Firm governance and duopoly: in weakness may lie strength

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Abstract

The paper examines the issue of firm governance when two firms compete in a duopoly. The paper assumes that a motivational asymmetry exists between owners and managers: owners wish to obtain maximum profits, managers wish to maximise sales; managers perceive that salary, social status or future job prospects are more closely associated with firm size (ie. sales) than with firm profits. The paper takes an agency view of the firm where owners only indirectly influence the behaviour of firms through the level of control they exert over managers. The paper extends Fershtman and Judd’s (1987) managerial incentive model to represent governance. The paper suggests that weakly governed firms may gain a competitive advantage over strongly governed firms.

The collapse of very large companies such as Enron, WorldCom and Tyco in recent years has highlighted the importance of corporate governance for corporate survival. Good corporate governance usually implies that the Board of Directors, who represent the interests of shareholders, actively monitor and control the behaviour of firm executives.
This paper examines the issue of firm governance when two firms compete in a duopoly. The paper assumes that a motivational asymmetry exists between owners and managers: owners wish to obtain maximum profits, managers wish to maximise sales; managers perceive that salary, social status or future job prospects are more closely associated with firm size (ie. sales) than with firm profits. The paper takes an agency view of the firm where owners only indirectly influence the behaviour of firms through the level of control they exert over managers. The paper extends Fershtman and Judd’s (1987) managerial incentive model to represent governance.

The paper proceeds as follows: firstly I briefly review game theory and its influence on the strategy literature; then I examine the incentive model of duopoly; I then propose a governance model of duopoly that is based on the incentive model; finally I discuss some aspects of the governance model.

Industrial organization economists have used game theory for many decades as a basis for examining duopoly behaviour. The introduction of game theory led to a resurgence of theoretical development within that discipline and led to game theoretic models replacing the structure-conduct-performance paradigm as ‘the organising framework for industrial economics’ (Martin, 2002:8). Game theory, and particularly the concept of non-zero sum games, has become popular as a lens through which to view business strategy (Dixit and Nalebuff, 1991; McMillan, 1992; Brandenburger and Nalebuff, 1996). More recently it has become a basis for strategy textbooks (Saloner et al, 2001; Besanko et al, 2004).
The essence of game theoretic models is that the outcome for a player depends not only on their own decision but also on their rival’s decision: the two decisions are interdependent. In duopoly this interdependence is realised through the demand function: the price achieved by each firm is dependent on the joint quantity brought to market ie. the sum of the quantities brought to market by the two firms. The market decision of each firm is therefore a crucial determinant of the profitability of both firms.

Fershtman and Judd’s (1987) model of incentive duopoly assumes that owners wish to maximise profits and managers wish to maximise sales. Owners recognise this asymmetry in objectives and, having recognised it, must now take it into account in their decision making. I say this pointedly because, as I will demonstrate below, owners would probably be better off if they did not recognise the asymmetry in objectives between owners and managers: both firms would then act as traditional profit maximisers and both would probably be better off. However, once owners perceive the motivational asymmetry between themselves and managers there is no turning back.

Fershtman and Judd propose a two stage game theoretic duopoly model where at the first stage owners choose an optimal incentive factor and in the second stage managers choose an optimal quantity to place on the market. (Note that Fershtman and Judd demonstrate quantity and price based models in their paper. In this paper I examine quantity based competition only: I therefore assume the both firms select a quantity to bring to market and that the market determines the price at which this quantity is sold.) The optimal incentive factor usually lies between zero and one; an
incentive factor of one implies that the firm acts as a strict profit maximiser; an incentive factor of zero implies that the firm acts as a strict sales maximiser. An incentive factor between zero and one implies that the firm’s objective function is a weighted average of sales and profits. Clearly a continuum of objective functions exists with strict profit maximising lying at one end of the continuum and strict sales maximising lying at the other end. In the first stage of the Fershtman and Judd game each firm’s owner selects an optimal point along this continuum.

