

# Economics of Corporate Governance in Non Profit Maximising Organisations

*Submitted by Bing Chao to the University of Exeter as a thesis for the degree of Doctor of  
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# Dedication

I dedicate my thesis work to my family and friends.

A special feelings of gratitude to my parents who always encourage me to pursue my personal goals and support me through thick and thin.

I also dedicate this thesis to my friends who have supported me through the process and I will always appreciate all they have done. To my old friends in China who grew up together with me.

I dedicate this work and give special thanks to my best friends Tingxiang Zou, Fangzhou Zhai and Wenshu Xu for inspiring me and being there for me throughout the entire doctorate program.

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# Abstract

It has been widely accepted that profit maximisation the cornerstone of economic analysis. The prevalence of non profit maximising firms such as cooperatives, partnership and the increasing importance in stakeholders' interest has raised my interest in this topic.

My thesis looks into the reasons that drive the prevalence of non-profit firms, such as the perception bias of managers, the special law and regulation in certain countries and the emphasis on the stakeholders' interests.

I base my analysis mainly on the oligopoly model and provided analysis on how the market is like in non-profit maximising environment compared to profit maximsing environment. I find out that non-profit firm is not necessary less profitable under certain circumstance. First chapter introduces the related literature; second chapter focuses on the influence of managers' perception bias on firms' decision; chapter three applied a two stage model to see how for-profit firms and non-profit firms react under uncertainty and last chapter focus on the governance of cooperative/partnership.

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<sup>1</sup> *Department of Economics, University of Exeter, United Kingdom*

# Chapter 1

## Literature Review in Corporate Governance

### 1.1 Introduction

Why has corporate governance become an important topic in recent years? One explanation could be that the world-wide privatisation and takeover waves. In general, corporate governance usually happen when there are divergence of interests between outside investor and the manager who runs the firm. Dispersed ownership strengthens the problem because the conflict arises when they need to make collective action.

The key point of corporate governance is to reach a balance between the protection of the small shareholder and managerial discretion. Dunlavy [1998] raised the idea that every shareholder had one vote no matter how much shares he/she held, which was called corporate democracy. However, although it is a way to avoid special privilege of some large shareholder, the system still gradually moved to one-share-one-vote. Therefore, the concentration ownership still exists.

Rostow [1959] argued that hostile takeovers are more effective way of disciplining management and persuading the shareholders to fulfill their responsibilities in election of directors. He argued that: the raider persuades the stockholders for once to act as if they really were stockholders, in the black-letter sense of the term, each with the voice of partial ownership and a

partial owners responsibility for the election of directors.

Another debate about management is whom does corporate governance represent? Berle Jr [1931] argued that corporate power should represent only shareholders while Dodd [1932] held the view that corporate government should protect the interest of every party who is involved in such as customers and employees even if shareholders' interests would be curtailed.

In a nutshell, we will review both empirical and theoretical research addressing the problems above and make some comparative comments in corporate governance in different types of organisations.

## 1.2 Importance of Corporate Governance

The world-wide privatisation which started in UK occupied 90% of European Commission's privatisation in 1991. After that, Latin America, Asia, Western Europe and former Soviet experienced a great wave of privatisation (US is not included because state ownership was always small). Shin [2001] put forward the idea that the new role of a state as a shareholder in a privatised corporation motivated the great change in structure of corporation. Besides, the boosting process of privatisation attached stock market great importance because all the OECD share sales are carried through public offering.

Household's growing investment in pension funds makes them powerful to influence the corporate governance. Institutional investors hold a great portion especially in relatively small countries such as Luxembourg and Netherlands. In Japan, Italy and Germany, percentage of institutional holding in GDP is less than other countries. Statistic shows there's increasing demand due to the transformation of Japanese system after a recession since 1980s.

Apart from that, the takeover and merging wave account for part of reasons for increasing importance in corporate governance. Globalization prompts the improvement of corporate governance to protect the investors in places like Eastern Europe, Asia which attract a lot of foreign investment.

The frequent financial crisis in the past several decades like East Asia crisis in 1998 and global crisis in 2008 together with common occurrence of scandals which is often discovered during economic downturns periods urge the reform in corporate governance.

## 1.3 Framework and Theoretical Basis

### 1.3.1 Agency Problem

Jensen and Meckling [1976] pointed out that a firm was in some degree a contracting relationship. In modern language, it is an agency problem involving the CEO and other principals (shareholders, creditors, employees, customers and other stakeholders). In this layer, the central issue is to understand how corporate governance deviates in practice from the efficient contracting benchmark.

Their paper combined the knowledge of the theories of agency, the theory of property rights and the theory of finance to develop a theory of ownership structure of the firm, trying to reveal the relationship between the agency cost and the separation and control issue. Besides, they also create a brand-new explanation of the factors influencing the issuance of debts and equity.

If both parties in the agency contract act in their best interests, we have every reason to believe that the agent will not maximise the interests of principals. Principal could use some incentives to motivate the agent or bear some monitoring costs to limit agents' aberrant behaviours. In this paper, agency costs are the sum of monitoring expenditure bonding expenditures and the residual loss<sup>1</sup>.

Before this paper, most existing literature focus on the normative aspects of agency problem by investigating how to structure the contract between principal and agents. Jensen and Meckling [1976] assumed that all the normative issues solved and given that only stocks and bonds could be issued as claims to see which contractual equilibrium would reach. With the falling of

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<sup>1</sup>The cost incurred by the divergence of agents decisions

owner manager's share of equity, the wealth costs to the owner of obtaining additional cash in equity market would rise. For a claim on the firm  $(1 - a)$ , the outsider will pay only  $(1 - a)$  times the value he expects the firm to have, given the induced change in the behaviour of the owner-manager.

Jensen [1986] creatively advocated that the best way to mitigate agency problems is to let the firm to take as much debt as possible because limited free cash flow to manager would decrease the chance of manager's harming investor's interests. However, Myers [1977] argued that highly-levered firm would face the financial distress and large bankruptcy cost.

A paradoxical question is since the making of regulation is in the interest of shareholders, why is it counterproductive? One explanation is the founder of the firm could not consider every party's interest in a complicated bargain which leads to inefficiency. The supporter of mandatory rules argued that even the firm have the right incentive to design the rules, they might have to change it afterwards because of the dispersed ownership.

### 1.3.2 Stakeholder Systems

Due to the different parties involved, contracts are usually incomplete. Falck and Heblich [2007] argued that we should consider the constituencies besides shareholders to guarantee the efficiency. However, the orthodox view was that through board representation a firm can extend the interest of other constituencies. Different countries vary a lot in this issue: US care more about profit of shareholders, while Germany and Japan consider more about other constituencies' interests.

Williamson [1984] articulated that shareholder is the weak side among the constituencies because he could not quit like the employees nor get the collateral as an assurance. Therefore, the governance rule should mainly protect the shareholders' interest.

Hansmann [1996] agreed with the view because considering only shareholders' profit would reduce the cost of decision making and management. If a firm were 100% owned by outsiders,

then all the activities of the firm would need market contracting, which will lead to inefficiency. Assigning ownership to those who are not patrons of the firm would waste the opportunity to use ownership. So he tries to seek the low-cost assignment of ownership and put forward that the costs would be minimised if the ownership is assigned to the patrons whose market contracting problem are severe.

Allen et al. [2009] noticed that the traditions of corporate governance in different countries are quite different. In most continental European countries, the firm's objectives are not only profit maximisation. Besides, they take other stakeholders' interests into considerations. Their paper models the objective function of stakeholder-oriented firms by assuming that, if the firm goes bankrupt, it would incur the cost to the employees to hunt for a new job. By adding this to the objective function, they find out the equilibrium would change in the competition. They conclude that both stakeholder and shareholder would better off by adopting a concern for stakeholder. And they derive the situation when the firm would choose to become a stakeholder-oriented firm voluntarily.

### 1.3.3 Modigliani Miller Theorem

Another popular issue that is debated over decades is the capital structure of financing a firm. Debt holders do not have voting rights and are limited to a fixed return, so the stockholder do not have to share profits if the business does well. However, the higher rates of debt would lead to greater risk and higher required interest rates.

Modigliani and Miller [1958] show that financing decisions don't matter in perfect capital markets They made Assumptions:

- Capital market is complete and all parties in the market have access to the information they need,
- No taxes and transaction costs,

- No bankruptcy costs,
- It is a competitive market, individuals and firms are price takers,
- Individual and firms can undertake financial transactions at the same cost,

MM Proposition 1 shows that: firstly, firms can not change the total value of their securities by splitting cash flows into two different streams; Secondly, firm value is determined by real assets; thirdly, capital structure is irrelevant.

With the development of MM theorem, they add up firm tax into the model, therefore the firm value would equal to the full-equity value plus the net present value of tax minus the financial distress costs.

### 1.3.4 Fisher Separation Theorem

The theorem was designed to provide decision rule for making investment and dividend policies representing shareholder firms. Although it was started by a simple setting, the rules are applicable even when more realistic assumptions are made. We list the assumptions in Fisher's analysis:

- There are only two points in time: the present (time 1) and a later time (time 2),
- There is no uncertainty, and hence, the outcome of all decisions is known now to everybody,
- There are no imperfections (e.g., no taxes, no transaction costs: borrowing rate = lending rate) in the capital market,
- All decision makers are rational,
- The company's managers wish to use the company's resources according to the wishes of the shareholder,
- There's no externalities.

If different shareholders have different indifference curves and investment preference, we could introduce capital market line. The theorem asserts that the objective of the corporation will be related to the net present value rather than the preferences of its shareholders.

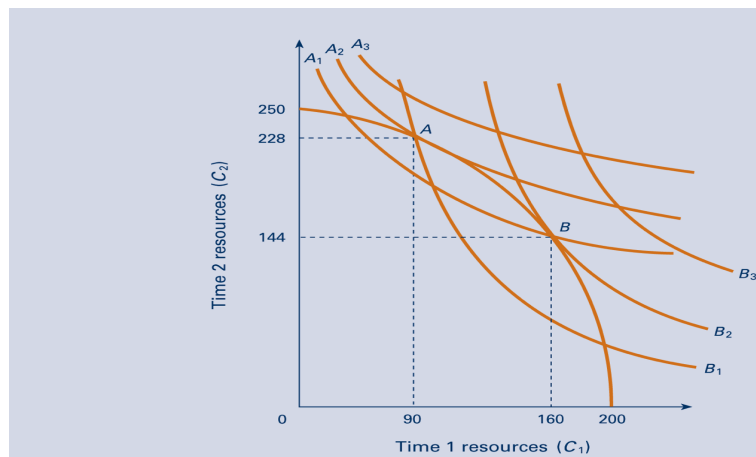


Figure 1.1: Company with Two Shareholders

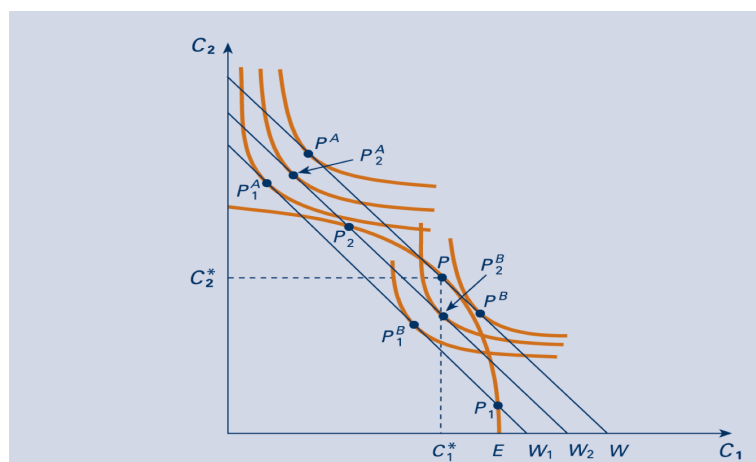


Figure 1.2: Two Shareholders with Access to a Market

Figure 1.1 shows that consumer A and B have different preferences and hence a firm would not be able to make a financial decision that would satisfy both of them. If we introduce a market opportunity line to indicate the combination of current and future consumption that an individual can achieve from a given wealth level as is shown in Figure 1.2. Choices  $P_1$  and  $P_2$  provide shareholders with inferior utility to the choice of  $P$ . Shareholders do not consume at



point P. The capital market allows them to consume at PA and PB respectively.

However, if there is imperfect competition, the fisher separation theorem would fail because the firm's production plan would influence the prices which in turn have impact on shareholders' profits. The same situation happens when externalities exist because that would change the utility function of shareholders and agreement would become hard to reach. In this case, shareholders will not just care about the effect of firms decisions on their wealth but will also care about the direct (externality) effects of the decisions upon their utility. For instance, a shareholder who lives near a factory with a smoking chimney, will want less production than the profit maximising level and less production than one who lives further away. Thus we see both disagreement between shareholders and deviations from profit maximisation.

### **1.3.5 Coase Theorem and Externality**

#### **1.3.5.1 Coase Theorem**

In economics, an externality is the cost or benefit that affects a party who didn't choose to incur that cost or benefit. Coase [2013] reconsidered the problem by introducing the example of a baker and a doctor sharing the same office building. In this scenario, both of them are influenced by the production of each other. He displayed that the efficient outcome of this case should not be dependent on responsibility of the externality on any party.

Under the assumptions that 1) there are complete property rights; 2) there are no negotiation costs, the Coase Theorem implies that parties would achieve an efficient outcome.

To remedy the externality eg: pollution produced by oil refineries, three approaches are introduced in this mechanism. Assume two oil refineries produce different levels of smog when refine one unit of oil. "Command and control" is a traditional method that sets the quantity limits on production plan but it is difficult to set the law to regulate the behaviour and once set, it will be difficult to modify. An alternative is to levy tax to internalise the externality. The desired result of the tax would be the tax amount to maximise the welfare and it is the efficient

amount of production as well. Pigouvian tax idea is not strongly related to Coase Theorem because it adjusts the price based on social cost and it neglects the negotiation between plants. The third solution is to calculate the optimal amount of pollution and issue the amount of permits to pollute. To conclude, the three methods have identical consequences although they reach them from different aspects.

### 1.3.5.2 Externality

Milne [1974] justified the profit maximisation of Fisher Separation Theorem under the assumption of no externalities. But the theorem would not apply if externalities exist. In most cases, there are externalities between the firms and shareholders, and shareholders will consider not only the profit but also the externality effects when making decisions.

Kelsey and Milne [2006] assume that there are negative externalities between the firm and its suppliers. Then, as before, a non-profit maximising firm will produce less of such externalities. A special case of an externality arises from the hold-up problem. Assume that suppliers may make firm-specific investments, which are non-contractible, e.g. in human capital. Ex-post, the firm can appropriate these investments. This imposes a negative externality on the suppliers of inputs and hence reduces the incentive to provide firm specific investments. With conventional firms there will be too little firm-specific human capital in equilibrium. However as already noted, a non-profit maximising firm will produce fewer negative externalities. Thus the hold-up problem will be reduced, and input suppliers will be more willing to supply firm-specific inputs, which brings about a Pareto improvement.

## 1.4 Models

### 1.4.1 Takeover Model

The most radical way to replace the management is by a hostile takeover which can be costly and destructive. Even in the US and the UK it rarely happens. The definition of a successful takeover is the raider owns more than 50% of the effective voting shares and then takes control of the board.

