than they would choose themselves.

This suggests an alternative way to endogenise the constitution of the firm. We can define the equilibrium constitution of the firm to be such that there is no strategic reason to change the constitution according to the objective of the firm as defined in

[12] Roberts and Steen (2000) have made a similar point. It may be in the interest of a firm to give shares to its workers to encourage investment in firm-specific human capital.

the constitution itself. Essentially the equilibrium constitution is a fixed point of the process of strategic delegation. This is intended as a theory of the objective function of the firm in an long run equilibrium, in which all possible adjustments have been made.

We obtain a result similar to the Coase conjecture. Consider a firm which is initially profit maximising. The firm will be tempted to change its constitution to increase sales and profits. However if the firm cannot commit to prevent further changes to the constitution, there could be a series of changes each of which increases the firm's current objective when it was implemented. The result of this process is that the firm will finish by producing the competitive level of output. Unlike the Coase analysis, it is not essential for our argument that the firm's output be durable.

The model needs to be supplemented by imposing the requirement that the firm does not make losses. For the usual reasons, losses are not sustainable in long-run equilibrium.

If instead of giving influence away the original owner *sold* influence then the process may even be in the interest of the original owner. Individual B is always prepared to pay an amount equal to his/her increase in consumer surplus. Up to the Stackleberg point, the owner gets an indirect benefit from selling influence via the strategic effect on profits.

5.1 Model

There are 2 firms. Firm 1 and firm 2, which compete Cournot style. For simplicity, we assume a linear inverse demand curve $p = 1 - x_1 - x_2$. Firm 2 is a conventional profit-maximising firm. Firm 1 has two members in the control group, one type A individual and one type of B. Recall type A (resp. B) individuals have utilities

$u^A = \pi^A$, (resp. $u^B = v^B(p)$).

We impose a zero profit condition. There are two reasons for this. Firstly as price falls below marginal cost, all other firms, which are assumed to be maximising profit, would exit from the industry. Thus issues of strategic delegation would no longer be relevant. Secondly since the model is intended as one of long run equilibrium, we assert that the firm would not be viable in the long run if it makes losses. The zero profit condition can also be justified by limited liability considerations. Owners cannot be forced to contribute additional funds to the enterprise.

Assumption 5.1 *Firms cannot make losses.*

This implies that, price must be greater than or equal to marginal cost, $p \geqslant c$. The following result demonstrates that in an equilibrium in which the firm does not wish to change its constitution, price will equal marginal cost.

Proposition 5.1 *The only equilibrium constitution is where* $\lambda^B = \lambda^{*B} = \frac{1-c}{x^B}$, $x_1 = 1 - c$ *and* $p = c$.

This implies that, in the absence of commitment, the firm will increasingly delegate more power to consumers' representatives.

5.2 Discussion

We have argued that by a process of successive strategic delegation, a firm can become taken-over by its customers. At first sight this may appear implausible. However we believe this story does capture some aspects of reality. Firstly it should be noted that a customer may be another firm. There are documented cases in which upstream firms have been taken over by downstream firms, including the much discussed takeover

of Fisher Body by General Motors. Another example is the purchase by farmers of firms which supply inputs (e.g. fertilizer) to farms, see Hansmann (1996) and Refsell (1914). This result implies that firms will have incentives to adopt devices, which preclude too much strategic delegation to prevent loss of control. The firm has an interest to commit to no further strategic delegation after the first stage. If such commitment is not possible then a far-sighted owner may not permit the first round of strategic delegation foreseeing that it will trigger a whole series of successive delegations, which will ultimately have the effect of reducing his/her profit.

An analogous story could be told in terms of input markets. The conclusion would be that successive rounds of delegation would hand control to input suppliers. who would bid more aggressively in the input market. The long run equilibrium of this process would occur where the firm's profits have been reduced to zero. In this case we would see the suppliers of inputs would eventually take over the firm. If the input is top-level management, there is evidence that such a takeover has indeed happened, see Roe (1994).

A related result can be found in Baye, Crocker, and Ju (1996). They show that firms in Cournot oligopoly have an incentive to divide themselves into competing divisions. The benefit of divisionalisation is that it has a strategic effect on the output of rivals. As the cost of creating new divisions tends to zero, price converges to marginal cost. Again lack of commitment can lead to excessive divisionalisation and a complete loss of market power.

6 MULTIPLE STRATEGIC INTERACTIONS

In previous sections we have found that the optimal constitution of the firm can be obtained by having a control group of two individuals and strategically adjusting their decision weights. This is obviously a very simplified model of a firm. The reason a very simple constitution can be optimal is that the firm was only engaged in one strategic interaction. In reality a firm is likely to be engaged in a number of strategic interactions. It can be selling products in a number of markets which are oligopolistic. In addition input markets may also be imperfectly competitive. The firm may be involved in other kinds of strategic interaction such as competitive advertising or patent races.

In this section we provide a more general model. In particular we show that these conclusions are not specific to Cournot oligopoly. We consider a firm which is engaged in m strategic interactions. In this case a more complex constitution for the firm is justified. The optimal constitution can be achieved by having $m+1$ members of the control group and strategically choosing their decision weights.

In this section we abstract from particular forms of inputs and outputs and game forms and consider a more general strategic situation. In this model, a number of agents control a firm, choosing strategic variables so as to maximize the weighted sum of their utilities that are derived indirectly from profits and directly from the strategic variables. This objective allows us to admit any form of bargaining model where the agents have an efficient sharing of welfare from the jointly decided strategic variables. In addition we allow other firms to interact with the firm under consideration.