The available choice of quantity for each firm lies between zero and the monopoly quantity. In the second stage of the Fershtman and Judd game each firm’s manager selects the optimal quantity, given that incentive factors have already been selected by owners. The summation of the quantities selected determines price, according to the demand function. Profitability of each firm is then easily determined by subtracting costs from revenue.

Due to the interdependence of the two firms in a duopoly their profit functions are more complex than that for the single firm situation. Profit for each firm is depicted
graphically in figure 1 as a function of quantity produced by each firm. Note that the
two firms are assumed to be symmetric: ie. unit variable cost is constant and identical
for the two firms, there are no fixed costs, and firm products are identical; the demand
function is assumed to be linear and downward sloping. Firm interdependence is
embodied in the demand function: price for each firm decreases with quantity
supplied to the market, irrespective of which firm supplies the quantity.

Each firm’s profit function is represented by one of the two bonnet shaped surfaces.
For any pair of quantities (one provided by each firm) profit is represented by the
vertical height above the intersection of the two quantity coordinates. Note that the
one pair of quantity coordinates determines profit for each of the two firms: one
vertically above the other on the surface of each bonnet. It is evident from the
diagram that firm profit changes continually as quantities change. The interest in
duopoly modeling lies in determining the pair of quantities selected by the firms and
then determining if the firms have reason to settle on the resulting pair of profit
points. If the firms have reason to stick with a pair of quantities that point represents
an equilibrium. Each firm’s owner wishes to arrive at the highest point that it can
achieve on its profit surface. Ideally each firm would like to arrive at the tip of the
bonnet: this is the monopoly point but is only achieved if the rival firm produces
nothing. However the firm cannot make an independent decision: its profit is dictated
also by the action of its rival. In this situation two independent entities are
simultaneously attempting to maximise their objective function; this situation is
inherently more complex than single entity maximisation.
To visualise the meaning of equilibrium and double maximisation consider two hillwalkers walking on the surfaces shown in figure 1, one hillwalker walking on one firm’s surface and the other hillwalker on its rival’s surface. The hillwalkers are at all times vertically one over the other. Both hillwalkers are controlled by a pair of rods, each rod manipulated by one of the firms. Imagine that one of the firms can move both hillwalkers on a north-south axis only and the rival firm can move both hillwalkers on an east-west axis only. The hillwalkers move in tandem as directed by the combination of actions of the two firms, each firm wishing to move its own hillwalker as high up as possible on its own surface. (In most game theoretic models players are indifferent to the outcome of their rival, they are only concerned with achieving the outcome that is best for themselves. This may not be true in business where firms may wish to maximise the gap between itself and its rival. This of course represents an objective different to profit maximisation and is a different problem to that which we are dealing with here. I will return later to this topic of relative advantage.)

Suppose now that one of the hillwalkers arrives high up on the flank of one of the bonnets. The rival firm’s hillwalker will have arrived at a point low down on the flank of its surface; the rival firm therefore will choose to move its rod along its designated axis so as to push its hillwalker further up its own slope. The first firm will then find that its hillwalker has moved considerably lower down the slope of its surface; the first firm will in turn move its rod so as to push its hillwalker further back up its slope. And so on. The play will end only when both hillwalkers arrive at a point which is simultaneously on the ridge of both bonnets. In figure 1 only one such point exists: the obvious saddle point where the two bonnets intersect. Should the
hillwalkers reach this point neither firm can gain by moving its hillwalker any further. This therefore is an equilibrium point. In game theoretic terms this point is referred to as a Nash equilibrium and in duopoly theory as a Cournot equilibrium after Cournot (1838) who first suggested this type of analysis. Note that in the industry depicted in figure 1 where firms are symmetric the two surfaces intersect at the equilibrium point. This means that both firms gain identical profit at equilibrium. This is not the general case: should the firms be asymmetric in costs or in product characteristics then firm profits will not necessarily be identical at the Cournot equilibrium.