Much researches have been done to the question of ex-post efficiency of the problem while less researches on the ex-ante efficiency of takeovers.

Scharfstein [1988] considered an ex-ante contract between a financier and a manager. The contract uses an uncertain compensation scheme as incentives. Besides, the contracts allow ex-post takeovers if the raider has more information than the financier or the raider is a better manager. In his opinion, takeover is efficient because it break the informational monopoly of incumbent manager and enable the replacement of inefficient manager. Besides, his arguments supports the regulatory intervention that bans anti-takeover defense. For instance, super-majority amendments, staggered boards, two-tier tender offers, and poison pills<sup>2</sup>.

The first model of tender offer owes to Grossman and Hart [1980] who suggested a couple of ways to boost the efficiency of hostile takeover mechanism which is all related to the dilution of minority shareholder rights. Following their research, a quantities of research are trying to analyse different variants in takeovers and most of the research discovered that gains of takeover went to the pocket of target shareholders through the free riding of small shareholders due to increasing price of target shares.

Analysis on the regulation in takeover focuses on several issues. Many people asked whether the regulation caused inefficient control contest. Harris and Raviv [1988] believed that one-share-one-vote makes the raider to pay highest possible price to take over a firm, while the deviation

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<sup>2</sup>Most poison pills give the right to management to issue more voting shares at low price to existing shareholders in the event that one shareholder owns more than a fraction  $x$  of the outstanding shares. Such action almost makes takeover impossible

from one-share-one-vote allows the shareholders to enjoy a gain in a value increasing in takeover. Another benefit brought by this mechanism is to release the family-owned firms' fear of losing control if the company goes public. The firm could retain control through the dual-class share structure by issuing two kinds of shares: votes-only shares and non-voting shares.

Shleifer and Summers [1988] raised another popular argument, he proposed that takeovers could damage the mutual trust between employees and management. Employees are less likely to invest in the current relation with if the incumbent management would be replaced by new ones.

### 1.4.2 Blockholder Models

Another way to mitigate the problem of collective decision is to have a semi-concentrated ownership structure so that the corporations has at least one large shareholder and have the incentives to monitor and change the management. This model is more common in the continental Europe and other OECD<sup>3</sup> country than in UK and US.

Grossman and Hart [1980] pointed out that large shareholders would promote the process of takeover. However, this might lead to an agency problem of moral hazard that was addressed by Brealey et al. [1977]: the concentrated ownership brought strong incentives for monitoring while the dispersed ownership would enable risk diversification to the largest extent. Therefore, risk-averse entrepreneur would benefit from having a large proportion of shares as a signal of firm quality and confidence in managing the firm.

After that, Admati et al. [1994] presented that large shareholder usually under-invest in monitoring and prefer to diversify their holdings through selling small quantities of their stocks in secondary market. In this case, their analysis showed that blockholders should be compensated for holding large shares.

In a nutshell, the explanation for the limited size of block is that big shareholder is inclined

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<sup>3</sup>20 countries originally signed the Convention on the Organisation for Economic Co-operation and Development. Since then, 14 countries have become members of the Organisations

to diversify the risk and under-monitor.

Holmström and Tirole [1993] upheld the opposite perspective, they argued that liquidity is an important fact to gain the precise valuation of the company and its performance. Since the more informative the stock price could be included in the corporate compensation, the more incentives managers would have.

Similar to takeover, there are always advantages and disadvantages in big shareholder monitoring. A point was mentioned by Aghion and Tirole [1997], Pagano and Röell [1998]: if the large shareholder took control of the firm and the staff member, the manager would be reluctant to make any investment. For a private held firm, concentrated structure would lead to over-monitoring and undermine the managers freedom to manage the company.

A lot of scholars argued that to avoid the over-monitoring and self-dealing, it is essential to create a corporate charter to control the power of blockholder. Bebchuk and Roe [1999] argued that Coase Theorem would not work even if corporate charter is theoretically accessible. In such case, regulation that limits blockholders rights would be needed. His conclusion is self-dealing would lead to concentrated ownership if there's no strict corporate law.

Another famous analysis is articulated by John and Qian [2003]. They tried to distinguish between large shareholder mechanism and hostile takeover mechanism. The cost of monitoring and the effectiveness of takeover were introduced to change the situations. This implied that we could not simply put US regulation into use in EU and Japan situations.

### **1.4.3 Large Creditor and Delegated Monitoring**

Pension funds, mutual funds and other financial intermediaries are now playing an important role in monitoring because they owns large stake in corporations. Black and Coffee [1994] pointed out that due to the legal constraints, they tend to be passive in monitoring. One strong point of large institutional monitoring is that fund managers gains no benefits in self-dealing, which makes them an ideal monitors. However, on the other hand, due to their lack of relations

with corporation management, there's no strong incentives for active monitoring.

In this area, Diamond [1984] did first formal research which showed that delegated monitoring by a bank would be more efficient when avoiding the duplication of monitoring by small shareholders. As bank is a well-diversified institution and could guarantee the fixed return to the depositors so there's no need for depositors to monitor.

To summarise, research shows that delegated monitoring would be effective because it provides one way to solve the collective decision problems. Nevertheless, the effectiveness of monitoring depends on the incentives of managers which in turn are more related to the bank regulation.

#### 1.4.4 Board models

Another common way to solve the collective action problem among dispersed ownership is to monitor the CEO by a board of directors. Usually, the directors of board are elected by shareholders they are required to choose CEO. The intention of the charter is to maintain check and balance and then to operate the shareholders democracy. But, the real situation is that CEOs could have huge influence in choosing directors and they have better access to the information than shareholders. In addition, the board would try to avoid conflicts with CEOs and plays an advisory role. Apart from this, directors only have limited stake in the corporations.

Recently, a lot of regulatory work has been done to reduce the influence of CEO over board to achieve the board independence. In this case, a minimum fraction of the board is required to be independent<sup>4</sup> to guarantee the board doesn't defend shareholders' interest. Two main flaws exist in this mechanism: one is that so-called independent board is short of the related knowledge, and the other is its dependence on CEO's reappointment. In concentrated ownership situation, this mechanism fails to explain because it is not only the independence from CEO

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<sup>4</sup>A director is defined as independent if he or she is not otherwise employed by the corporation is not engaged in business with the corporation and is not a family member

but the independence from large shareholders that matters.

Dewenter and Warther [1998] proposed that under the permission of dismissing minority directors, they would be reluctant to go against management. His model also showed that board would only be active when they are in crisis.

Boone et al. [2007] used the rate of independent directors as a variable and assumed that independent directors are less informed than the others. He obtained a result that the decomposition and size of the board is varied in different firm with different characteristics.

Hirshleifer and Thakor [1994] considered the relationship between board monitoring and external monitoring by raiders. The threats from taking over had a positive effect on managers and board's discipline.

In summary, there's very little in common in these researches, and all the literature displays the complication of these board issue. Most of the research focuses on the board decomposition and selection of directors. The function of the board and how board raises its effectiveness are worth investigation in the future.

#### **1.4.5 Executive Compensation Models**

Apart from monitoring, another way to increase the incentive of management and to protect shareholders is to make the goal of CEO consistent with the shareholders' by structuring the CEO rewards.

Most of the managers' income include fixed basic salary and a bonus related to his performance during a period (usually the accounting profits), and sometimes a stock options. The package would include pension rights and severance pay and so on.

The amount of executive compensation experienced a booming increase in US before 2008, the bull market and the upward market standard determine the executive compensation. The gap in CEO pay keeps widening in US mostly owing to the stock options in the compensation package.

Concerns are raised because stock options might stimulate managers' incentives to raise firms' stock values, but would also be used by managers as a way to make themselves rich by exploiting shareholders. Hermalin and Weisbach [1998] modeled the bargaining process between the CEO, the remuneration committee and the board. Most of the theory followed the previous analysis of contracting theory under moral hazard. Holmström and Tirole [1993] argued that secondary stock trading account for the rationality of main decomposition of executive compensation packages. However, the executive compensation consultants base the design of compensation contracts more on other consideration than the informativeness.

Gibbons and Murphy [1992] pointed out the fact that CEOs are driven by not only explicit but also implicit incentives, which made the problem more complicated. They argued that the pay is not the only incentive. Managers' future career would be affected. Therefore, elder managers would care more about explicit incentives and less about implicit ones in general.

Most of the agency theory doesn't consent the executive compensation theory because they believed stock price could be manipulated and the scandal of Enron, WorldCom etc have proved this point.

#### **1.4.6 Multi-constituency and Stakeholder Models**

We usually assume that the board and executive compensation should reflect shareholders' interests. However, situations are different. Bacon and Brown [1975] put forward that if a firm had a long-term relationship with a bank, it would be very likely to be a member of board. Similarly, if a CEO is related to the company's business, it would be common to discover he is sitting in the board.

In Germany, the law even requires having minimum percentage of employees on the board. Till now, it is still a hot debated and undecided issue to see to what extent the board should be compulsively regulated to have other constituencies except for shareholders. Only small amount of literature could be found doing highly stylised models of multiple constituencies.



One type of model is sharing control with creditors: they try to find out what effect of different division of control rights between manager, shareholder and creditor would have on the liquidity and restructuring decision. Aghion and Bolton [1992] focused on the situation of concentrated ownership like a family-owned firm that is reluctant to share the control of the firm. It will cherish the option of doing its own future action and refuse a lot of lucrative bids even if this would limit the development of the business.

Dewatripont and Tirole [1994] proposed that threat from liquidation if poor performance appeared would be an incentive for management. As claimholder get most of the liquidation value, they are more willing to liquidate the firm than shareholders who wish to reorganize the firm.

Chang and Mayers [1992] gave an insight to limit shareholders' power to dismiss management. He assumed under dispersed ownership, to dismiss management, the firm needs to rely on the decision of creditors. The research showed that the higher leverage, the more likely a poor performance manager would be dismissed.

Another interpretation of the model can be explained as the shared control by employees and provider of capital. In these kind of model, the employee representatives played an important role in checking shareholders' abusing power to dismiss a manager.

Grossman and Hart [1986] and Hart and Moore [1990] articulated the general theory of property right that centring a hold-up problem<sup>5</sup>. Property-rights theory solve not only physical capital but also human capital. A classic case of hold-up problem is how to decide the investment in a research project because we could not know the value it will bring until it comes out. Besides, the cost of research would not be included in ex-post trade, so the better way for researchers to negotiate a higher pay is to own some assets required to produce the invention. The general ideal of property theory is that to some extent, sharing the control with employees who make valuable human-capital investment.

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<sup>5</sup>potential ex-post expropriation of unprotected returns from ex ante human capital investment

Hart and Moore [1990] considered firms which were R&D intensive industries. In this model, firms should solve the issues of protecting the employees against hold-up problems and financial capital providers. They tried to induce employees to invest most. In reality, existence of capital provider would make employees under-invest in human capital. They proved that to maximise the firm value, it is useful to share control with employees.

There are several ways for employees to share control with employees: giving employees shares, let them sit on the board or increasing unionisation to improve their bargaining power. Holmström [1999] gave the view that it is very likely to incur strike or unionisation if employees are not involved in decision-making.

Thus the employee board member would act as a facilitator of protecting human capital investors' interests and restricting shareholders' urge of dismissing employees. Gorton and Schmid [2000] did some empirical analysis addressing German firms. Interestingly, they found out that shareholders took actions against the influence of employees like making the firm highly levered, or holding some informal meetings among shareholder representatives in case some important information revealed.

An extreme case of employee board representatives was explained by Steenland et al. [1999]. It is not rare to see the situation that only human capital matters in some industries like accounting, law partnership and even universities. They derived that in these kinds of partnerships, employee-dominated boards would be the most efficient choice.

Hansmann and Hansmann [2009] and Hart and Moore [1996] refuted the popular prediction that the control rights should be given to "insiders". They observed that most popular form of governance structure was "outsider" ownership. This paradox was described as shareholders were the homogeneous constituency that would minimise the decision-making cost. They also looked at the distortion in decision-making that happened in a cooperative and supported the idea that shareholders are the most weak roles that required protection.

Allen et al. [2007] used a simple two-stage incomplete information model to measure the

firm value of stakeholder firms and shareholder firm value. Surprisingly, firms can be more valuable in stakeholder society than shareholder society in some cases. Besides, they point out the globalization circumstance and compare the symmetric and asymmetric equilibrium by models.

To summarise, although a lot of persuasive work has been done to support the employee representation on board, there's still no mandating rules of employee representation on the board as in Germany. In addition, No formal model on links between politics and corporate governance has been built even if their relationship is obvious.

#### **1.4.7 Corporate Governance that Deviates Profit Maximisation**

Fershtman and Judd [1987]'s paper examined the internal contracting and external strategic considerations under oligopoly. They found a principal (firm owner) will want to distort the incentives of his agents (firm managers) in order to affect the outcome of the competition between his agent and competing agents. The general implications of analysis are clear. In general, the owner of a firm will alter his managers' incentives in that direction which will cause opposing agents to change their behaviour in beneficial directions. In some cases, various asymmetries may cause the owners to distort their managers' behavior in opposing directions. The variety of problems that can be analysed by focusing on this joint determination of internal incentives and external environment is obvious.

The major weakness of the analysis above is the assumption of linear contracts and the absence of a detailed asymmetric information structure which motivates the existence of contracts in the first place. This study is offered as an imperfect but intuitive and suggestive analysis of the possibilities that arise when we jointly examine managerial incentives and market structure.

Kelsey and Milne [2005] argued that in the presence of imperfect competition, appropriate choice of corporate governance can reduce market distortions and/or shift the equilibrium in the favour of a given firm. Moreover the general model shows that similar considerations apply

to other market distortions. According to their arguments, in monopoly or Cournot-style competitions, there are incentives for increased consumer involvement in the governance of firms. Clearly this does not happen in all instances of monopoly or imperfect competition. In those industries where the cost of organisation is low and there is monopoly power, cooperatives or similar organisations come to dominate. An important factor, which affects the costs of organisation is geographical distance. If customers live close together they can meet and organize more cheaply. A second, possibly more important, cost of organising is the cost of collective decisions. All systems of collective choice impose costs, both direct costs of operating the mechanism and indirect costs if the outcome is inefficient. Costs of collective decisions are greater the more diverse the preferences of the group of individuals making the decision.

Yalcin and Renström [2003] endogenised the objective of a monopoly firm through shareholder voting, in a simple two-sector general equilibrium model. In this way they ensured that the firm's objective is consistent with the preferences of the owners, which it would fail to be under traditional profit maximisation. When the shareholders realise that the firm has market power, they showed that rational voting may imply overproduction as well as underproduction, relative to the CEE<sup>6</sup>. For certain distribution of shares, the CEE allocation was obtained. They characterised the properties of the underlying distribution of shares for either case to be generated. They also found that a nationalised monopoly, when all individuals own the same amount of shares, may underproduce relative to the CEE. Finally, we endogenised share ownership by allowing trade in shares. If investors are myopic in the sense that they do not recognise their influence on the voting outcome, and thereby on the share prices, when they trade, then any distribution of shares could constitute an equilibrium. If individuals realise their influence on the voting outcome when trading, and if individuals are allowed to sell short their shares, then trade occurs until the distribution of shares is such that the voting outcome supports the CEE. This result is close to the Coase Theorem, in the sense that the economy trades itself to efficiency.