The idea of the general model is to provide an integrated structure, which allows general results. More detailed models can be fitted into the general framework. This

allows illustrations of the general results and additional results that depend upon the specific restrictions of the illustrative models.

6.1 Model

The model consists of $m+1$ firms. Firm 0 interacts strategically with m other firms. The profits of firm 0 are given by,

$$\sum_{j=1}^{m} \phi^j (x_j, y_j).$$

The profits of firm j are given by $\psi^j (x_j, y_j)$, for $1 \leqslant j \leqslant m$. Here $x_1, ..., x_m$ are strategic variables controlled by firm 0 and y_j is a strategic variable controlled by firm j for $1 \leqslant j \leqslant m$.

Suppose that the control group of firm 0 consists of $m+1$ individuals, $0 \leqslant i \leqslant m$. Individual 0 is only concerned about the profits he receives from firm 0. He/she has utility function $u^0 \left(\pi^0\right)$. For $1 \leqslant i \leqslant n$, individual i has utility function $u^i \left(\pi^0, x_i\right)$. We assume that $\frac{\partial u^i}{\partial x_i} > 0$. As usual firm 0 may be represented as maximising, $\sum_{i=0}^{m} \lambda^i u^i$, for some weights λ^i.

We consider the following 2-stage game. First firm 0 chooses the λ^i's. In the second stage, firm 0 chooses $x_1, ..., x_m$ and firm j chooses y_j, for $1 \leqslant j \leqslant m$. In the second stage firms make their choices simultaneously and independently.

Proposition 6.1 *The optimal value of λ^j is given by*

$$\lambda^j = -\frac{\phi_2^j}{\frac{\partial u^j}{\partial x_j}} \frac{\psi_{21}^j}{\psi_{22}^j}. \tag{6}$$

Proof. Let R^j denote the reaction function of firm j, defined by $\psi_2^j \left(x_j, R^j (x_j)\right) = 0$. The slope of the reaction curve is given by, $\psi_{21}^j \left(x_j, R^j (x_j)\right) + \psi_{22}^j \left(x_j, R^j (x_j)\right) R^{j\prime} (x_j) = 0$, hence $R^{j\prime} = \frac{-\psi_{21}^j}{\psi_{22}^j}$.

If firm 0 can act as a Stackleberg leader in all of its strategic interactions, its profit will be given by, $\sum_{j=1}^{m} \phi^j \left(x_j, R^j\left(x_j\right)\right)$. The first order condition for maximising this is: $\sum_{j=1}^{m} \phi_1^j \left(x_j, R^j\left(x_j\right)\right) + \phi_2^j \left(x_j, R^j\left(x_j\right)\right) R^{j\prime}\left(x_j\right) = 0$ or

$$\sum_{j=1}^{m} \phi_1^j - \phi_2^j \frac{\psi_{21}^j}{\psi_{22}^j} = 0. \tag{7}$$

Firm 0's first order condition for x_j is, $\sum_{i=0}^{m} \lambda^i \frac{\partial u^i}{\partial \pi^0} \frac{\partial \phi^j}{\partial x_j} + \lambda^j \frac{\partial u^j}{\partial x_j} = 0$. The λ's are only unique upto positive scalar multiple. Hence we may normalise them by requiring $\sum_{i=0}^{m} \lambda^i \frac{\partial u^i}{\partial \pi^0} = 1$. This simplifies the first order condition to

$$\frac{\partial \phi^j}{\partial x_j} + \lambda^j \frac{\partial u^j}{\partial x_j} = 0. \tag{8}$$

Comparing (7) and (8) we see that if

$$\lambda^j \frac{\partial u^j}{\partial x_j} = -\phi_2^j \frac{\psi_{21}^j}{\psi_{22}^j}, \tag{9}$$

the firm can obtain profits as if it were a Stackleberg leader in all of the strategic interactions. Since this sets an upper bound to the profits firm 0 can make in the second stage, the result follows. ■

Incentive compatibility implies that it will be not be possible to implement a negative value of λ^j. If either there are negative (resp. positive) externalities and strategic substitutes (resp. complements) then equation (6) implies that the optimal λ^j will be positive. Otherwise the best value of λ^j would be zero.

To be specific assume that firm j's strategic variable has a negative effect on firm 0, $\phi_2^j < 0$ and there are strategic substitutes $\psi_{21}^j < 0$. Then λ^j is larger:

1. the greater the negative externalities, i.e. the smaller is ϕ_2^j, this implies firm 0 has a greater incentive to reduce y_j;

2. the stronger the strategic substitutability i.e. the smaller is ψ^j_{21}. This means that an increase in x_j will cause a larger reduction in firm j's marginal benefit from y_j;

3. the greater firm $j's$ responsiveness to changes in marginal benefit, measured by $\left|\psi^j_{22}\right|$;

4. the smaller is $\frac{\partial w^j}{\partial x_j}$, an individual with lower marginal benefit from x_j needs larger influence within the organisation to get x_j increased.

This discussion clarifies the factors which determine the λ's, as well as demonstrating that a multi-member control group may be optimal.

7 STABILITY OF NON-PROFIT FIRMS

In this section we argue that a firm, where shareholders are also consumers, is not vulnerable to takeover by an outsider. Consider a cooperative of M individuals, $1 \leqslant i \leqslant M$.[13] In the initial situation, assume that individual i gets benefits $\pi_0 + d_i$, from shares in the firm. Here π_0 denotes the current value of the firm's profits and d_i denotes the value of being able to purchase the good below the monopoly price. These benefits are experienced, whether or not the individual owns shares in the firm. Assume that the cooperative's decisions are made by majority rule, so a change will be introduced if at least half the members approve.