In game theory the above play is not regarded as a series of sequential events but instead is viewed as occurring at a single point in time. Both players are assumed to think through the above sequence of events and realise from the beginning that the only equilibrium point is the one described above. Both players proceed directly to that point by choosing the appropriate quantity (each firm assuming that its rival is thinking in the same fashion and simultaneously choosing the appropriate quantity).

Clearly many points exist for a firm where it can achieve greater profits than at the Cournot point. Stackelberg (1943) suggests an alternative strategy: if a firm can makes its decision in advance of its rival and gain the high ground early its rival will have no choice but to make its decision given this fait accompli. In this sequential decision-making situation Stackelberg suggests that the first firm should choose the quantity that positions its hillwalker as high as it can on its profit surface such that that point lies directly over the ridge of its rivals profit surface. Its rival then will have no choice but to choose the quantity appropriate to this point as it can do no better given that the first firm has made such an irrevocable decision: it can only
move its hillwalker along one axis and it is already at the highest point that it can reach along that axis. Stackelberg’s scenario corresponds to the strategic situation where an industry leader and follower make strategic moves in a sequentially correlated fashion.

The difficulty with the Stackelberg scenario is that two such equilibrium points exist – one where each player acts as leader - and there is no rationale for determining which one will move first and which second and therefore which of the two points is achieved. In game theoretic terms these are a pair of hawk-dove equilibria. In the absence of some focal consideration (Schelling, 1980) such as one of the firms being an obvious leader and the other an obvious follower there is a risk that both firms will act as leader, each selecting their Stackelberg quantity. This would result in an especially large quantity of product being placed on the market depressing price and consequently depressing profits for both firms. Consumers of course would be very happy with this situation: a plentiful supply of cheap goods would be made available.

As can be distilled from the above discussion it may be in the interest of each firm to increase production beyond the Cournot quantity. This is because, unlike in the monopoly situation, the firm gains the all the revenue from the increase in sales due to the extra quantity but its rival takes a share of the revenue lost due to the price increase. However, it is in the firm’s interest to so increase production only if its rival does not do likewise, for if its rival also increases sales both will be worse off. This opens up a question for strategists: how can one of the two firms increase production beyond the Cournot point while at the same time inhibiting its rival from carrying out the same action?
I noted earlier that in the Fershtman and Judd model both sets of owners recognise that managers are motivated to maximise sales and, taking this into account, apply to them an incentive factor. However, as both sets of owners do this, both managers select a quantity greater than the Cournot quantity leaving both firms worse off than at the Cournot point (although better off than at the double Stackelberg point). I now wish to suggest a modification to the Fershtman and Judd model that allows one firm only to increase the quantity brought to market.

Let us assume that if owners are very strong they exert much control over managers requiring them to act as strict profit maximisers. If owners are very weak they exert little control over managers who therefore follow their own inclination to maximise sales paying little regard to profit. Between these two extremes lies a continuum of governance structures varying from very strong to very weak. Let the position of the firm along this continuum be represented by a governance factor. This factor plays a similar role to that of the incentive factor in the Fershtman and Judd model. The objective function under which firms operate remains a weighted average of profit and sales, the weighting represented now by the governance factor.

This governance model is different to the incentive model in one significant respect. The governance factor is not a decision variable: owners do not choose the level of governance that they wish to apply. The governance factor is a parameter of the model and determined by circumstance ie. if firms are very strongly governed a governance factor of one is assigned, if firms are very weakly governed a factor of zero is assigned, and if firms lie in between these two extremes a governance factor is
assigned in proportion to the level of control exerted by owners over managers. The governance model is therefore represented as a single stage game in contrast to the incentive model which is two stage.