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<sup>6</sup>Competitive Economics Equilibrium and it is the efficient allocation

If individuals are not allowed to sell short their shares then we showed that the equilibrium is such that all shareholders agree on the production decision, but it typically involves underproduction relative to the CEE. They concluded that it is not market power itself that causes underproduction, but the inability to perfectly trade the rights (i.e., shares) in the economy.

Vickers [1985] addressed the issue of strategic delegation in terms of a framework borrowed from the literature on incentive compatibility. This enables one to see in what sense delegation is almost always advantageous; and a relationship between delegation and Stackelberg leadership becomes clear. These claims are illustrated by examining delegation in the context of the familiar model of Cournot oligopoly. They also suggested that the separation of the ownership and control of a firm may be a good thing for the owners, because non-profit-maximising managers may earn higher profits than profit-maximisers. In addition, this affects the validity of 'natural selection' arguments to justify the hypothesis that firms are (as if) profit-maximisers: if profit-maximisers do not earn maximum profits then such arguments fail. Furthermore, strategic delegation may influence the design of managerial incentive schemes, perhaps helping to explain why they are sometimes based on relative, rather than absolute, performance. Lastly, vertical arrangements - such as those between a manufacturer and distributor, can be viewed within the perspective of strategic delegation. By not integrating his operations, the manufacturer effectively delegates some decisions to an agent with incentives different from his own. Vertical restraints imposed by the manufacturer further influence those incentives.

## 1.5 Comparative Perspectives

The key issue in corporate governance that we have mentioned above is to solve who should be involved in corporate governance, how to handle the collective decision problem, how to regulate takeovers and how the boards should be structured. None of these issues have simple solutions. Under different circumstances, we tend to have different answers. For instance, human capital-intensive firms might require a more complicated employee-involved governance

than capital-intensive project. The investment period of a certain project would also have big influence on the corporate governance manner. So there's no universally applicable optimal rules in all corporations.

Generally Speaking, there are two three corporate governance systems competing against each other around world: one is Anglo-American market base system another is long-term investment model like Germany and Japan and the third system is in France and Italy, where firms are owned and controlled by wealthy families . In different periods, commentators have different preference of systems. The 1980-1990 witnessed the booming economic increase in Japan and Germany when the long-term investor governance exceeded Anglo-American style. However, after 1990, when Japan and Germany experienced the recession period and American growth increased and enjoyed a long-lasting bull stock market, most of the commentators incline to regard the Anglo-American system a more advantageous way.

Critics of US system in 1980s like Prowse [1990] took the view that the reason for Japan and Germany's fast growth rate owed to their firm relationship with banks and other long-term debt and equity holders, which made their cost of capital low.

Porta et al. [1998] pointed out that the crash of stock market in 1990 directly caused the loss of low cost capital which in turn induced the recession.

One overwhelming criticism of Anglo-American system is its quarterly-based performance measure that makes the managers myopic to focus on the short-term performance and pay much attention on the threat of being taken over, raised by Stein [1988], Porter [1992], Shleifer and Vishny [1989].

Although the debate about which system is better never stops, most of the scholars tried to reconcile these contradictions and admit the strength of the other system. The Enron scandal and 2008 sub-prime lending crisis set off alarm about US corporate governance. Generally, Codes provide suggestions on a variety of issues like executive compensation, auditor role, non-shareholder constituencies and capital structure and anti-takeover devices. But the dominant

issue in these codes is still the board-related issues such as board membership criteria, board size, and the proportion of insider and outsider directors.

## 1.6 Empirical Evidence

Many papers focus on corporate governance, so it is not possible to include them all in a short chapter. We listed the main approaches that are introduced to resolve the collective decision problems: takeover, large investors, boards of directors, CEO incentive schemes and fiduciary duties.

### 1.6.1 Hostile Takeovers

Hostile takeover is an easy permanent approach to control a firm while avoiding the management problems. Although discussed in a lot of cases, but in reality, they are rare events. Even in 1980 when US experienced a takeover wave, the takeover rate exceeded 1.5%, but dropped afterwards immediately. Among these takeover cases, only 4% of the deals are hostile after 1990 and during the peak period of takeover, the percentage never surpassed 30%, argued by Schwert [2000].

We tend to consider that firms with poor performance would be more likely to be the target of hostile takeover, but Comment and Schwert [1995] found that although the statistic showed that the number of successful targets is less, the test didn't prove they had significant difference between the successful ones and their peers. The UK studies by Franks and Mayer [1996] also showed that there was no explicit evidence proving the pre-bid performance affected the takeovers.

If the hostile takeover is an effective one, then the value change from the pre-bid to the combined post-bid should be positive. A remarkable view made by Andrade et al. [2001] was that the US target shareholder got average 24% premia from the takeover and even higher from the hostile takeovers. Interestingly, the gain of bidder shareholders is not significant from zero.

Takeover defences could be articulated as a way to reduce the total bids and help the board

to choose the highest premia from bidders. Pre-bid defence consists of capital structure, super majority requirements, cross-shareholding, voting right restriction, enhanced voting rights, subjection of share transfer to board approval and change of control in major contracts. The most powerful one is the shareholder approval<sup>7</sup>. The outcome of takeover defences is mixed. Mikkelson et al. [1997] showed that the probability of a CEO to be replaced after takeover was high, which was conform to the entrenchment and disciplining. Small negative returns are found concerning the wealth effect. The opposite evidence was shown by Comment and Schwert [1995] that takeover defence would increase the premia. This indicated that the managerial entrenchment was dominated by bargaining effect. Mikkelson et al. [1997] found that firms with independent boards would receive 23% more premia than firms with captive boards which implied that independent boards could take more advantage of the anti-takeover devices.

The degree of deviation from the one-share-one-vote mechanism refers to the issuance of dual class stock. Shares with different voting rights usually been sold at different prices. Theoretically, the dual class premia depended on the size of dual class issuance, the inequality of power rights, the value of assets under control and the possibility a small shareholder being pivotal. The expected premia of voting shares in different countries varied a lot from 5.4% to 82%. The value is large in Italy and small in Sweden and the US but a lot of factors affecting the results are not well controlled. Hoffmann-Burchardi [2000] reported that the premia skyrocketed from 20% in middle 1998 to 54% in December 1999 in Germany by looking at the time series. In contrast, Finland experienced a drop in voting premia from 100% in the late 1980 to 5% currently. The same situation happened in other North European countries.

In balance, hostile bids are strongly related with the large premia which was still difficult to find a rational reason to explain its sources and it is hard to handle the controversial entrenchment and bargaining effects checking each other. Despite the widespread interest in hostile takeovers, there's still not much specific studies on the countries except for UK and US.

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<sup>7</sup>post-bid defences takes much longer



## 1.6.2 Large Investors

It is quite hard to make comparisons of the large shareholders' effect in different countries because they are under different system even if in the same country, there could be institutional differences.

Most of the large shareholder decisions are executed through the board of directors in that large shareholders have the power to appoint the board member and management to represent their interests. On top of that, they could block the unfavourable decisions or initial decisions by exercising their powers.

Corporate law, charters and regulations restrict the powers, but they vary a lot across different countries. Huge differences could also be observed in jurisdiction areas. Much empirical work has been done but not based on the strict theoretical analysis. The popular question they'd like to address are as follows: Does large investors improve corporate performance? Do large shareholders abuse voting power? Is there an empirical evidence between large shareholders and market liquidity?

Warshaw [1924] was the first person to test the hypothesis that risk diversification caused shareholder dispersion. The statistics in his studies showed that average shareholder numbers skyrocketed 250% from 1900 to 1923. Bolton et al. [1998] argued that the static measurement of the ownership concentration is not a perfect way to evaluate the ability of shareholders, there's a well-operated system to intervene and execute control over management to limit the managerial discretion even if the ownership is dispersed.

Demsetz [1968] began an empirical studies between market liquidity and shareholder dispersion. Benston and Hagerman [1974] joined the research by measuring the trading volumes and the shareholder numbers while keeping other variables controlled. They derived that larger numbers of shareholders and reduced the minimum trade unit would cause higher secondary market liquidity.

A lot of literature has focused on the asymmetric information problems, but quite few in the

role of liquidity in monitoring. Heflin and Shaw [2000] has showed that insider ownership reduced liquidity because they would be more likely to trade with an insider. Bank as a delegated monitoring agency is not traditional. Some empirical works has been done to do some comparisons between the companies that with banks on the board. It is obvious that the involvement of bank in board would facilitate the management of a company especially when encountering some financial crisis and economics recessions, commented by Tilly [1989]. There's another emerging concept called relationship banking which put emphasis on the business relationship between banks and clients. Ongena and Smith [2000] put forward that the function of banks in this definition is collecting information and arranging loans for the customers rather than hold an equity as shareholders or sit on the board.

### 1.6.3 Minority Shareholder

Proxy fights are very commonly used to remove corporate boards in US. Manne [1965] compared the process of corporate voting with the political ones. The average times of proxy fights is 17 and most of proxy fights are raised by minority dissidents with average share stake 9%, according to Mulherin and Poulsen [1998].

After the booming period of hostile takeovers at the end of 1990s, shareholder activism became the other way to get over the dispersed ownership. For instance, they made shareholder proposals, letter writing and some private negotiation. One argument voiced by Black [1998] was shareholder activism played an important role in proxy fights, appointing directors. On the other hand, Bhagat and Romano [2002] held the opposite opinion believing that shareholder activism just made small effect on the event that did not create huge influence on company value. The reason why fund managers involved in this is this might be correlated with their private benefits as well as future careers.

Shareholder suits, although vary a lot in different countries, could complement corporate voting and potentially substitute other governance mechanism. Most of the empirical work test

three main hypothesis: who is the beneficiary of shareholder suits; Are managers disciplined by shareholder legislation; does the shareholder litigation stimulate or check other monitoring?

Romano [1991] did the most comprehensive research of US during the period 1960-1987. Her result was that shareholder suits only benefited the lawsuit but not the shareholders. Only a little evidence showed the disciplined function of litigation. Executive turnover in sued firm is higher but the managers rarely faced any financial losses. On the other hand, suits play a role both help and hinder other types of monitoring.

#### **1.6.4 Executive Compensation**

Executive compensation in the US enjoyed explosive increase since 1970 and reached a peak in 2000 due to the bulk of option plans. Statistics demonstrate that the US CEOs' compensation package alone is higher than total package in most of the Europe countries. The intention of the executive compensation is to offer some incentives that align the interest of managers with those of shareholders. The incentives could be categorised as implicit (dismissal of executives which would affect future career) and explicit one (sensitivity of pay). Holmstrom and Kaplan [2001] justified that the high market valuation in 1990s was the driver of incentive pay.

The consensus views in early 1990 showed that the sensitivity of pay was too low to reward the good performance of manager or to incur losses after poor performance. (See Baker et al. [1988], Jensen and Murphy [1990]). Hall and Liebman [1998] proposed in their paper that the sensitivity of equity-based compensation with respect to firm value is 50 times higher than that of the salary and bonus components. They also pointed out that even the median performance CEOs could have annualised 11.5% increase in mean wealth.

Agency theory decided that the incentive pay should depend on the comparative performance rather than the absolute performance. Early works of Gibbons and Murphy [1990] showed that change in cash compensation was negatively related to market performance but positively related to firm performance. Arye Bebchuk and Fried [2003] also put forward that the optimal price

of option could be determined by agency theory. Besides, Bertrand and Mullainathan [2001] proposed that boards protected by state anti-takeover laws would enjoy more incentive pay for less possibility of being taken over.

Implicit incentives are usually in the form of executive dismissal or post-retirement board service. Brickley et al. [1999] discovered that in the US, CEO career continued after retirement. 75% of them would hold directorship. 49.5% of them would stay on their boards and 18% of the case are chairmen. Most of the implicit incentives are written in the CEO contracts and must be disclosed.

### 1.6.5 Multiple Constituencies and Stakeholders

Creditors, employees, suppliers and clients are the four main constituencies.

The main theory to justify the rationale of sharing control between managers, shareholders and debt holders is their different role in restructuring. Kaplan and Strömberg [2000] found that financial constituencies have control and liquidation rights that are contingent on performance and control shifts between constituencies depend on the corporate performance.

The research on employee involvement mainly focused on two questions: does employee employment reduce shareholder value and is employee involvement efficient if contracts are incomplete. Does the co-determination have positive effect on shareholder wealth and company performance? Gerum and Wagner [1998] argued that most supervisory boards subject to the quasi-parity regime<sup>8</sup> did not have to be consulted on important decisions. Gorton and Schmid [2000] found that co-determination reduced the market-to-book value and ROE<sup>9</sup>. Co-determination intensity and its incidence correlate, with the factors that influence stock price and accounting performance, especially the company size and sector are difficult to control and requires further work.

Shareholders are the owners of the firm and managers took fiduciary duties for them rather

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<sup>8</sup>More than 200 employees

<sup>9</sup>Return on Equity

than the stakeholders. Although it is widely accepted by UK, US and other Anglo-Saxon countries that corporate governance is a way to separate ownership and control from an agency perspective, beyond these cases firms' objective functions deviate far from shareholder maximisation. Zingales [2000] and Jensen [2001] believed that stakeholders were the valuable intangible assets such as the employees in high technology companies. They looked into some most successful companies in this field such as Google and discovered that the well communications between different stakeholders would be the key of firms' competency. On the contrary, plenty of scholars view the caring for the welfare of stakeholders are the waste of social resources. Pagano and Volpin [2005] and Jensen and Meckling [1976] pointed out that managers who raise the income of employees to enhance their loyalty or make some contributions to charities to the environment would incur the adverse impacts on productivity because all the actions are based on managers preferences and personal sense of "social responsibility". Jiao [2010] measured the relationship between Tobin's Q and stakeholder welfare in which Tobin's Q could be indicated by market value divided by replace value. He found out that the stakeholder score which measures to which extent the firms meet the expectation of stakeholders was positively related to firm value: an increase of 1 stakeholder welfare score would leads to 0.587 in Tobin's Q.

# Chapter 2

## Evolution of Managers' Preferences

### *Abstract*

*It has been widely accepted that economic agents will not definitely act rational or always try to maximise their payoffs. Large amounts of empirical analysis have been done to prove the existence of dispositions in business area and professional fields. My research applies both theoretical approach and simulations to show that dispositions of managers in making decisions might lead to higher actual payoff for all the agents under an evolution process.*

## 2.1 Introduction

### 2.1.1 Background

The assumption that economic agents are rational and always try to maximise their profits is widely accepted in economic analysis. Here, rationality refers to that the agents could correctly perceive the material payoff and choose the corresponding strategies to maximise these payoffs. Those assumptions are also justified by a large amount of literature of evolution theory. Some scholars argued that the reason why profit maximisation is a reasonable assumption is because that in the long run, the market competition would force the firms to minimize the costs so as to survive the fierce competition. If not, they will be driven out of the market by more profitable rivals.