In a cooperative, decisions can be distorted due to the difference in preferences between the median voter and the mean voter. To exclude this effect, we shall make the following assumption. If it is seriously violated, there is little case for having this

[13] We assume that M is odd, so that there is a well-defined median voter.

good supplied by a cooperative, since only a minority of members would get a benefit from it.

Assumption 7.1 *The median value of d_i is greater than or equal to the mean value. i.e. $\left|i : d_i \geqslant \bar{d}\right| \geqslant \frac{M}{2}$, where $\bar{d}$ denotes the mean value of d_i.*

We consider the following model of a takeover attempt. First a raider decides whether or not to offer to purchase the shares from members at price p. Then the existing shareholders decide simultaneously and independently whether or not to accept the offer. If the raider is successful, (s)he will increase profits to π_1 by raising price or eliminating positive externalities. We assume that $\pi_0 + \bar{d} > \pi_1 > \pi_0$. If this assumption were not satisfied the raider's policies would be approved by a majority vote of the existing members and there would be no need for a takeover.

The following result implies that the cooperative is not in fact vulnerable to a takeover.

Proposition 7.1 *There does not exist a subgame perfect equilibrium in pure strategies, in which the raider succeeds in taking over the firm.*

The raider is not able to take-over the firm for the reasons identified in Grossman and Hart (1980) The existing shareholders free-ride on the price of shares. By not accepting the offer, shareholders get the benefit from the increase in share price without contributing to the costs. Grossman and Hart (1980) argue that firms have incentives to overcome the free-rider problem by adopting constitutions, which allow raiders to either compulsorily purchase minority shares or dilute the rights of minority shareholders. Alternatively it may be desirable for government to introduce legislation allowing compulsory purchase of minority shares (as in the UK). In the present

context, the raider's behaviour is undesirable to existing shareholders and possibly society in general. It is in the interest of the cooperative to introduce a constitution, which gives strong protection to minority rights. This will make free-riding easier and consequently reduce the chances of a hostile takeover. Hansmann (1996) shows that most consumer cooperatives allocate voting rights in proportion to the fraction of the output purchased. This would be one way to protect against takeovers. This may explain why most governments offer separate laws dealing with cooperatives and business firms. Protection against takeover may be more desirable for cooperatives. If the industry is an oligopoly then the strategic considerations, discussed in section 4, could also make a take-over of a cooperative unprofitable.

8 CONCLUSION

8.1 Summary

In this paper we have argued that an important determinant of corporate governance is the degree of competition in product and input markets. This is supported by the evidence in Hansmann (1996). Consider the alternative hypothesis that choice of firm organisation depends upon political attitudes. In particular those with more left-wing attitudes prefer non-standard firms. The evidence does not seem to support this view. Manufacturing is generally carried out by conventional for-profit firms, while accountants, lawyers and farmers tend to use cooperative or partnerships. However one would not expect any of the latter groups to have particularly left-wing political views.

We believe an advantage of our model is that it provides an endogenous theory of corporate governance. This can be done in three ways, the firm's constitution

could be chosen by an entrepreneur to maximise the value at which the firm can be sold; the firm's constitution could be chosen by those currently controlling the firm to maximise their objectives or the system of corporate governance could be chosen by a social planner to maximise social welfare. Although a number of suggestions have been made, at present economics lacks a well established theory of corporate governance. All three proposals have validity beyond the present context. None of them would imply that a firm would aim to directly maximise profit in the presence of market imperfections.

It has been argued that firms produce profits at the expense of such factors as the well being of the community or the environment Defenders of capitalism have argued that, profit maximisation is compatible with broader objectives. A firm which neglects the local community or the environment will not make the highest profit in the long-run, since relations with suppliers, workers, customers, etc. will be damaged. We take this argument one stage further. Where there is market power, profit maximisation is not in the interest of the firm, even in the short run. This arises because firms' decisions are made by individuals who are also members of the community. In part, they bear the consequences of their own decisions. As argued in Hansmann (1996), economic institutions emerge endogenously to cope with market power, externalities or asymmetric information.

Our study of monopoly, suggest that increasing economic democracy is likely to be socially desirable. However in some cases we may get the opposite result. For instance, suppose that all the firms in a Cournot oligopoly have the same shareholders who are not consumers. Then they will unanimously agree that each firm in the industry should produce its share of the collusive output. Hence the final price to the consumer will be the monopoly price. This will be detrimental to social welfare

for the usual reasons.

Another case where profit-maximising behaviour may be socially desirable, is durable goods monopoly. Coase (1972) argued that if initially, a monopolist sold a durable good at the monopoly price, then subsequently it would be profitable to sell additional units at a lower price. If consumers anticipated this, demand will be reduced in the first period, hence the firm will not be able to achieve the full monopoly price. Under some assumptions, it can be shown that if the good is infinitely durable and consumers have perfect foresight then, the monopolist will price at marginal cost.

It seems unlikely that this argument can be extended to non-profit maximising firms. If the firm cuts price in the second period, the cost is born by those who purchased in the first period. If these consumers are represented in the firm's control group, they will have less incentive to cut price in future periods than a profit maximising firm. Consequently a non-profit maximising firm would set a higher price for a durable good. This will result in price being above marginal cost, which is socially undesirable for the usual reasons.