Unless both firms are very strongly governed, the probable outcome of this new situation is that larger quantities will be placed on the market by managers of both firms and both firms will make lower profits than at the Cournot point. But which of the two firms will make the greater profit? The surprising answer is that the firm that is more weakly governed will outperform one more strongly governed. The reason why this is so is as follows. The more weakly governed firm, whose managers by assumption are more interested in sales, produces a greater quantity than the more strongly governed firm. Due to duopolistic competition, and assuming that products are similar, the one price holds for both firms. Assuming similar cost structures for both firms, the more weakly governed firm therefore makes more profit than its more strongly governed rival. This is not to say that it makes more profit than it would at the Cournot point: it may or may not depending on the governance factors for the two firms. However it is clear that the more weakly governed firm gains a relative (i.e. competitive) advantage over its more strongly governed rival.
The situation may be illustrated by a simple worked example. Figure 2 shows results for a duopoly where both firms produce identical products at a cost of £8, where the maximum price that consumers will pay is £25, and where price decreases by £1 for every additional 10,000 units placed on the market. Profits for both firms are shown after a tax rate of 40% is applied. Firm one is assumed to always act as a strict profit maximiser. Reading from left to right, figure 2 shows how profits for both firms alter as firm two varies from strong to weak governance.

Some observations may be made. Firm two, the firm that is less strongly governed, makes slightly higher absolute profit and significantly increases its relative profit as it varies from strict profit maximisation. The difference in profit between the two firms is greatest at a governance factor of 0.5. At governance factors of value less than this the relative difference in profit decreases. If firm two should be very weakly governed...
governed and therefore a strict sales maximiser there is little difference in profit between the two firms; note also that both firms are significantly worse off than if both were strongly governed. Figure 2 suggests that profit maximisation and maximising competitive advantage need not necessarily yield the same result. Profits for both firms are maximised when both are very strongly governed. However, competitive advantage for firm two is at its greatest if its governance factor is 0.5, i.e. when it is relatively weakly governed.

The most vulnerable firm in this scenario is the very strongly governed firm whose managers are required to act as strict profit maximisers. Should the rival firm’s owner display any level of weakness in governance the strong owner will be worse off than at the Cournot point and be placed at a competitive disadvantage to the rival. Ironically the very weakly governed firm is in the strongest relative, and possibly also absolute, position: its stronger rival will be reluctant to weaken its control over its managers as to do so would further increase production and leave both firms worse off; it can do little else but grin and bear the situation. The main danger for the weakly governed firm occurs if its rival is also weakly governed. In that case both firms will be induced to overproduce leading to poor profits. One could argue that in such a weakly controlled industry owners get what they deserve.

Two considerations arise. Firstly owners, seeing that weak governance can lead to advantage, may seek to alter the level of control they apply to managers. This of course would switch the game back to the incentive game: level of governance becomes a decision variable and the game becomes that of Fershtman and Judd. The argument against this is that level of governance control is not easily altered – it is
something inherent in the way the Board of Directors operates. That is not to say that it cannot change – a change of chairperson or composition of the Board would likely effect such a change – it is merely to say that it is not easily changed: it is a structural parameter, not a decision variable. In contrast, owners can easily change the incentive variable.

Secondly, it may be argued that where firm objectives are asymmetric costs also may be asymmetric and the firm that moves towards sales maximisation may have higher costs. While it is true that costs do not have to be symmetric among firms it does not necessarily follow that the more weakly governed firm has the higher costs. Weak governance need not imply weak management and it is managers, not owners, who monitor costs. However, under weak governance managers become more focused on sales and for that reason may spend less time monitoring costs. Also, costs are less significant under sales maximisation than under profit maximisation and their importance may be lessened in the eyes of managers.

The above discussion suggests a framework for determining the inherent profitability of an industry. The governance model suggests that we would expect firms to be highly profitable in industries where firms are all strongly governed and act as profit maximisers. The model suggests that we would expect firms to be poorly profitable in industries where firms are generally weakly governed and act as sales maximisers. In industries where some firms are strongly governed and some are weakly governed we would expect varying levels of profitability: the model suggests the counterintuitive result that the weakly governed firms would outperform the strongly
governed firms. A suggested agenda for future research is to empirically examine the
correlation between industry profitability and firm governance.

**Bibliography**


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