One of the impediment to develop the profit maximisation theory is its inconsistency with large amount of psychology and experimental studies that suggest individuals would pursue some personal objectives instead of maximising their actual payoffs. Most literature emphasise human being's disposition such as favour for fairness, concern for relative payoff, being altruistic or spiteful, and being overconfident about decisions. Inaccuracy of individuals' judgment about the business environment and their various abilities to make profit would influence the decisions they make, which would in turn cause the departure from the material payoff maximising. The professions that are proved to be overconfident in the literature are judges (Guthrie et al. [2001]), psychologists (Oskamp [1965]), entrepreneurs (Cooper et al. [1988]), security analysts (Bondt and Thaler [1985]), and managers (Russo and Schoemaker [1992]).

Geared up partly by the experimental and psychological evidence, voluminous literature are starting to address this with respect to evolutionary theory. Contrary to the prevalence of orthodox view of payoff maximising principle, these works point out that non-rational behaviour that deviates from the profit maximisation might survive the evolutionary pressure. A remark made by Güth and Yaari [1992] delineates the presence of concern for fairness. Fershtman

and Weiss [1998] shed light on the concern for social status. Altruism, spite and envy were addressed by Weinstein [1980], Possajennikov [2000] and Bergman et al. [2000]. They provided the justification for the existence of perception bias and found out that this disposition would be stable in particular models rather than being driven out by the rational rivals who maximise their material payoffs.

In the paper of Heifetz et al. [2007], they extended the results by focusing on some particular models of some specific payoff and bias functions and on characterising the evolutionary dynamics of the distribution of preferences. Having a disposition has two effects on a player's payoff: a direct effect through player's own decision and an indirect effect by influencing the rival's play. They proved that the convergence of the disposition is in fact generic: In almost all kinds of games, the distortion of the disposition might benefit the player to some extent. To summarise, any such bias will not die out under any payoff monotonic selection dynamics. Results based on solely evolutionary stability are static in nature. That could explain the rationality of how particular populations with behavioural bias could survive the competition given the initial arbitrary states and also remind us of the importance of establishing the dynamic models.

The setting of the paper is to assume that two individuals would operate upon their perceived profit functions but receive their payoff according to their actual payoff function. The evolutionary fitness of a particular type is based on the equilibrium payoffs in the artificial second stage 'type competition' while the actual payoff functions are given and each individual would play their equilibrium strategy. They proved that if this game is dominance solvable and under the mechanism of payoff monotonic selection dynamics, the population would still converge to a unit mass at a unique type that deviates from the rational type in most economic models. Following the results of Samuelson and Zhang [1992], they developed a relatively straightforward way to find the long run population dynamics given a game with continuum of actions.

The literature above has provided enough justification for the presence of the perception bias



among human beings. Its tentacles spread widely to the industrial organisation field as well. The underlying reasonableness are listed as follows: Firstly, the firms' decisions are predominately depending on the managers in modern industries, so we could assume that firms' choices would also be subject to the perception bias as individuals. Secondly, the ways firms compete in the oligopoly environment is similar to the game that incorporates two players. In business world, it is reasonable to assume that the firm with lower payoff due to the wrong decision of managers would be phased out and being replaced with the type with higher payoff. Since the financial crisis in 2008, more emphasis has been put on the research on the managers' behaviour. Some believed that those top professions are naturally overconfident when making investment choices, whilst others think it is the incentive packages drive the managers' bold decisions. In my paper, I will explore whether managers' dispositions will survive the competition like individuals' disposition does in society and find out how it will affect the business decision of both firms.

In next session, we will explain the general analysis of the dynamic evolution process. In session 3, several examples will be used to explain the theory and we will discuss the value of the firm under the equilibrium with bias. In session 4, a simulation will be used to illustrate the process of the selection process.

### 2.1.2 General Analysis

Heifetz et al. [2007] did general analysis of games with disposition. In their model, two players,  $i$  and  $j$ , engage in the strategic interaction. The strategy space of the two players are  $X^i = X^j \subset \mathbf{R}$ . Typical strategies are denoted  $x^i$  and  $x^j$ . They consider a symmetric game where the payoff of the two players are given by

$$\Pi^i(x^i, x^j) \equiv \Pi(x^i, x^j), \Pi^j(x^i, x^j) \equiv \Pi(x^j, x^i),$$

for a function  $\Pi : \mathbf{R}^2 \rightarrow \mathbf{R}$ . In the process of their interaction, the players' perceived payoffs are

$$U^i(x^i, x^j, \tau^i) \equiv \Pi^i(x^i, x^j) + B^i(x^i, x^j, \tau^i),$$

$$U^j(x^i, x^j, \tau^j) \equiv \Pi^j(x^i, x^j) + B^j(x^i, x^j, \tau^j),$$

where

$$B^i(x^i, x^j, \tau^i) \equiv B(x^i, x^j, \tau^i), \quad B^j(x^i, x^j, \tau^j) \equiv B(x^j, x^i, \tau^j),$$

for a function  $\mathbf{B} : \mathbf{R}^3 \rightarrow \mathbf{R}$ . The function  $\mathbf{B}^i$  and  $\mathbf{B}^j$  are the dispositions of players  $i$  and  $j$ , and  $\tau^i$  and  $\tau^j$  are the players' types. Types are drawn from the set  $\mathbf{T} = [\underline{\tau}, \bar{\tau}] \subseteq \mathbf{R}$ , where  $\underline{\tau} < 0 < \bar{\tau}$ . The players in the game would try to maximise their perceived payoff rather than actual payoff. As a normalisation, they assume that

$$B^i(x^i, x^j, 0) \equiv B^j(x^i, x^j, 0) \equiv 0$$

Let  $\Gamma = (X^i, X^j, \Pi^i, \Pi^j, B^i, B^j)$  denote the game that players  $i$  and  $j$  choose the strategies  $x^i$  and  $x^j$  respectively to maximise their perceived payoffs  $U^i$  and  $U^j$  whilst the actual payoffs are  $\Pi^i$  and  $\Pi^j$ . They listed several assumptions as below:

**Assumption A:** The game  $\Gamma$  has a unique pure strategy equilibrium  $(\hat{x}^i(\tau^i, \tau^j), \hat{x}^j(\tau^i, \tau^j))$  for each  $(\tau^i, \tau^j) \in \mathbf{T} \times \mathbf{T}$ . Besides, we add some simple conditions under which Assumption A holds below.

Because we adopted the indirect evolutionary approach, we will measure the fitness of a type through its payoff that it could achieve in equilibrium of the underlying game  $\Gamma$ . To get the result, we need to know how the equilibrium payoffs change as the type profile changes. For many games with multiple equilibria, the comparative statics of equilibrium payoffs in response changes in types  $\tau^i$  and  $\tau^j$  will differ for different equilibria. To seek the general results that may hold across a variety of problems, we therefore adopted the assumption that the underlying

game has a unique pure strategy equilibrium for each profile of types.

**Assumption A1:**  $U^i$  is  $C^2$  and differentiably strictly concave in  $x^i$ , i.e.,  $U_{ii}^i(x^i, x^j, \tau^i) < 0$  for all  $(x^i, x^j, \tau^i) \in R^2 \times T$ ; analogously for  $U^j$ .

**Assumption A2:**  $U^j$  is  $C^2$  and there exists  $\epsilon > 0$  such that  $|U_{ij}^i(x^i, x^j, \tau^i)| < (1-\epsilon) |U_{ii}^i(x^i, x^j, \tau^i)|$  for all  $(x^i, x^j, \tau^i) \in R^2 \times T$ ; analogously for  $U^j$

Assumption A1 ensures that the strategy sets  $X^i$  and  $X^j$  are convex, so the best responses are well-defined while assumption A2 ensures that the slope of each player's best response function is uniformly less than 1 in absolute value. This could guarantee the existence of Nash Equilibrium in the game given the types  $(\tau^i, \tau^j)$ ,  $(\hat{x}^i(\tau^i, \tau^j), \hat{x}^j(\tau^i, \tau^j))$  is simply defined.

Given Assumption A, we could adopt the indirect evolutionary approach. The actual payoffs of players  $i$  and  $j$  in the unique Nash equilibrium of the primitive game  $\Gamma$  are:

$$f^i(\tau^i, \tau^j) \equiv \Pi^i(\hat{x}^i(\tau^i, \tau^j), \hat{x}^j(\tau^i, \tau^j)),$$

$$f^j(\tau^i, \tau^j) \equiv \Pi^j(\hat{x}^i(\tau^i, \tau^j), \hat{x}^j(\tau^i, \tau^j))$$

Now we consider the game that both players will choose a type  $\tau^i, \tau^j \in \mathbf{T} = [\underline{\tau}, \bar{\tau}]$ .

We consider a "type game" in which each player chooses a type  $\tau^i, \tau^j \in T = [\underline{\tau}, \bar{\tau}]$ , and receive a payoff according to the fitness function  $f^i$  and  $f^j$ .

**Assumption B:** The types game  $\mathcal{T} = (T, T, f^i, f^j)$  is dominance solvable. As with Assumption A, two conditions also holds.

**Assumption B1:**  $f^i$  is  $C^2$  and differentiably strictly concave in  $\tau^i$ , i.e.,  $f_{ii}^i(\tau^i, \tau^j) < 0$  for all  $(\tau^i, \tau^j) \in T \times T$ ; analogously for  $f^j$ .

**Assumption B2:**  $|f_{ij}^i(\tau^i, \tau^j)| < |f_{ii}^i(\tau^i, \tau^j)|$  for all  $(\tau^i, \tau^j) \in T \times T$ ; analogously for  $f^j$ .

Under Assumption B1, they ensure that an interior Nash equilibrium in the types game is defined and under Assumption B2 the slope of each player's best response function in the type game is less than 1 in absolute value.

Under Assumption B1, an interior Nash equilibrium in the types game is defined implicitly by the equations:

$$f_i^i(\tau^i, \tau^j) = 0, \quad f_j^j(\tau^i, \tau^j) = 0.$$

Since the type game is symmetric, the unique Nash equilibrium in the types game is also symmetric and given by  $(\hat{\tau}, \hat{\tau})$  if  $\hat{\tau}$  is interior and is defined implicitly by the equation  $f_i^i(\hat{\tau}, \hat{\tau}) \equiv 0$ .

**Lemma 1** *Under Assumption A and Assumption B, the type game  $\mathcal{T}$  is dominance solvable. The unique strategy profile that survives iterated elimination of strictly dominated strategies is the unique symmetric Nash equilibrium  $(\hat{\tau}, \hat{\tau})$ .*

**Proof:** We appeal to Theorem 4 in Moulin [1984]. It suffices to show that:

- (1) The strategy set of each player is a one-dimensional compact interval;
- (2) The payoff function of each player is continuous, twice differentiable, and strictly concave with respect to the player's strategy;
- (3) The slope of each player's best response function is less than 1 in absolute value.

Condition (1) is satisfied in the types game because the set of possible strategies for each player is the compact interval  $T = [\underline{\tau}, \bar{\tau}]$ . Assumption B1 and B2 ensure that condition (2) and (3) are satisfied. Hence, the type game is dominance solvable and the unique outcome that survives iterated elimination of strictly dominated strategies is the unique Nash equilibrium  $(\hat{\tau}, \hat{\tau})$ .

To work out how the dispositions evolve, they suppose that there is a continuum of individuals of different types. We consider a continuous-time model in which at each point  $t \geq 0$  in time, this population is characterised by the distribution  $G_t \in \Delta(T)$ , where  $\Delta(T)$  denotes the set of Borel probability distributions over  $T$  assuming that the initial distribution  $G_0$  has full support over  $T$ . And at each instant in time, individuals are randomly matched in pairs to play the

game  $\Gamma$ . Therefore the average fitness levels of individuals of type  $\tau$  at time  $t$  is then given by

$$f(\tau, \tau') dG_t(\tau').$$

## 2.2 Application

In this section, I will try to apply the general analysis to organisations. If both parties in the agency contract act in their best interests, we have every reason to believe that the agent will not maximise the interests of principals. Principal could use some incentives to stimulate the agent or bear some monitoring costs to limit agents' aberrant behaviours. Most existing literature focus on normative aspects of agency problem by investigating how to structure the contract between principal and agents. Jensen and Meckling (1976) assumed that all the normative issues solved and given that only stocks and bonds could be issued as claim to see which contractual equilibrium would reach. A reduction of owner manager's share of equity, the wealth costs to the owner of obtaining additional cash in equity market would rise. For a claim on the firm  $(1 - a)$ , the outsider will pay only  $(1 - a)$  times the value he expects the firm to have given the induced change in the behaviour of the owner-manager. They combine the knowledge of theory of agency, the theory of property rights and the theory of finance to develop the theory of ownership structure of the firm, trying to reveal the relationship between the agency cost and the separation and control issue. Besides, they also create a brand-new explanation of the factors influencing the issuance of debts and equity.

In our paper, we have to omit the principal-agent problem in corporate governance and assume that managers all behave without considering their own private benefits. A voluminous amount of literature has addressed the problem of how the disposition of managers would affect their behaviours. In this paper, we are going to analyse how the disposition of managers, which could be pessimism, optimism, risk loving, envy or altruism would affect the degree to which the managers would behave deviating from rational expectation.

## 2.2.1 Perception Bias

### 2.2.1.1 Overconfidence

The prevalence of optimism and overconfidence implies that individuals who are optimistic and making the irrational decision under economic environment might grow in number at the expense of other types including those people with accurate perceptions and eventually take over the entire population.

Suppose under oligopoly setting, there are two firms competing and interacting with each other. Their managers could decide which policy to take by setting the price or quantity. Under monotonic payoff selection mechanism, the firm with lower actual payoff will be driven out by its rival and then a new firm that has a manager with random disposition would come in and be matched with the incumbent firm.

Now we first consider a one period duopoly Bertrand model with two firms  $i$  and  $j$  and they compete in price. The prices charged by each firm are  $p_i$  and  $p_j$ . Firm  $i$  faces a demand curve

$$D_i = \alpha - bp_i + dp_j \text{ for } i \neq j,$$

$b$  and  $d$  depend on consumers' preferences over the good sold by firm  $i$  relative to the good that are sold by firm  $j$  where  $b \geq d > 0$ . So firm  $i$ 's demand is at least as sensitive to its own price as it is to the price charged by its competitor, and the goods they produce are strategic complements. Each firm would choose the price to maximise its profits given by

$$\text{Max } (p_i - c)(\alpha - bp_i + dp_j), \tag{2.1}$$

where  $c$  presents the marginal cost of producing one unit of output and is same for both firms.

$$\pi_i(p_i, p_j) = (\alpha - bp_i + dp_j)(p_i - c), \tag{2.2}$$

$$\pi_j(p_i, p_j) = (\alpha - bp_j + dp_i)(p_j - c) \quad (2.3)$$

denote the profit function of each firm where  $\alpha > 0$ . When  $d > 0$ , the firm imposes positive externality on one another and they are strategic complements. The first order condition for profit maximisation gives

$$(\alpha - bp_i + dp_j) - (p_i - c)b = 0,$$

which yields the reaction function:

$$p_i = \frac{\alpha + bc + dp_j}{2b}.$$

Given the symmetric expression for firm  $j$ , we could solve the equilibrium price  $\hat{p}$  under the circumstance of no perception bias or disposition against each other:

$$\tilde{p} = \frac{\alpha + bc}{2b - d}.$$

However the policy makers of the firms may differ in the way they perceive the objective functions, although their actual payoff functions are symmetric. Now we could enrich the model by introducing the disposition parameter. Specifically, firm  $i$  perceives the value of  $\alpha$  to be  $\alpha_i = \alpha + \tau_i$   $\tau_i \in T = [\underline{\tau}, \bar{\tau}]$ , when the expected value of the intercept of demand function is  $\alpha$ . Analogously for firm  $j$ . The pessimistic type of managers would try to be less optimistic about the market demand that makes  $\tau < 0$ , while the confident managers tend to overestimate the the intercept value of  $\alpha$  which means  $\tau > 0$ .