More generally we believe that there needs to be a rethinking of many results from industrial organisation to allow for more detailed modelling of the internal organisation of the firm.

As an example consider management buy-outs (MBO's). Much of the existing literature on management buy-outs has used an agency theoretic approach. It is argued that their main benefit is improved incentives for management. In the present paper we argue that the changes in corporate governance can affect a firm's position in the product and/or labour markets. The main effect of an MBO is to transfer control of the firm from investors to a suppliers of managerial labour. If the managerial labour market is imperfectly competitive this could have the effect of improving the firm's

strategic position in that market. Thus an MBO may advantageously affect the firm's position in markets as well as having beneficial effects on incentives.

A possible direction for the future is that skilled labour will become more important. This would shift the bargaining power within organisations. In the firm of the future it is possible that capital will be hired by a coalition of skilled workers. The model in the present paper may help us to understand such changes.

8.2 Inefficient Mechanisms and Hold-ups

One possible criticism of our model is that we restrict attention to *efficient* decision-procedures within the firm, while, inefficiency appears to be common. In practice, there are many kinds of friction, which may arise in intra-firm bargaining. Despite this we believe similar analysis to the present paper will apply to most plausible mechanisms which are not fully efficient. It is virtually impossible to prove general results for all inefficient mechanisms, since there are too many possible sources of inefficiency. We shall illustrate our arguments by considering a specific example, the hold-up problem.

We may modify our model to allow for the possibility of a hold-up as follows. There are two time periods, $t = 0, 1$. At time $t = 0$ each member i of the control group can make a relationship-specific investment, e_i for $1 \leqslant i \leqslant M$. The investment is only of use in the current firm and reduces the cost of production. It is observable but not verifiable. At $t = 1$ the model is like that in the present paper. The firm is assumed to use a decision procedure at $t = 1$, which is ex-post efficient. In general the members of the control group will not choose the efficient level of investment at $t = 0$ because they will not receive the full marginal benefit of their investments. The extent of under-investment depends upon the particular decision rule used. In

this case, the results of the present paper will apply for a given level of ex-ante investments.

In the special case, where the ex-ante investments only affect fixed costs, our previous results still apply despite the ex-ante inefficiency. A uniform pricing monopolist will charge less than the profit-maximising price. Now assume now that the firm-specific investments reduce marginal cost. Then the under-investment tends to increase marginal cost relative to the first-best, while the managerial firm will have a smaller mark-up over marginal cost than a profit-maximising firm. These two effects are working against one another and in general it will not be possible to provide an unambiguous comparison.

8.3 Related Literature

Levin and Tadelis (2002) shows that partnerships can be superior to standard firms in the provision of services. The point is the quality is not observable. As is well known, a partnership will hire less workers than the corresponding for-profit firm. Where worker ability varies, this results in the partnership hiring higher quality workers and hence producing a better service. Assuming customers cannot observe the quality directly, they will prefer to purchase from partnerships, which can therefore be more profitable. This has a similar structure to the model in the present paper. In both cases the choice of corporate governance affects the beliefs of other agents. This causes them to change their behaviour, which indirectly affects the profits of the firm. Taking into account these indirect effects a conventional firm may not be the most profitable. Evidence also supports this viewpoint. As Hansmann (1996) shows the main reasons for firms to adopt non-profit forms are imperfect competition and asymmetric information

Fershtman and Judd (1987), Sklivas (1987) and Vickers (1985) have previously shown that a profit maximising owner of a firm may have strategic reasons for giving incentives to managers not to maximise profit. In particular in Cournot oligopoly, a manager whose pay depends on a convex combination of profit and revenue will make more profit than a manager whose pay depends on profit alone.

APPENDIX

A Oligopoly

This appendix contains proofs of our results on oligopoly.

Proposition 4.2 In a symmetric subgame perfect equilibrium with n firms, ℓ_n is given by

$$\ell_n = \frac{(n-1)(1-c)}{(n^2+1)x^B}.$$

Proof of Proposition 4.2 Consider a given firm, firm i. In a symmetric equilibrium $x_j = x_k$ for $j, k \neq i$. Hence using equation (4), $x_j = \frac{1-c-(n-2)x_j-x_i+\lambda_i x^B}{2}$. Solving $x_j = \frac{1-c-x_i+\lambda_i x^B}{n}$. The reaction function of firms other than i is given by

$$x_{-i} = \frac{n-1}{n}\left(1-c-x_i+\ell_n x^B\right), \tag{10}$$

where $x_{-i} = \sum_{j\neq i} x_j$ denotes the total output of all firms other than i.

In the Stackleberg equilibrium when firm i is the leader and takes the reaction function defined by (10) as given, the value of x_i is given by $x_i^s = \frac{1-c-(n-1)\ell_n x^B}{2}$.

From equation (4), the equilibrium value of x_i is, $\hat{x}_i = \frac{1-c+\lambda_i x_1^2-\left(\sum_{j\neq i} x_j\right)}{2}$. Substituting from (10), $2\hat{x}_i = 1-c-\left(\frac{n-1}{n}\left(1-c-\hat{x}_i+\ell_n x_1^2\right)-\lambda_i x^B\right)$, hence $\hat{x}_i = \frac{1-c}{(n+1)} - \frac{n-1}{(n+1)}x_1^2\ell_n + \frac{n}{(n+1)}\lambda_i x^B$.