Here the firms' managers' disposition are  $B^i = \tau_i(p_i - c)$  and  $B^j = \tau_j(p_j - c)$ .

The perceived payoff of each firm could be written as

$$U_i = (p_i, p_j, \tau_i) = (\alpha - bp_i + dp_j)(p_i - c) + \tau_i(p_i - c), \quad (2.4)$$

$$U_j = (p_i, p_j, \tau_j) = (\alpha - bp_j + dp_i)(p_j - c) + \tau_j(p_j - c). \quad (2.5)$$

We assume  $-\alpha \leq \underline{\tau} \leq 0 < \bar{\tau}$  and  $\frac{-ad^2 - cd^3 + bcd^2}{-4b^2 + 2bd + d^2} \in T$  to make sure that  $\alpha_i$  and  $\alpha_j$  are larger than 0.

Therefore  $\tau$  stands for how deviated the managers behaviours are from the common rational prior from the Bayesian information processing.

We could easily find out the unique Nash equilibrium of this price competition from above perceived utility functions:

$$\begin{aligned} \hat{p}_i(\tau_i, \tau_j) &= \frac{2\alpha b + \alpha d + 2b\tau_i + d\tau_j + 2b^2c + bcd}{4b^2 - d^2} \\ &= \frac{\alpha + bc}{2b - d} + \frac{2b\tau_i + d\tau_j}{4b^2 - d^2}, \end{aligned} \quad (2.6)$$

$$\begin{aligned} \hat{p}_j(\tau^i, \tau^j) &= \frac{2\alpha b + \alpha d + 2b\tau_j + d\tau_i + 2b^2c + bcd}{4b^2 - d^2} \\ &= \frac{\alpha + bc}{2b - d} + \frac{2b\tau_j + d\tau_i}{4b^2 - d^2}, \end{aligned} \quad (2.7)$$

The second order condition of perceived payoff function  $F''(p) = -2b$  which guarantees the existence of profit maximisation point  $\hat{p}_j(\tau^i, \tau^j)$  and  $\hat{p}_i(\tau_i, \tau_j)$ .

If we substitute  $p_i$  and  $p_j$  into the utility function (1), it yields the resulting fitness functions:

$$f_i(\tau_i, \tau_j) \equiv \pi_i(p_i(\tau_i, \tau_j), p_j(\tau_i, \tau_j)), \quad (2.8)$$

$$f_j(\tau_i, \tau_j) \equiv \pi_j(p_i(\tau_i, \tau_j), p_j(\tau_i, \tau_j)). \quad (2.9)$$

Take the first derivative of the fitness function regarding  $\tau_i$  and  $\tau_j$  and make it equal to 0, we got

$$\tau_i = \frac{-(\alpha d^3 + cd^4 + d^3\tau_j - 2b^2cd^2 + 2abd^2 + bcd^3)}{(-8b^3 + 4bd^2)}, \quad (2.10)$$

$$\tau_j = \frac{-(\alpha d^3 + cd^4 + d^3\tau_i - 2b^2cd^2 + 2abd^2 + bcd^3)}{(-8b^3 + 4bd^2)}. \quad (2.11)$$



To satisfy the second order condition, it requires  $-d^3 < -8b^3 + 4bd^2 < 0$ .

In unique Nash equilibrium, the perception bias that will survive the evolution process will be:

$$\tau' = \tau_i = \tau_j = \frac{-d^2(\alpha + cd - bc)}{-4b^2 + 2bd + d^2} \quad (2.12)$$

**Proposition 1** *Consider the competition under oligopoly model described above, and the managers of both firms would have random dispositions  $\tau$ , suppose that  $\tau' = \frac{-\alpha d^2 - cd^3 + bcd^2}{-4b^2 + 2bd + d^2} \in T$  and  $-d^3 < -8b^3 + 4bd^2 < 0$ . For any initial distribution of types with full support  $T$ , the distribution of types of managers converges in distribution to a unit mass  $\tau'$  under any regular payoff monotonic selection dynamics.*

This proposition shows that the dispositions of managers would evolve to  $\frac{-\alpha d^2 - cd^3 + bcd^2}{-4b^2 + 2bd + d^2}$ , notice that this type is extremely positive if  $c = 0$  and is increasing in  $c$ . On top of that, if  $c \neq 0$ , then we could rewrite the expression  $\frac{d^2(-\alpha - cd + bc)}{-4b^2 + 2bd + d^2}$ . Since  $b > d$ , we could guarantee  $-4b^2 + 2bd + d^2$  is negative. The value of  $d^2(-\alpha - cd + bc)$  would depend on the the difference between  $b$  and  $d$  along with  $\alpha$  and  $c$ . The big difference between  $b$  and  $d$  and large  $c$  would make it more likely to be positive. While on the other hand, the large  $\alpha$  and small  $c$  would make the expression negative.

The underlying intuition behind this is straightforward. Type  $\tau'$  will eventually prevail in the management level at the expense of other type including the rational type when  $\tau = 0$ . Other types will be extinct under any regular payoff-monotonic selection dynamics. Since  $d > 0$ , the actions are strategic complements, so the aggressive behaviour of an manager would induce their rival to play aggressively as well.

With the increase of marginal cost, the equilibrium will shift upwards which implies the managers would play more aggressively. Similarly, we could analyse how  $(b - d)$  and  $\alpha$  influence  $\tau'$ . If consumers are much less sensitive about the price of its alternative, then the managers will play softly and reduce the price they charge. In the meantime, they will evolve to be less

optimistic in general.

Analogously, big actual intercept of the demand function would make the managers to act fiercely and play aggressively, which in turn will raise the price. However, since the price one manager decided to charge imposes positive externality to another, the aggressive behaviour of the other firm would benefit the firm itself in this model. Being optimistic is costly because he is no longer playing the best response strategy. Hence being moderate overconfident is better than being wildly overconfident when facing managers with other perception bias. This is also consistent with other experiment and psychological literature.

Psychological studies have shown that most people are overconfident about their own relative abilities, and unreasonably optimistic about their futures. (Weinstein [1980]; Taylor and Brown [1988]). When assessing their position in a distribution of peers on almost any positive trait-like driving ability (Svenson [1981]), income prospects, or longevity, a vast majority of people say they are above the average, although of course, only half can be (if the trait is symmetrically distributed).

This chapter explores whether optimistic biases could plausibly and predictably influence economic behaviour in one's entry into competitive games or markets. Many empirical studies show that most new businesses fail within a few years. For example, using plant-level data from the U.S. Census of Manufacturers spanning 1963 -1982, Dunne et al. [1988] estimated that 61.5 percent of all entrants exited within five years and 79.6 percent exited within ten years. Most of these exits are failures.

In the experiments, the success of entering subjects depends on their relative skill (compared to other entrants). Most subjects who enter think the total profit earned by all entrants will be negative, but their own profit will be positive.

Proposition 1 goes against the prevalence of economic cornerstone of profit maximisation rule, but offers the justification for the broad existence of perception bias.

### 2.2.1.2 Risk Awareness

We discussed the optimism of managers in terms of their views towards the demand function of the good their firms produce in previous session. Another important part of perception bias is towards the slope of the demand function.

Firm  $i$ 's demand function is

$$q_i = a - bp_i + dp_j,$$

where  $d$  represents how sensitive are the demand of product  $i$  to the change of market price of this good. The manager of the firm  $i$  may perceive this slope  $b$  with bias. Specifically, the manager of firm  $i$  would perceive the value of  $b$  to be  $b_i = b + \tau_i$  and  $\tau_i \in [\underline{\tau}, \bar{\tau}]$ . The larger slope indicates the higher risk towards firm  $i$  as the slight change in its price might cause dramatic demand change. The positive value of  $\tau_i$  means the manager tries to overestimate the risk and might act softer in the competition and negative value of  $\tau_i$  means that the manager might underestimate the risk and will take more aggressive step in the competition. The perceived payoff of each firm is written as:

$$U_i(p_i, p_j, \tau_i) = [a - (b + \tau_i)p_i + dp_j](p_i - c), \quad (2.13)$$

$$U_j(p_i, p_j, \tau_j) = [a - (b + \tau_j)p_j + dp_i](p_j - c), \quad (2.14)$$

the best response functions of both firms given that  $\tau_i, \tau_j$  are known are:

$$p_i(p_j) = \frac{a + dp_j + c(b + \tau^i)}{2(b + \tau^i)}, \quad (2.15)$$

$$p_j(p_i) = \frac{a + dp_i + c(b + \tau^j)}{2(b + \tau^j)}. \quad (2.16)$$

We could find out the unique Nash equilibrium for both firms as follow:

$$\hat{p}_i(\tau_i, \tau_j) = \frac{2a(b + \tau_j) + d[a + c(b + \tau_j)] + 2c(b + \tau_j)(b + \tau_i)}{4(b + \tau_j)(b + \tau_i) - d^2}, \quad (2.17)$$

$$\hat{p}_j(\tau_i, \tau_j) = \frac{2a(b + \tau_i) + d[a + c(b + \tau_i)] + 2c(b + \tau_i)(b + \tau_j)}{4(b + \tau_i)(b + \tau_j) - d^2}. \quad (2.18)$$

If the managers act according to their perceived payoff functions, and the firm with lower actual payoff is eliminated, we could find the dominance solvable strategy of the bias towards risk.

Substitute  $p_i$  and  $p_j$  in equation 2.1 with equation 2.17 and 2.18 and the fitness function is again the function of  $\tau_i$  and  $\tau_j$ .

In equilibrium,

$$\tau' = \tau_i = \tau_j = -b - \frac{d}{2}.$$

**Proposition 2** *Consider the competition under oligopoly model described above, and the managers of both firms would have random bias  $\tau$  towards the slope  $b$  of demand function, suppose that  $\tau' = -b - \frac{d}{2} \in T$ . For any initial distribution of types with full support  $T$ , the distribution of types of managers converges in distribution to a unit mass  $\tau'$  under any regular payoff-monotonic selection dynamics.*

Proposition 2 points out that the bias towards the slope will not be eliminated through the selection process. Instead, the striking fact we discovered is that the bias will converge to a negative value. It indicated that managers' tend to underestimate the risk and this bias would survive the selection process. The more interesting fact is that even if the price is negatively correlated to the demand, we found that the bias that survives the selection process will lead to overall positive impact of price. It implies that the managers that survive the competition would be the ones being optimistic about the demand of market.

### 2.2.2 Interdependence

In this section, we would like to incorporate managers' dispositions towards their rivals in the oligopoly game. Having the same setting as above and the perceived payoff of the firms will be weighted average of its own payoff and its rival's payoff. This could be due to factors like altruism or spite in a rat race. Spite is a common case in oligopoly model when one firm tries to squeeze his rival out of the market aiming to achieve the monopoly profit.

Managers' perceived payoff would consist of two parts: actual payoffs and negative reality from his rival since the manager would be willing to see his rival to lose profit than make profit. On the other hand, there might be some cases the manager will get positive externality from the rival's gain. For example, The manager might get positive payoff from the rival's gain if he holds some rival's share. Also, when a new product first enters the market, their peer that produces the same kind of product might get positive payoff if their rival gets good profit since it implies a good reputation was built for this product. <sup>1</sup>

The perceived payoff of the firm  $i$  and  $j$  are given by

$$U_i(p_i, p_j) = (\alpha - bp_i + dp_j)(p_i - c) + \tau_i(\alpha - bp_j + dp_i)(p_j - c), \quad (2.19)$$

$$U_j(p_i, p_j) = (\alpha - bp_j + dp_i)(p_j - c) + \tau_j(\alpha - bp_i + dp_j)(p_i - c). \quad (2.20)$$

The first term represents its actual payoff, while the second term represents the perceived payoff from its rival's actual payoff. If  $\tau > 0$ , this means this firm would like to set a positive weight to its rival's actual payoff, and if  $\tau < 0$  it means this firm would resent its competitor's payoff.

Take the first derivative of the perceived payoff function yields the reaction function:

$$p_i = \frac{a + bc + dp_j - d\tau_i(c - p_j)}{2b}, \quad (2.21)$$

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<sup>1</sup>When Iphone first enters Chinese market, it boosts the total market of smartphones. Most of the smart phone manufacturers enjoyed more than 50% annual growth in profit from 2011 to 2015. Similarly, Volkswagen first signed a 25 year contract to make passenger cars in Shanghai in 1983. This built a very good image of German manufacturer and cleared the way for other major German auto manufacturers to enter Chinese market.

$$p_j = \frac{\alpha + bc + dp_i - d\tau_j(c - p_i)}{2b}. \quad (2.22)$$

In equilibrium, the price set by each firm are:

$$\begin{aligned} p_i &= \frac{-(2\alpha b + \alpha d + 2b^2c + bcd + \alpha d\tau_i - cd^2\tau_j - cd^2\tau_i\tau_j - bcd\tau_i)}{d^2\tau_i + d^2\tau_j - 4b^2 + d^2 + d^2\tau_i\tau_j} \\ &= \frac{(\alpha + bc)(2b + d + d\tau_i) - cd^2(\tau_i + \tau_j)}{d^2 - 4b^2 + d^2(\tau_i + \tau_j + \tau_i\tau_j)}, \end{aligned} \quad (2.23)$$

$$\begin{aligned} p_j &= \frac{-(2\alpha b + \alpha d + 2b^2c + bcd + \alpha d\tau_j - cd^2\tau_i - cd^2\tau_i\tau_j - bcd\tau_j)}{d^2\tau_j + d^2\tau_i - 4b^2 + d^2 + d^2\tau_i\tau_j} \\ &= \frac{(\alpha + bc)(2b + d + d\tau_j) - cd^2(\tau_i + \tau_j)}{d^2 - 4b^2 + d^2(\tau_i + \tau_j + \tau_i\tau_j)} \end{aligned} \quad (2.24)$$

Replace them into the actual payoff function and in the second period dynamic selection process

$$f_i(\tau_i, \tau_j) \equiv \pi^i(p_i(\tau_i, \tau_j), p_j(\tau_i, \tau_j)), \quad (2.25)$$

$$f_j(\tau_i, \tau_j) \equiv \pi^j(p_j(\tau_i, \tau_j), p_i(\tau_i, \tau_j)) \quad (2.26)$$

Take the first order condition of the fitness function we could find out the equilibrium value of  $\tau_i$  and  $\tau_j$

$$\frac{\partial f_i(\tau_i, \tau_j)}{\partial \tau_i} = 0$$

$$\frac{\partial f_i(\tau_i, \tau_j)}{\partial \tau_i} = 0$$

$$\begin{aligned} \tau_i &= \frac{2bd + d^2\tau_j + d^2 + 2bd\tau_j}{2bd - d^2\tau_j + 4b^2 - d^2 + 2bd\tau_j} \\ &= \frac{(2bd + d^2)(1 + \tau_j)}{(2bd - d^2)(1 + \tau_j) + 4b^2}, \end{aligned} \quad (2.27)$$

$$\begin{aligned} \tau_j &= \frac{2bd + d^2\tau_i + d^2 + 2bd\tau_i}{2bd - d^2\tau_i + 4b^2 - d^2 + 2bd\tau_i} \\ &= \frac{(2bd + d^2)(1 + \tau_i)}{(2bd - d^2)(1 + \tau_i) + 4b^2} \end{aligned} \quad (2.28)$$

By Theorem 1 we know that this game is dominance solvable:

$$\tau' = \tau^i = \tau^j = \frac{d}{(2b-d)}$$

**Proposition 3** *Consider the game described above with  $T = [-1, 1]$ . For any initial distribution of types with full support of  $T$ , the distribution of types of managers under duopoly competition model would converge to  $\frac{d}{(2b-d)}$  under any regular payoff-monotonic selection dynamics.*

Proposition 3 shows that given  $d > 0$ , positive externalities are imposed on one another, over time the interdependence level of managers would converge to  $\frac{d}{(2b-d)}$  at a moderate level of altruism. This counter intuitive result shows that the managers will survive the competition are not the ones that provoke vicious competition. The disposition of altruism stays in management and explains the collusion between managers in big firms to ensure they get better welfare.

## 2.3 Firm Value

So far we have already discussed the progress of how the dispositions of managers would change in a duopoly model given that both the agents would play Nash equilibrium according to their perceived payoff functions. What interests us is whether the managers' disposition will lead to the increase of the firm's value for sure. Is it for sure that the firm value would be lower than the situation that no dispositions are imposed to the perceived payoff function?

### 2.3.1 Firm Value Without Bias

To make it simpler, we still assume that the firm value is the profit they made. Therefore the equilibrium price is  $\tilde{p} = \frac{\alpha+bc}{2b-d}$ , insert the equilibrium price into the profit function equation 2.1, we could get the firm value in standard Bertrand model:

$$FV = \frac{b(a-bc+cd)^2}{(2b-d)^2} \tag{2.29}$$

### 2.3.2 Firm Value With Overconfidence

Similarly, to calculate the firm value when it reaches the Nash equilibrium given their biased perceived payoff functions, we just need to substitute the equilibrium price as function of  $\tau$  from equation 2.10 and 2.11 in equation 2.1 to find out the firm value:

$$FV_{overconfidence} = \frac{2b(2b^2 - d^2)(a - bc + cd)^2}{(-4b^2 + 2bd + d^2)^2} \quad (2.30)$$

### 2.3.3 Firm Value with Interdependence

Analogously, under the circumstance of interdependence, the firm value in Nash equilibrium is:

$$FV_I = \frac{(4b^2 - d^2)(a - bc + cd)^2}{16b^2(b - d)}$$

### 2.3.4 Comparative Analysis

If we compare the firm value under other circumstances,

$$L_1 = \frac{FV}{FV_{overconfidence}} = \frac{d^4 + 4bd^3 - 4b^2d^2 - 16b^3d + 16b^4}{2d^4 - 8bd^3 + 4b^2d^2 + 16b^3d - 16b^4}$$

And to make the situation simple we set  $b = 1$ ,

$$L_1 = \frac{d^4 + 4d^3 - 4d^2 - 16d + 16}{2d^4 - 8d^3 + 4d^2 + 16d - 16}$$

Set the range of value of  $d$  from  $(0, 1)$ , we discovered that the ratio of  $L_1$  is between  $(0.5, 1)$  and with the increase of  $d$ ,  $L_1$  will drop from 1 to 0.5. Overall the firm value under equilibrium with perception bias would be larger than the firm value without any bias. That proves that perception bias would not necessarily lead to the loss of the profit.

Then we consider the comparison between no-bias firm and interdependence firm:



$$L_2 = \frac{FV}{FV_{pI}} = \frac{16b^3(b-d)}{(2b-d)^2(4b^2-d^2)},$$

Again we set  $b = 1$ ,

$$L_2 = \frac{16(1-d)}{(2-d)^2(4-d^2)}.$$

In this situation, with the increase of  $d$ , which implies the higher sensitivity of the consumer demand to the competitor's price would lower the value of  $L_2$ , and it will drop from 1 to 0 when  $d$  increase from 0 to 1. It implies that when the consumer's choice is not relevant to the rival's price, the firm would achieve the same amount of profit as the firm under normal Bertrand model. However, when the value of  $b$  and  $d$  gets closer, which indicates the higher substitutability, the firms that assigns positive weight to the profit of other firm would achieve higher profit. This also explains why some this perception bias could survive the cruel business competition and also in the relatively friendly and altruistic business environment the economy might be mainstream in some countries.

## 2.4 Simulation of Other Evolution Process

As we discussed in the previous session, the process of evolution dynamics is to assume that the firms with higher average fitness will have higher growth rate compared to the population with lower average fitness and it will lead to a unique Nash equilibrium.

However, in business environment, one firm will be driven out of the market if they have lower payoff. I wonder when the elimination is based on individual firm, would it lead to result?

To model the process of selection process, we could replace the parameter with the real numbers and run this competition in a simulation and see whether the results would be consistent with the result derived from population dynamics we just discussed.

Figure 1 shows when two firms with different levels of confidence compete with each other by conducting the best reaction function derived from their perceived payoff. Then we compare

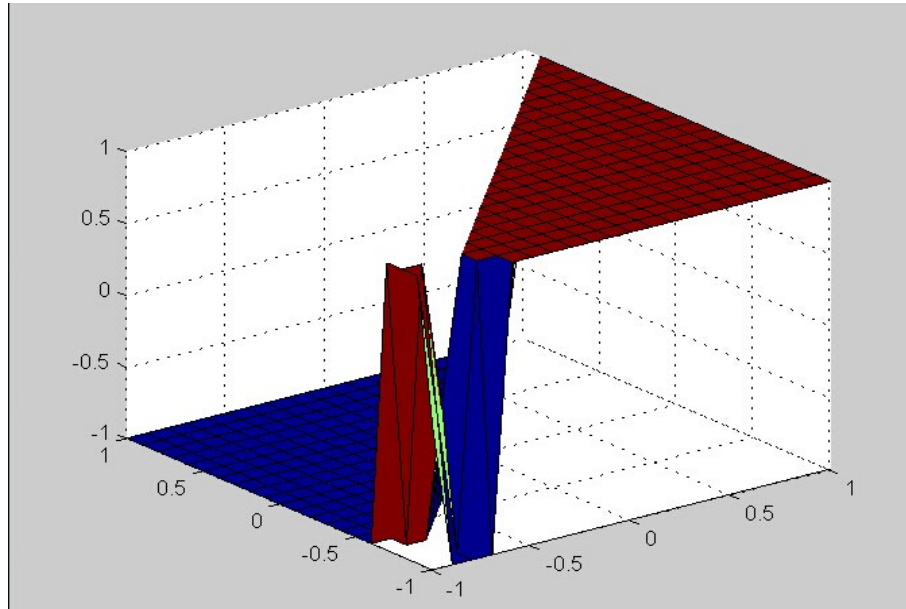


Figure 2.1: Competition Result

their actual payoffs and get the one with lower payoff to be phased out. 1 in the graph means firm  $i$  survives and  $-1$  means firm  $j$  survives.

To make the evolution process more accurate, we set a large number of firms ( $n$ ) in this simulation, in each stage, every manager with a random overconfidence level  $\tau$  from  $[-1, 1]$  will be matched with another one randomly, and they will compete in price competition. They apply the strategies according to their perceived payoffs. The one with higher actual payoff will survive. In the next period, we will create another  $n$  firms and the expected value of their dispositions will be no longer 0. Instead, it will become the average dispositions of the managers that won in previous stage. The evolution process like this will happen  $t$  times, and we will be find out which disposition will dominate the population. The table below lists the value of parameter in the simulation, and the code could be found in Appendix.

$\alpha$	b	c	d	n	t
2	0.8	0.3	0.5	$2^{10}$	$2^5$

Under this setting we found the average disposition of the survivors is  $\hat{\tau}_s = -0.8182$ , while

according to our previous theory, the value of  $\frac{-ad^2 - cd^3 + bcd^2}{-4b^2 + 2bd + d^2}$  is  $\hat{\tau}_t = 0.447$  when they have perception bias. Which factors leads to the big difference in this simulation and the theory? If we look into why the type  $\hat{\tau}_s$  would prevail in the population, surprisingly, type  $\hat{\tau}_s$  will win the game over all other types as is shown in Figure 2.2. Green line is the profit earned by a manager with  $\hat{\tau}_s$  when competing with other managers with different dispositions ranging from  $[-1, 1]$ . Red line indicates the other firm's actual profit facing type  $\hat{\tau}_s$  with the changing dispositions. The interesting fact is that for the other firm that faces competition with type  $\hat{\tau}_s$ , the best strategy he could choose is around  $\hat{\tau}_t$ , but it will still be eliminated when facing type  $\hat{\tau}_s$ .

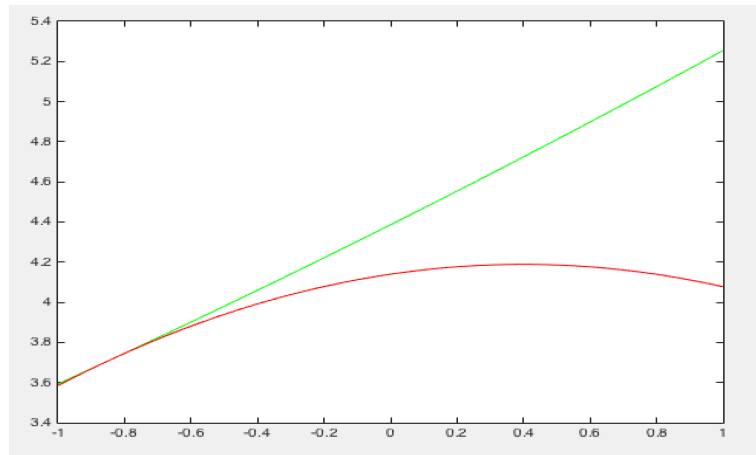


Figure 2.2: Competition between  $\hat{\tau}_s$  and Other Types

Similarly, although type  $\hat{\tau}_t$  will be the unique Nash equilibrium under payoff monotonic selection process, it will not always win the two-firm competition as is shown in Figure 2.3.

This counter intuitive result shows that when the eliminations process is based on the survival chance rather than the best response strategy, the type will converge to a negative value.

This result is also meaningful in real business environment. Negative  $\tau$  will lead to more aggressive strategy. The rat race will lower the market price and the profit. Therefore the type that survives in this elimination process will not make more profit compared to when the type converges to Nash Equilibrium strategy  $\hat{\tau}_t$ .

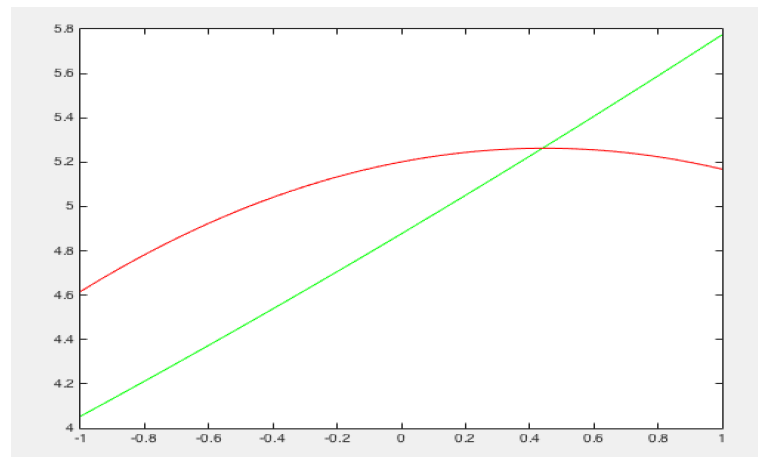


Figure 2.3: Competition between  $\hat{\tau}_t$  and Other Types

## 2.5 Conclusion

This chapter applies the evolution theory from Heifetz et al. [2007] to managers' disposition when they make business decisions. We find that in price competition, the managers that are being optimistic and altruistic will prevail in the business world. It shows that people with those dispositions are easier to get successful although some may argue that it is the competition changes their personalities. When the agents' actions are strategic complements in the underlying game, when there are positive externalities in the underlying game, and when the types and actions are complements, these will lead to the emergence of a positive type in convergence. Similarly, negative externalities, strategic substitutability of action or types will reverse the result.

Another fact we found is that the profit the firm can make will not necessarily be lower than the firms controlled by a manager without disposition.

In the part of simulation, if we consider the situation that is similar to business environment: the firm with lower payoff will be phased out in the elimination process, we find that the pessimistic type will prevail. This is due to the pessimistic type might not get highest payoff, but it is more likely to win the competition.

## Appendix 2.A Simulation Code for Perception Bias

```

a = 3;b = 0.8;d = 0.5;c = 1;n = 2^10;t=2^5
for i=1:n
    m = (rand-0.5)*2+0.44;
    T(1,i) = m;
end
for i=1:t
    j=1;
    for i = 1:n
        if mod(i,2)==1
            pricei=(2*a*b+a*d+2*b*T(1,i)+d*T(1,i+1)+2*b^2*c+b*c*d)/(4*b^2-d^2);
            pricej=(2*a*b+a*d+2*b*T(1,i+1)+d*T(1,i)+2*b^2*c+b*c*d)/(4*b^2-d^2);
            profiti=(a-b*pricei+d*pricej)*(pricei-c);
            profitj=(a-b*pricej+d*pricei)*(pricej-c);
            if profiti>=profitj
                T(1,j)= T(1,i);
            else
                T(1,j)= T(1,i+1);
            end
        end
        j=j+1;
    end
end
e=mean(T(1,1:n/2))
for i=1:n
    m=(rand-0.5)*2+e;
    T(1,i)=m;
end
end

```

# Chapter 3

## Optimal Corporate Governance and Financial

### Structure

#### *Abstract*

*No consensus has been reached over the debate whether Anglo-Saxon companies perform better than continental European companies. Although profit maximisation is the cornerstone of economic analysis, we proved that under specific situations, it might not be the case if we compare the firm value in different business environments. We also find out that there's an optimal level of corporate governance in equilibrium which is consistent with the law in continental Europe. It implies that firms might choose to consider the stakeholders' interests voluntarily.*

## **3.1 Introduction**

### **3.1.1 Agency Perspective of Corporate Governance**

Corporate Governance is of enormous practical importance in most Anglo-Saxon countries. Profit maximisation is the only goal of those firms and they believe that firms should operate at the interests of shareholders. Shleifer and Vishny [1997] explained that corporate governance is aimed at dealing with how to make suppliers of finance to get their investment back. The law also requires that firms should put shareholders' interest. And most existing literature are focusing on the agency problem and the cause of the problem is the separation of ownership and control. How could finance suppliers assure that the managers will not steal the capital or invest it into bad projects and how could they provide them incentives to make them exert maximum effort. Some scholars take the view that corporate governance could be taken care of as the existence of competition will force the firms to minimize the cost of external funds in the long run and Alchian [1950] enlightened this in a evolutionary theoretical way.