The level of λ_i, which maximises profit, is achieved where the equilibrium output is equal to the Stackleberg output, $\hat{x}_i = x_i^s$. Thus $\frac{1-c}{(n+1)} - \frac{n-1}{(n+1)}\ell_n x^B + \frac{n}{(n+1)}\lambda_i x^B = \frac{1-c-(n-1)\ell_n x^B}{2}$, which implies

$$\lambda_i = \frac{(n-1)(1-c)}{2nx^B} - \ell_n\frac{(n-1)^2}{2n}.^{14} \tag{11}$$

[14] Equation (11) implies that λ_i is a decreasing function of ℓ_n. Thus λ_i and λ_j are strategic substitutes.

This gives the profit maximising choice of λ_i, given that all other firms choose $\lambda_j = \ell_n$, for $j \neq i$.

In symmetric equilibrium, $\lambda_i = \ell_n$, hence $\ell_n \left(1 + \frac{(n-1)^2}{2n}\right) = \frac{(n-1)(1-c)}{2nx^B}$, from which the result follows ■

Lemma A.1 *In a Cournot duopoly where firm 2 is a profit maximising firm, the market equilibrium is given by,*

$$\bar{x}_1 = \frac{1 - c + 2\lambda^B x^B}{3}, \quad \bar{x}_2 = \frac{1 - c - \lambda^B x^B}{3}, \quad \bar{p} = \frac{1 + 2c - \lambda^B x^B}{3}. \tag{12}$$

Proof. By Proposition 4.1, the reaction function of firm 1 (resp. 2) is given by $x_1 = \frac{(1-c-x_2)+\lambda^B x^B}{2}$, (resp. $x_2 = \frac{(1-c-x_1)}{2}$). Solving in the usual way we obtain, $\bar{x}_1 = \frac{1-c+2\lambda^B x^B}{3}$ and $\bar{x}_2 = \frac{1-c-\lambda^B x^B}{3}$. The equilibrium price is given by, $\bar{p} = 1 - \frac{1-c+2\lambda^B x^B}{3} - \frac{1-c-\lambda^B x^B}{3} = \frac{1+2c-\lambda^B x^B}{3}$. ■

Proposition 5.1 The only equilibrium constitution is where $\lambda^B = \lambda^{*B} = \frac{1-c}{x^B}$, $x_1 = 1 - c$ and $p = c$.

Proof of Proposition 5.1 **To check $\lambda^B = \lambda^{*B}$ is indeed an equilibrium.** If $\lambda^B = \bar{\lambda}^B$ then from (12) the equilibrium quantity and price will be $x_1 = 1 - c$ and $p = c$.

As before we may represent the firm's objective as: $\psi_1 = \pi_1 + \bar{\lambda}^B v^B$
$= \frac{1}{9}\left((1-c)^2 + (1-c)\lambda^B x^B - 2\lambda^{B^2} x^{B^2}\right) + \bar{\lambda}^B v^B \left(\frac{1+2c-\lambda^B x^B}{3}\right)$. From the point of view of the equilibrium constitution, the effect of a change in λ^B on the firm's objective is given by $\frac{d\psi_1}{d\lambda^B} = \frac{1}{9}\left((1-c)\, x^B - 4\lambda^B x^{B^2}\right) + \frac{1}{3}\bar{\lambda}^B x^B$. Note that the initial value of λ^B, $\bar{\lambda}^B$ is treated as constant for this differentiation. The second order condition is satisfied. Evaluating at $\lambda^B = \lambda^{*B}$, $\left.\frac{d\psi_1}{d\lambda^B}\right|_{\lambda^B=\lambda^{*B}} = \frac{1}{3}(1-c)\left[1 - x^B\right] \geqslant 0$, since $x^B \leqslant 1$. This establishes that the firm would not want to decrease λ^B.

The firm has no incentive to increase λ^B, since it is already supplying the entire

market. Firm 2's output is zero, hence there is no strategic effect of further reductions in λ^B. The only effect of reducing λ^B further would be to cause the firm to increase its output beyond the current level. This is not desirable as the current level is already optimal according to the current objective function.

Uniqueness. Assume $\bar{\lambda}^B < \frac{1-c}{x^B}$. Then $\left.\frac{d\psi_1}{d\lambda^B}\right|_{\lambda^B=\lambda^{*B}} = \frac{x^B}{9}\left((1-c)+\bar{\lambda}^B\left(3-4x^B\right)\right)$.

If we assume $x^B \leqslant \frac{3}{4}$ then it is clear that $\left.\frac{d\psi_1}{d\lambda^B}\right|_{\lambda^B=\lambda^{*B}} > 0$. If $x^B > \frac{3}{4}$, $\left.\frac{d\psi_1}{d\lambda^B}\right|_{\lambda^B=\lambda^{*B}} > \frac{x^B}{9}\left((1-c)+\frac{1-c}{x^B}\left(3-4x^B\right)\right) = \frac{(1-c)}{3}\left(1-x^B\right) > 0$, since $x^B < 1$. This implies that if $\bar{\lambda}^B < \frac{1-c}{x^B}$ then there is a strategic advantage to increasing λ^B. Hence $\lambda^B < \frac{1-c}{x^B}$ is not compatible with equilibrium.

If $\bar{\lambda}^B > \frac{1-c}{x^B}$, price would be below marginal cost and hence would not satisfy the zero profit constraint. Consequently such values of $\bar{\lambda}^B$ would not be sustainable in long run equilibrium. ■

B Stability

This appendix shows that a non-profit firm is not vulnerable to takeover by a profit maximising outsider.