### **3.1.2 Corporate Governance in Different Countries**

Unlike the Anglo-Saxon countries, the firms' objective function might vary differently and even deviate from maximising firms' profit. Rieckers and Spindler [2004] explained that for example in Germany, firms are required to pursue more than shareholders' interests by introducing the co-determination system in which large corporations provide equal seats for both employees and shareholders in supervisory board.

Germany is not the only country who consider stakeholders' interests. In Japan, survey by Yoshimori [1995] shows that over 97% of the managers think that it's important to consider stakeholders when they make decisions and it is regarded as one of the corporate culture in Japan as well. Most customers in Japan according to the survey say that they will be less inclined to buy the products from less responsible employers. The result is similar in Germany

and France. On the contrary, the survey shows that majority of the managers in US and UK firms will prioritize shareholders' interest. In China, the reform of Company Law in 2007 also has regulated that employees in big companies should account for at least 1/3 of the seats of supervisory board and it is recognised as a big step towards bearing more social responsibility in mind when conducting corporate governance. (Wang et al. [2006])

In Scandinavia countries like Denmark, Sweden, Luxembourg there's a one-tier employee representation boards on request elected by minimum 2 people in companies more than 35 people to incorporate stakeholders interest into consideration.

It is obvious to see that although different countries have different corporate governance system but they all try to include stakeholders into their consideration at decision making process to some extent.

### **3.1.3 Debtholder Interest**

Debt holders are the claimants to the predetermined level on the firms' income. Put it in another way, shareholders will get nothing if the debts are not paid. Who holds the debt also influences corporate governance. It depends on whether the shares are held by insiders (managers, employees) or in the hands of outsiders such as banks. The identity of shareholders, for instance whether the shares are concentrated in big shareholders or spread among many small shareholder also matters in corporate governance. Shareholders usually have the control rights of the firms but debt holders can acquire some control rights if the covenants are violated. What will happen if the financial structure changes? As a matter of fact, Modigliani and Miller [1958] and Miller and Modigliani [1961] pointed out the rather striking counterintuitively fact that under some conditions, the firm value is not related to the firm's financial structure.

Brander and Lewis [1986] consider the specific choice of financial structure under the oligopoly models. They assume that the intercept of the demand function is subject to a continuous distribution and also firms are protected by the limited liability. The result is clear in their paper:



debt created divergence of objective between the claim holders and managers which will lead to the quantity or price not optimal for profit maximisation. This is because when an oligopoly in which the financial and output follow in sequence, limited liability firm would put a leveraged firm in a more aggressive stance. Firms will have incentives to use the financial structure to influence the output and this demonstrate the new element to determine the debt-equity ratio.

### **3.1.4 Corporate Social Responsibility**

Corporate social responsibility has been mentioned more and more by large listed companies along with the surge of the money and activities involved. Such activities include corporate donation to charity, paying fair trade price or wages, being environmentally friendly etc. We argue that being stakeholder oriented is also an efficient way to improve a company's credit and image which might in turn give rise to its corporate social responsibility. According to Blumkin et al. [2014], firms taking care of stakeholders interests will send positive signalling of product quality which will give rise to an excessive level of contributions that even surpass the cost of the signal and this might be one of the approaches that could explain why in some periods, stakeholder oriented firms perform better than pure profit maximisation firms.

### **3.1.5 Empirical Works**

Although no agreement has been reached about whether the firm value could be increased by giving stakeholders more weight in corporate governance, some empirical work has provided evidence that the interest of stakeholders and shareholders could be aligned. Fauver and Fuerst [2006] proved that being stakeholder oriented can benefit the firm in some industries. They found out that firm value measured by Tobin's Q will increase as the rise of the employee presentation in Germany and France. In addition, they found that excessive stakeholder orientation would lead to the decrease of firm value when employee presentation in supervisory board exceed  $\frac{1}{3}$ .

### 3.1.6 Related Literature

My paper is related to a number of strands of literature. Allen et al. [2007] showed the case in a dynamic two period duopoly model and they assume that considering stakeholder oriented firms will take into account employees' interest when they form their objective functions. They found out that this would soften the competition and will not necessarily lead to the loss of profit under the equilibrium. They also made extension to the shock of structure, managerial incentives.

Magill et al. [2011] used a production model to look into stakeholder problem by modeling uncertainty by an exogenous probability distribution over states of nature. The difference lies in firms' choice of investment would influence the distribution of future output which in turn affect the consumers and employees. When some weight assigned to employee and consumer surplus in the objective function, the firm will increase social welfare for sure.

Jensen [2001] is the steadfast supporter of profit maximisation. He used the failure examples of centrally planned socialist and communities to display those economies who wish to use the non-market forces to reallocate resource will reduce social welfare even if it advocates it will increase. Special interests group will continue to use the stakeholder theory to legitimize their positions.

Heifetz et al. [2007] shed light on the problem from the perspective of evolution theory and they proved that human disposition like perception bias, altruism will not die out in the selection progress. Instead, they will survive the competition and converge to a unit mass which could give them higher payoff in equilibrium as well. Jensen and Meckling [1976] solve the profit maximisation concerning agency issues of managers and employees.

## 3.2 Motivation

It is undoubtedly certain that stakeholders' interest should be included in the model no matter it is out of social convention or legal requirement. However, it is difficult to calculate the non-pecuniary interest so the most important task in this paper would be:

- How should the objective function be modelled when considering stakeholder oriented firms?
- How could the difference of the objective function affect the strategy in competition ?
- With the process of globalisation, what if the firms from shareholder oriented society compete with the stakeholder oriented society?
- Will the firm value of shareholder oriented firms will be higher than stakeholder oriented firms for sure?

## 3.3 Model

### 3.3.1 Shareholder Firms

#### 3.3.1.1 Simple one period model

We first analyse the corporate governance that only takes into account shareholder's payoff in a one period duopoly model.

Assume there are two firms  $i \in 1, 2$  and they provide differentiated goods and compete in prices. Each firm  $i$  faces a demand curve:

$$DM = a - bp_i + dp_j,$$

For firms  $i$  and  $j$ ,  $p_i$  and  $p_j$  are the prices charged by each firm respectively and  $b$  and  $d$  depend on consumers' preferences over the good sold by firm  $i$  relative to that sold by firm  $j$ . We assume that  $2b \geq 3d$  so that firm  $i$ 's demand is at least as sensitive to its own price as it is to the price

charged by opponent. Each firm would choose price to maximise its profit:

$$\text{Max}(p_i - c)(a - bp_i + dp_j)$$

where  $c$  represents the marginal cost of producing one unit of output and same for both firms. The FOC for the profit maximisation gives:

$$(a - bp_i + dp_j) - (p_i - c)b = 0, \quad (3.1)$$

It yields the reaction function :

$$p_i = \frac{a + bc + dp_j}{2b}.$$

Since the the situation will be similar to the other firm, the equilibrium will be symmetric. We could solve the equilibrium:

$$\hat{p}_s = \frac{a + bc}{2b - d}.$$

We assume that  $a - c(b - d) > 0$  so that  $\hat{p} > 0$ . Therefore in equilibrium the profits are positive.

### 3.3.1.2 Two Period Model Under Uncertainty

We could now introduce a similar second period to enrich our model. In the two stage model, both firms' costs are subject to a shock  $\hat{\epsilon}$  which is uniformly distributed from  $(-\epsilon, \epsilon)$ .

We also assume that both firms have debt  $D$ , and the return rate for the debt  $r$ . To make it simpler, we assume the shocks that affect the two companies are negatively correlated, so only one firm survive the first period. If the firm survives the first period, it will have  $\pi_2$  monopoly profit in the second period and be able to pay the debt as well as the interest to the debt holder. On the other hand, we also assume that if the company doesn't survive, it will make no profit and will fail to pay the debt to the debt holder. This is for easier analysis because we would obtain the same result if we assume they can claim the residual assets. This would just complicate the calculation. We assume that  $\pi_2$  is larger than  $2bc\epsilon$  for the easier analysis in the future.

For the firms that only maximise shareholder's profit, they will choose the optimal price and maximise the total profit.:

$$\text{Max } E[\pi_1] + Pr(\tilde{\epsilon} \leq p_i - c)[\pi_2 - D](1 + r),$$

$$\text{Max } (p_i - c)(a - bp_i + dp_j) + Pr(\tilde{\epsilon} \leq p_i - c)[(\pi_2 - D)(1 + r)].$$

The first term in the model represents the expected payoff in the first period and the second term represents the expected payoff in the second period which is the probability that the firm survives the first period times the payoff it will get after paying back the debt. Take the first order condition of  $p_i$ :

$$\frac{\partial V_i}{\partial p_i} = (a - bp_i + dp_j) - b(p_i - c) + \frac{\pi_2 - D(1 + r)}{2\epsilon}.$$

The marginal effect of the of the first period could be captured by the first two terms and the marginal effect of the second period profit is depending on the marginal change of its survival probability  $\frac{1}{2\epsilon}$ . Price of two goods are strategic complements as  $\frac{\partial^2 V_i}{\partial p_i \partial p_j} = d > 0$  we could find out the reaction function of  $p_i$ :

$$p_i = \frac{a + dp_j + bc + \frac{\pi_2 - D(1+r)}{2\epsilon}}{2b}$$

Analogously, we could find the reaction function for firm  $j$  as well and solve the price under symmetric equilibrium:

$$\hat{p}_2 = \frac{a + bc + \frac{\pi_2 - D(1+r)}{2\epsilon}}{2b - d}. \quad (3.2)$$

The subscript 2 indicated the equilibrium price in the two stage model and we could compare

the one period equilibrium in equation (1) and obtain that

$$\hat{p}_2 - \hat{p} = \frac{\pi_2 - D(1+r)}{(2b-d)\epsilon}.$$

The intuition for this result is simple. When the firm try to maximise the profit of both periods with debt and uncertainty, it will set a slightly higher price than price in the one period model so it could increase its probability to enter into second period, which means the existence of uncertainty will soften the competition by leading to a higher equilibrium price and a lower output.

### 3.3.2 Stakeholder Oriented Firms

After analysing profit maximising firms under this duopoly environment, we turn to focus on the stakeholder society. The difficulty in forming objective function of stakeholder oriented society lies in the measurement of its stakeholder's interests especially when it comes to the non-pecuniary benefits. In Allen et al. [2007] paper, they consider employees' interest when they form the objective function of the firm by adding a loss  $K$  which indicates employees' benefit when the firm could not survive. In this paper, when taking debt holders' interests under consideration, we could form the model under same framework. In my model, stakeholder oriented firm would try to maximise the weighted average of shareholder's interest and stakeholder's interest. In particular, we assume that the debt holders will suffer from the failure of the company without getting their debt back.

Thus we write the objective function as follows:

$$Max \lambda[(p_i - c)(a - bp_i + dp_j) + Pr(\tilde{\epsilon} \leq p_i - c)(\pi_2 - D(1+r))] + (1 - \lambda)Pr(\tilde{\epsilon} \leq p_i - c)D(1+r).$$

In this situation, we assume that the objective function of the firms that considers stakeholder's interest is to assign  $\lambda$  to the expected profit of the firm just as the shareholder oriented

firm and  $(1 - \lambda)$  to the debt holder's payoff which is the probability of the survival times the payoff debt holders will gain. This is a simple way to sketch the objective function in stakeholder capitalism as it only need to take into account whether debt holders could get their principal back.

We could find out its reaction function by taking FOC of its objective function:

$$p_i = \frac{\lambda[a + dp_j + bc + \frac{\pi_2 - D(1+r)}{2\epsilon}] + (1 - \lambda)[\frac{D(1+r)}{2\epsilon}]}{2b\lambda}.$$

Analogously, under this situation, we could find out the equilibrium by replacing  $p_i$  with  $p_j$ :

$$\hat{p}_s = \frac{\lambda(a + bc + \frac{\pi_2 - D(1+r)}{2\epsilon}) + (1 - \lambda)[\frac{D(1+r)}{2\epsilon}]}{(2b - d)\lambda}. \quad (3.3)$$

By comparing the equilibrium price under different types of firms we could find out that

$$\hat{p}_s = \hat{p}_2 + \frac{(1 - \lambda)\frac{D(1+r)}{2\epsilon}}{(2b - d)\lambda} \geq \hat{p}_2 \geq \hat{p},$$

where the subscript  $s$  denotes the equilibrium price charged by a stakeholder firm. Since  $b > d$ , and  $(1 - \lambda) > 0$  so this means concern for debt holder will serve to push the firm to set a higher price and to lower the quantity in order to soften the competition. The intuition again is obvious. A stakeholder firm would care more about survival in the first period than shareholder firms in that it cares about debt holders' interest on top of shareholders'. Therefore they will charge higher price to increase the possibility to survive in the first period. This will drive the result to deviate more from the efficiency benchmark under perfect competition paradigm.  $p_s$  is also increasing in the concern for  $D$ . In the words, the increase in the debt amount will lead to further increase of the price and lower output.

### 3.3.3 Global Environment

So far, we have discussed the symmetric situations where all firms are operating within the same business environment. In real world, globalisation has made competition happen under different business environment. Imagine a German car company competes with a US car company and their objective function will be different but they target at similar customers. Now we consider a framework where different types of firms compete with each other. The result will show the type of firms that behave better in globalisation and give some guidance about whether a firm should enter into the new market that have a different corporate governance culture .

We assume here firm  $i$  is a shareholder firm and firm  $j$  is a stakeholder firm. Firm  $i$  only considers profit maximisation while firm  $j$  considers both shareholders and debt holders.

In the case of two period model with a shock to cost, firm  $j$ 's reaction function is given by:

$$p_j = \frac{\lambda[a + dp_i + bc + \frac{\pi_2 - D(1+r)}{2\epsilon}] + (1 - \lambda)[\frac{D(1+r)}{2\epsilon}]}{2b\lambda}.$$

Analogously, firm  $i$ 's reaction function is given by :

$$p_i = \frac{a + dp_j + bc + \frac{\pi_2 - D(1+r)}{2\epsilon}}{2b}.$$

From two reaction functions, we could easily derive the equilibrium prices for both firms.