If $p \geqslant \pi_1$, the raider can never make a positive profit, hence we may assume $\pi_1 > p > \pi_0$. Let $L = \{i; \pi_0 + d_i \leqslant p\}$ be the set of individuals whose total benefit from the co-operative is less than the raider's offer. Let $\ell = |L|$, by Assumption 7.1 $m \geqslant \ell$.

Lemma B.1 *In any pure strategy Nash equilibrium of the subgame following the raider's offer precisely m individuals accept. In particular all members of L accept the offer.*

Proof. First we shall check that such a profile is indeed an equilibrium. A member

who accepts the offer will get pay-off $p + d_i$. This would fall to $\pi_0 + d_i$ if (s)he rejected the offer. A member who rejects the offer will get pay-off $\pi_0 + d_i$. Since every individual who rejects the offer is pivotal, this would fall to p if (s)he accepts. (Recall by construction, no member of L rejects the offer and hence $\pi_0 + d_i > p$.) It follows that this profile of strategies is indeed an equilibrium.

Now to demonstrate that there are no other pure strategy Nash equilibria. We shall consider all other possible profiles in turn and show that in each case at least one individual has a profitable deviation. First consider profiles in which there are $r > m + 1$ acceptances. In this case the raider will take control of the firm and raise the share value to π_1. Consider an individual who accepts the raider's offer. Currently (s)he receives pay-off p. If instead (s)he rejected the raider's offer, the bid would still succeed. Hence his/her payoff would be $\pi_1 > p$.

Secondly consider the case where there are $r = m + 1$ acceptances. Since $m \geqslant \ell$, there exists an individual $\tilde{\imath} \notin L$ who accepts the raider's offer. Note that such an individual is pivotal. If instead (s)he rejected the raider's offer as before his/her pay-off would be $\pi_0 + d_i$, which is greater than his/her current pay-off, p.

Thirdly consider a profile, in which there are $r = m$ acceptances and there exists $\hat{\imath} \in L$, who does not accept the offer. Then $\hat{\imath}$'s current payoff is $\pi_0 + d_i$. This would increase to p if $\hat{\imath}$ instead accepted the offer.

Finally consider a profile, in which there are $r < m - 1$ acceptances. Consider an individual who currently is rejecting the raider's offer. His/her current pay-off is $\pi_0 + d_i$. If (s)he deviated and accepted the raider's offer (s)he would receive $p + d_i$.

■

Proof of Proposition 7.1 By Lemma B.1, if the raider made an offer she would not get enough acceptances in the second round to gain control of the firm. Hence

the raider would make a loss of $(m-1)(\pi_0 - p)$. It follows that making a take-over bid is not part of any subgame perfect equilibrium. ■

References

Allen, F., and D. Gale (2000): "Corporate Governance and Competition," in *Corporate Governance*, ed. by X. Vives, pp. 23–76. CUP, Cambridge, UK.

Askildsen, J. E., N. J. Ireland, and P. J. Law (1988): "Some Consequences of Differential Shareholdings Among Members in a Labor-Managed and Labor-Owned Firm," in *Eonomic Analysis of Participatory and Labor Managed Firms*, ed. by D. C. Jones, and J. Svejnar, pp. 65–81. JAI Press, Greenwich, Connecticut.

Baye, M. R., K. J. Crocker, and J. Ju (1996): "Divisionalization, Franchising and Divestiture Incentives in Oligopoly," *American Economic Review*, 86, 223–236.

Bolton, P., and C. Xu (1999): "Ownership and Managerial Competition: Employee, Customer or Outside Ownership," Working paper, Princeton University.

Coase, R. (1972): "Durability and Monopoly," *Journal of Law and Economics*, 15, 143–149.

De Marzo, P. (1993): "Majority Voting and Corporate Control: The Role of Dominant Shareholder," *Review of Economic Studies*, 60, 713–734.

DeMeza, D., and B. Lockwood (1998): "Does Asset Owernship Always Motivate Managers? The Property Rights Theory of the Firm with Alternating Offers Bargaining," *Quarterly Journal of Economics*, 113, 361–386.

DIERKER, E., AND B. GRODAL (1996): "Profit Maximization Mitigates Competition," *Economic Theory*, 7, 139–160.

FARRELL, J. (1985): "Owner-Consumers and Efficiency," *Economics Letters*, 19, 303–306.

FERSHTMAN, C., AND K. L. JUDD (1987): "Equilibrium Incentives in Oligopoly," *American Economic Review*, 77, 927–940.

GERAATS, P. M., AND H. HALLER (1998): "Shareholders' Choice," *Journal of Economics*, 68, 111–135.

GROSSMAN, S., AND O. HART (1980): "Takeover Bids, the Free Rider Problem, and the Theory of the Corporation," *Bell Journal of Economics*, 11, 42–64.

HANSMANN, H. (1996): *The Ownership of Enterprise*. Harvard University Press, Cambridge, Mass.

HART, O. (1995): *Firms Contracts and Financial Structure*. Oxford University Press, Oxford.

HART, O., AND J. MOORE (1990): "Property Rights and the Nature of the Firm," *Journal of Political Economy*, 98, 1119–1158.

——— (1996): "The Governance of Exchanges: Members' Cooperatives versus Outside Ownership," *Oxford Review of Economic Policy*, 12, 53–69.

IRELAND, N. J., AND G. STEWART (1995): "On the Sale of Production Rights and Firm Organization," *Journal of Comparative Economics*, 21, 289–307.

KELSEY, D., AND F. MILNE (1996): "The Existence of Equilibrium in Incomplete Markets and the Objective of the Firm," *Journal of Mathematical Economics*, 25, 229–245.

LEVIN, J., AND S. TADELIS (2002): "A Theory of Parternships," *working paper, Stanford University*.

MILNE, F. (1974): "Corporate Investment and Finance Theory in General Equilibrium," *Economic Record*, pp. 511–533.

——— (1981): "The Firm's Objective Function as a Collective Choice Problem," *Public Choice*, 37, 473–486.

RAJAN, R., AND L. ZINGALES (2000): "The Governance of the New Enterprise," in *Corporate Governance*, ed. by X. Vives, pp. 201–233. CUP, Cambridge, UK.

REFSELL, O. (1914): "The Farmers Elevator Movement," *Journal of Politcal Economy*, 22, 872–895 and 969–991.

RENSTROM, T., AND E. YALCIN (1997): "Endogenous Firm Objectives," *Journal of Public Economic Theory*, forthcoming.

ROBERTS, J., AND E. V. STEEN (2000): "Shareholder Interests, Human Capital Investment and Corporate Governance," Working paper, Stanford Business School.

ROE, M. J. (1994): *Strong Managers, Weak Owners*. Princeton, New Jersey.

SADANAND, A. B., AND J. M. WILLIAMSON (1991): "Equilibrium in a Stock Market Economy with Shareholder Voting," *International Economic Review*, 32, 1–35.

SHLEIFER, A., AND R. VISHNY (1997): "A Survey of Corporate Governance," *Journal of Finance*, 52, 33–56.

Sklivas, S. D. (1987): "The Strategic Choice of Managerial Incentives," *Rand Journal of Economics*, 18, 452–458.

Tirole, J. (1999): "Incomplete Contracts: Where Do We Stand?," *Econometrica*, 67, 741–782.

Tirole, J. (2001): "Corporate Governance," *Econometrica*, 69, 1–35.

Vickers, J. (1985): "Delegation and the Theory of the Firm," *Economic Journal*, 95 (conference supplement), 138–147.

C FULL PROOFS

This appendix gives more detailed proofs of selected results. It is included to help with checking the results. It is not intended for publication.

Proposition 4.2 In a symmetric subgame perfect equilibrium with n firms, ℓ_n is given by

$$\ell_n = \frac{(n-1)(1-c)}{(n^2+1)x^B}.$$

Proof of Proposition 4.2 Consider a given firm, firm i. In a symmetric equilibrium $x_j = x_k$ for $j,k \neq i$. Hence using equation (4), $x_j = \frac{1-c-(n-2)x_j-x_i+\lambda_i x^B}{2}$. Solving $x_j = \frac{1-c-x_i+\lambda_i x^B}{n}$. The reaction function of firms other than i is given by

$$x_{-i} = \frac{n-1}{n}\left(1-c-x_i+\ell_n x^B\right), \tag{13}$$

where $x_{-i} = \sum_{j\neq i} x_j$ denotes the total output of all firms other than i.

We shall now proceed to find the Stackleberg equilibrium when firm i is the leader. Firm i's profits are given by $\pi_i = \left(1-c-x_i-\frac{n-1}{n}\left(1-c-x_i+\ell_n x^B\right)\right)x_i = \left(\frac{1-c}{n}-\frac{x_i}{n}-\frac{n-1}{n}\ell_n x^B\right)x_i$. The first order condition for profit maximisation is, $\frac{1-c}{n} - 2\frac{x_i}{n} - \frac{n-1}{n}\ell_n x^B = 0$. Solving, the Stackleberg value of x_i is given by $x_i^s = \frac{1-c-(n-1)\ell_n x^B}{2}$.

Choice of λ_i. From equation (4) the equilibrium value of x_i is, $\hat{x}_i = \frac{1-c+\lambda_i x^B-\left(\sum_{j\neq i} x_j\right)}{2}$. Substituting from (10), $2\hat{x}_i = 1-c-\left(\frac{n-1}{n}\left(1-c-\hat{x}_i+\ell_n x_1^2\right)-\lambda_i x^B\right) = \frac{1-c}{n} + \frac{n-1}{n}x_i - \frac{n-1}{n}\ell_n x^B + \lambda_i x^B$. Solving $\hat{x}_i = \frac{1-c}{(n+1)} - \frac{n-1}{(n+1)}x_1^2\ell_n + \frac{n}{(n+1)}\lambda_i x^B$.

The level of λ_i which maximises profit is achieved where the equilibrium output is equal to the Stackleberg output, $\hat{x}_i = x_i^s$. Thus $\frac{1-c}{(n+1)} - \frac{n-1}{(n+1)}\ell_n x^B + \frac{n}{(n+1)}\lambda_i x^B = \frac{1-c-(n-1)\ell_n x^B}{2}$ or $\frac{n}{(n+1)}\lambda_i x^B = \frac{1-c}{2} - \frac{1-c}{(n+1)} + \frac{n-1}{(n+1)}\ell_n x^B - \frac{(n-1)\ell_n x^B}{2} = \frac{(n-1)(1-c)}{2(n+1)} - (n-1)\ell_n x^B\frac{(n-1)}{2(n+1)}$. Hence

$$\lambda_i = \frac{(n-1)(1-c)}{2nx^B} - \ell_n\frac{(n-1)^2}{2n}. \tag{14}$$

This gives the profit maximising choice of λ_i, given that all other firms choose $\lambda_j = \ell_n$, for $j \neq i$.

In symmetric equilibrium, $\lambda_i = \ell_n$, hence $\ell_n \left(1 + \frac{(n-1)^2}{2n}\right) = \frac{(n-1)(1-c)}{2nx^B}$ or $\ell_n = \frac{(n-1)(1-c)}{\left(2n+(n-1)^2\right)x^B}$. The result follows. ■

Lemma A.1 For given λ^B the market equilibrium is given by,

$$\bar{x}_1 = \frac{1-c+2\lambda^B x^B}{3}, \quad \bar{x}_2 = \frac{1-c-\lambda^B x^B}{3}, \quad p = \frac{1+2c-\lambda^B x^B}{3}. \tag{15}$$

Proof of Lemma A.1 By Proposition 4.1, the reaction function of firm 1 (resp. 2) is given by $x_1 = \frac{(1-c-x_2)+\lambda^B x^B}{2}$, (resp. $x_2 = \frac{(1-c-x_1)}{2}$). Substituting, the equilibrium value of x_1 is given by $\bar{x}_1 = \frac{\frac{1-c}{2}+\frac{x_1}{2}+\lambda^B x^B}{2}$. Hence $\frac{3}{4}\bar{x}_1 = \frac{1-c}{4} + \frac{\lambda^B x^B}{2}$ or $\bar{x}_1 = \frac{1-c+2\lambda^B x^B}{3}$. From the reaction function, $\bar{x}_2 = \frac{\left(1-c-\frac{1-c+2\lambda^B x^B}{3}\right)}{2} = \frac{1-c-\lambda^B x^B}{3}$. The equilibrium price is given by, $p = 1 - \frac{1-c+2\lambda^B x^B}{3} - \frac{1-c-\lambda^B x^B}{3} = \frac{1+2c-\lambda^B x^B}{3}$. ■

Proposition 5.1 The only equilibrium constitution is where $\lambda^B = \lambda^{*B} = \frac{1-c}{x^B}$, $x_1 = 1-c$ and $p = c$.

Proof of Proposition 5.1 **To check $\lambda^B = \lambda^{*B}$ is indeed an equilibrium.** If $\lambda^B = \bar{\lambda}^B$ then from (12) the equilibrium quantity and price will be $x_1 = 1-c$ and $p = c$.

As before we may represent the firm's objective as,: $\psi_1 = \pi_1 + \bar{\lambda}^B v^B$
$= \frac{1}{9}\left((1-c)^2 + (1-c)\lambda^B x^B - 2\lambda^{B^2} x^{B^2}\right) + \bar{\lambda}^B v^B \left(\frac{1+2c-\lambda^B x^B}{3}\right)$. From the point of view of the equilibrium constitution, the effect of a change in λ^B on the firm's objective is given by $\frac{d\psi_1}{d\lambda^B} = \frac{1}{9}\left((1-c)x^B - 4\lambda^B x^{B^2}\right) + \frac{1}{3}\bar{\lambda}^B x^B$. Note that the initial value of λ^B, $\bar{\lambda}^B$ is treated as constant for this differentiation. The second order condition is satisfied. Evaluating at $\lambda^B = \lambda^{*B}$, $\left.\frac{d\psi_1}{d\lambda^B}\right|_{\lambda^B=\lambda^{*B}} = \frac{x^B}{9}\left[1-c-4\frac{1-c}{x^B}x^B + 3\frac{1-c}{x^B}\right] = \frac{x^B}{9}(1-c)\left[1-4+3\frac{1}{x^B}\right] = \frac{1}{3}(1-c)\left[1-x^B\right] \geqslant 0$, since $x^B \leqslant 1$. This establishes that the firm would not want to decrease λ^B.

The firm has no incentive to increase λ^B, since it is already supplying the entire market. Firm 2's output is zero, hence there is no strategic effect of further reductions in λ^B. The only effect of reducing λ^B further would be to cause the firm to increase its output beyond the current output. This is not desirable as the current level is already optimal according to the current objective function.

Uniqueness. Assume $\bar{\lambda}^B < \frac{1-c}{x^B}$. Then $\left.\frac{d\psi_1}{d\lambda^B}\right|_{\lambda^B=\lambda^{*B}} = \frac{1}{9}\left((1-c)\,x^B - 4\bar{\lambda}x^{B^2}\right) + \frac{1}{3}\bar{\lambda}^B x^B = \frac{x^B}{9}\left((1-c) + \bar{\lambda}^B\left(3-4x^B\right)\right)$.

If we assume $x^B \leqslant \frac{3}{4}$ then it is clear that $\left.\frac{d\psi_1}{d\lambda^B}\right|_{\lambda^B=\lambda^{*B}} > 0$. If $x^B > \frac{3}{4}$, $\left.\frac{d\psi_1}{d\lambda^B}\right|_{\lambda^B=\lambda^{*B}} > \frac{x^B}{9}\left((1-c) + \frac{1-c}{x^B}\left(3-4x^B\right)\right) = \frac{(1-c)}{9}\left(x^B + \left(3-4x^B\right)\right) = \frac{(1-c)}{3}\left(1-x^B\right) > 0$, since $x^B < 1$. This implies that if $\bar{\lambda}^B < \frac{1-c}{x^B}$ there is a strategic advantage to increasing λ^B. Hence $\lambda^B < \frac{1-c}{x^B}$ is not compatible with equilibrium.

If $\bar{\lambda}^B > \frac{1-c}{x^B}$, price would be below marginal cost and hence would not satisfy the zero profit constraint. Consequently such values of $\bar{\lambda}^B$ would not be sustainable in long run equilibrium. ■