We found out that :

$$\widehat{p}_{Ishare} = \widehat{p}_s - \frac{Db(r+1)(\lambda-1)}{\epsilon\lambda(4b^2-d^2)}, \quad (3.4)$$

$$\widehat{p}_{Istake} = \widehat{p}_s + \frac{Dd(r+1)(\lambda-1)}{2\epsilon\lambda(4b^2-d^2)}, \quad (3.5)$$

$$\widehat{p}_{Istake} - \widehat{p}_{Ishare} = \frac{D(r+1)(1-\lambda)}{2\epsilon\lambda(2b+d)}. \quad (3.6)$$

The subscript *Istake* denotes the price charged by the stakeholder firm under international competition environment while subscript *Ishare* denotes the price charged by the shareholder



firm under international environment. Since  $0 < \lambda < 1$ , we conclude that:

$$\hat{p}_{Ishare} < \hat{p}_{Istake},$$

$$\hat{p}_{Istake} < \hat{p}_s,$$

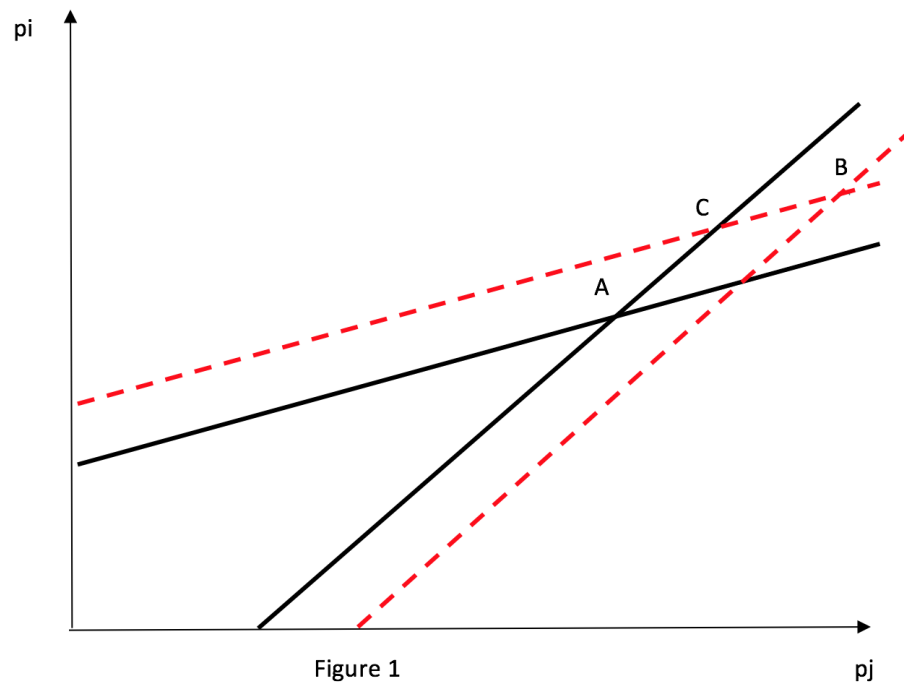
$$\hat{p}_2 < \hat{p}_{Ishare}.$$

**Proposition 1** *In a globalised business environment where a stakeholder oriented firm competes with a shareholder oriented firm in a two stage dynamic game under price competition, the equilibrium price of the stakeholder firm is higher than the shareholder oriented firm. The shareholder oriented firm still act softer than in a pure profit maximising environment and the stakeholder oriented firm act tougher than in a pure stakeholder oriented environment.*

- Under globalisation situation, if a profit maximisation company is competing with a stakeholder oriented company, the profit maximising firm will charge lower price than a stakeholder firm in price competition, the price they charge are strategic complements so the profit maximising firm can take advantage of the stakeholder firm's softer pricing strategy.
- However, both firms will still set lower price than in pure stakeholder environment as the existence of profit maximising firm speed up the competition and drag down the equilibrium price as is shown in Figure 1. The best response function of a stakeholder oriented firm is represented as the red dashed line which has larger intercept than the best response function of a shareholder oriented firm. Point *C* is the equilibrium in global environment whilst point *B* is the equilibrium in stakeholder society. This provides explanation for real world cases. Globalisation accelerates the competition among companies across the world. It leads to lower price compared to a pure stakeholder oriented environment and large consumer surplus but leaving firms exposed to higher risks under uncertainty. German auto makers have been well-renown for its high quality cars and also been known as

charging higher price than other foreign brand to match its quality. The recent scandal of Volkswagen revealed that many VW cars being sold in America had a "defeat device" in diesel engine that could detect when they are being tested. VW holds the reputation for its safety and high quality, but when it enters American market, the fiercer competition in Anglo- Saxon environment forces it to lower the price and even to cut cost on meeting the regulation abroad.

- Although the profit maximising firm will charge lower price and escalate the competition, it will still act softer than in a pure profit maximising environment as is shown at point *A* in Figure 1.
- If the board has decided to choose large  $\lambda$ , which means less emphasis on debt holders' payoff, the price difference in a global environment between the two type of firms would decrease as they act in a similar way. Similarly, the increasing amount of debt will cause the big gap of the price difference.
- The big value of  $\epsilon$  implies large uncertainty to the marginal cost and this will decrease the price difference between the two types of firms as they both need to set higher price to be ready for the high chance of negative shock to the cost.



### 3.3.4 Optimal Corporate Governance

We have found out the price charged by the stakeholder firms and shareholder firms under equilibrium if  $\lambda$  is known. In real business world, there might be regulations in some countries that stakeholders interest must be taken into account demonstrated in forms of employee representatives in supervisory board to protect stakeholders. When it comes to debt holders' interest, there's so far no legal requirement. Why do those companies choose to take care of debt holders' interests then? Is it out of building a good reputation or social norms? Is it likely that they choose to consider debt holder's interests because it will also maximise its actual payoff in competition. If being profit maximising under a stakeholder environment is not the optimal choice, to what extent should a company care about debt holders? Does an optimal  $\lambda$  exist if being stakeholder oriented is better than being profit maximising?

This results show that the concern for the debt holders will help increase firms' chances of surviving. Therefore in the stakeholder society, firms tend to use more debt financing compared

to shareholder society.

### 3.3.4.1 General Analysis

**Theorem 1** *Let  $T \subset R$  be a compact set of strategies,  $f : T \times T \rightarrow R$  be the continuous payoff function of a symmetric two-player game, and  $g : T \times \Delta(T) \rightarrow R$  is a regular, payoff monotonic growth-rate function. Let  $G_t$  be the population dynamics defined by the differential equation*

$$\frac{d}{dt}G_t(s) = \int_s g(\tau, \tau') dG_t(\tau), S \subseteq T \text{ Borel measurable}$$

given initial distribution  $G_o$  with full support on  $T$ . For every strategy  $d \in D$  there is a neighborhood  $W_d \subset T$  such that  $\lim_{t \rightarrow \infty} G(W_d) = 0$ . In particular, if the game is dominance solvable, so that  $U = \{u\}$  for some  $u \in T$ , then  $G_t$  converges in distribution to the unit mass at  $u$ .

**Proof.** See Heifetz et al. [2007].

The idea that in strategic situations players may gain an advantage from having an objective function different from actual payoff maximisation dates back to Schelling [1960]. Heifetz et al. [2007] find the general conditions under which results about the evolution of preferences are valid. To establish the result, they adopted the indirect evolutionary approach, positing that evolutionary selection dynamics operate on preferences based on the equilibrium payoffs that individuals with these preferences obtain. The individuals choose their actions in the underlying game based on their perceived payoff functions and then receive payoffs according to their actual payoff functions. Therefore the evolutionary fitness of a particular type is based on the equilibrium payoffs in a second stage "types" game with payoff functions given by the actual payoffs induced in equilibrium given the action of each type.

They showed that if the game is dominance solvable, then given any initial distribution with full support and any payoff monotonic selection dynamics, the population converges to a mass unit at the unique type profile that survives the iterated elimination of strictly dominated

strategies in the type game.

Two players  $i$  and  $j$ , engage in strategic interaction. Typical strategies are denoted  $x_i$  and  $x_j$ . Consider a symmetric game in which the payoffs of the two players are given by

$$\Pi^i(x^i, x^j) \text{ and } \Pi^j(x^j, x^i),$$

for a function  $\Pi : R^2 \rightarrow R$ .

In the course of playing, the perceived payoffs of players are :

$$U^i(x^i, x^j, \tau^i) \equiv \Pi^i(x^i, x^j) + B^i(x^i, x^j, \tau^i),$$

$$U^j(x^j, x^i, \tau^j) \equiv \Pi^j(x^i, x^j) + B^i(x^j, x^i, \tau^j).$$

Let  $\Gamma = (X^i, X^j, \Pi^i, \Pi^j, B^i, B^j)$  denote the game in which players  $i$  and  $j$  choose actions  $x^i$  and  $x^j$ , respectively, to maximise their perceived payoffs,  $U^i$  and  $U^j$  and obtain true payoffs  $\Pi^i$  and  $\Pi^j$ . If we maintain the following assumption about  $\Gamma$  :

**Assumption A1:**  $U^i$  is  $C^2$  and differentially strictly concave in  $x^i$ , i.e.,  $U_{ii}^i(x^i, x^j, \tau^i) < 0$  for all  $(x^i, x^j, \tau^i) \in R^2 \times T$ ; analogously for  $U^j$ .

**Assumption A2:**  $U^i$  is  $C^2$  and differentially and there exists  $\epsilon > 0$  such that  $|U_{ij}^i(x^i, x^j, \tau^i)| < (1 - \epsilon)|U_{ii}^i(x^i, x^j, \tau^i)|$  for all  $(x^i, x^j, \tau^i) \in R^2 \times T$ ; analogously for  $U^j$ .

Then consider a "type game" where each players chooses a type  $\tau^i, \tau^j \in T = [\underline{T}, \bar{T}]$ , and receives a payoff according to the fitness function  $f^i$  and  $f^j$ . Since they have the original symmetric game and all individual have same true payoff function  $\Pi$ .

**Assumption B1:**  $f^i$  is  $C^2$  and differentibly strictly concave in  $\tau^i$ , i.e.,  $f_{ii}^i(\tau^i, \tau^j) < 0$  for all  $(\tau^i, \tau^j) \in T \times T$ ; analogously for  $f^j$ .

**Assumption B2:**  $|f_{ij}^i(\tau^i, \tau^j)| < |f_{ii}^i(\tau^i, \tau^j)|$  for all  $(\tau^i, \tau^j) \in T \times T$ ; analogously for  $f^j$ .

**Theorem 1** *Suppose that Assumption A and B are satisfied. Then there exists a unique type  $\hat{\tau} \in T$  such that given any initial distribution of types with full support  $T$ , the distribution of types converge in distribution to a unit mass at  $\hat{\tau}$  under any regular, payoff-monotonic selection dynamics.*

### 3.3.4.2 Application

We have analysed the situation where a stakeholder firm competes with a shareholder firm and we could extend the situation to a more general case. Theorem 1 provides support for it as the objective function  $f(x)$  is continuous and the payoff selection function  $g(x)$  is defined accordingly to the theorem. So we believe that under global environment where different firms with different choices of corporate governance compete with each other, the best corporate governance could be found through this evolutionary process.

Assume that two firms in the global environment have  $\lambda_i$  and  $\lambda_j$  respectively and  $4b^2 - 2bd - d^2 > 0$  for easy analysis. We could easily find their reaction function as below:

$$p_i = \frac{\lambda_i[a + dp_j + bc + \frac{\pi_2 - D(1+r)}{2\epsilon}] + (1 - \lambda_i)[\frac{D(1+r)}{2\epsilon}]}{2b\lambda_i},$$

$$p_j = \frac{\lambda_j[a + dp_i + bc + \frac{\pi_2 - D(1+r)}{2\epsilon}] + (1 - \lambda_j)[\frac{D(1+r)}{2\epsilon}]}{2b\lambda_j}.$$

In equilibrium, we could rewrite the price charged by firm  $i$  and  $j$  as the function of  $\lambda_i$  and  $\lambda_j$ :

$$p_i(\lambda_i, \lambda_j) = \frac{4b^2(m + n) + 2bd(m + k)}{4b^2 - d^2},$$

$$p_j(\lambda_i, \lambda_j) = \frac{4b^2(m + k) + 2bd(m + n)}{4b^2 - d^2},$$

Where  $m = \frac{a+bc+\frac{\pi_2-D(1+r)}{2\epsilon}}{2b}$ ,  $n = \frac{(1-\lambda_i)D(1+r)}{2b\lambda_i\epsilon}$ ,  $k = \frac{(1-\lambda_j)D(1+r)}{2b\lambda_j\epsilon}$ .

If we insert the equilibrium price under global society into firm's actual payoff function as the second stage type game where the firm with lower actual profit will be eliminated: To solve the optimal  $\lambda$ , we could apply the envelope theorem to this situation:

Let  $X$  denote the choice set and let the relevant parameter be  $t \in [0, 1]$ . Letting  $f : X * [0, 1] \rightarrow R$  denote the parameterized objective function, the value function  $V$  and the optimal choice correspondence  $X^*$  are given by :

$$V(t) = \sup_{x \in X} f(x, t)$$

$$X^*(t) = x \in X : f(x, t) = V(t)$$

Envelope Theorem describes sufficient conditions for the value function  $V$  to be differentiable in the parameter  $t$  and describe its derivative as:

$$\Omega_i = (p_i - c)(a - bp_i + dp_j) + Pr(\tilde{\epsilon} \leq p_i - c)(\pi_2 - D(1 + r)). \quad (3.7)$$

And we could find the fitness function for firm  $i$  and firm  $j$  are:  $\Omega_i(\lambda_i, \lambda_j)$  and  $\Omega_j(\lambda_i, \lambda_j)$ .

If we consider there are a large amount of firms in the market and they compete with each other continuously and randomly matched in pairs. Each firm's  $\lambda$  is drawn from a uniform distribution from  $[\underline{\lambda}, \bar{\lambda}]$ .

If we take the FOC of  $\Omega_i$  with respect to  $\lambda_i$ , and of  $\Omega_j$  with respect to  $\lambda_j$  and make it equal to 0, we could derive the best response function of choosing  $\lambda_i$  given  $\lambda_j$  and and the choice of  $\lambda_j$  given  $\lambda_i$ :

$$\lambda_i = f(\lambda_j), \lambda_j = f(\lambda_i).$$

In equilibrium, the "type game" above can be solved using the iterated elimination of strictly dominated strategy:

$$\tilde{\lambda} = \frac{2D(4b^2 - 2bd - d^2)(r + 1)}{D(1 + r)(4b^2 - 2d^2 - 2bd) + 2cd^2\epsilon(b + d) + d\pi_2^2 + 2ad^2\epsilon}. \quad (3.8)$$

**Proposition 2** *In a stakeholder society where both firms set weights to shareholder and debt holders' interest when forming their objective functions, the best corporate governance when they are competing with each other in a duopoly environment that maximises their actual payoffs is to choose  $\lambda = \tilde{\lambda}$  where  $\tilde{\lambda}$  is the optimal weight that should be assigned to shareholders' profit to*

*maximise the firm's actual payoff.*

Proposition 2 establishes a possible optimal corporate governance level that take into account both shareholders and stakeholders. It is easy to see that  $\tilde{\lambda}$  is between  $(0, 1)$ . We assume that the firms will act upon their own objective function while they will be selected through a payoff monotonic process in which the firm with the higher actual payoff will survive in the duopoly model. Therefore, we could conclude that after several rounds of competition, both firms' choice of corporate governance level in terms of the weight they should assign to the debt holders interest under stakeholder society will gradually converge to a unit mass  $\tilde{\lambda}$ . Sensitivity analysis will give us further knowledge about the optimal governance level:

- $\tilde{\lambda}$  is increasing in  $D$  under the assumption  $(4b^2 - 2d^2 - 2bd) > 0$  which is intuitively clear: Higher level of debt will lead the firm to assign more weight on the shareholders' profit because too much concern about debt holders will cause the firm to set a higher price and even if the firm survives, it still needs to pay large amount of debt towards debt holders and the total profit would not experience a significant surge. The manager would rather set smaller weight to the debt holder's interest and to reach a balance.
- $\tilde{\lambda}$  is increasing in  $r$  as well given  $\pi_2 \geq 2bc\epsilon$ . The intuition behind this implies that higher interest rate will make the debt more costly in the second stage to pay back, so the firm will tend to set lower weight on debt holders' pay to achieve higher actual payoff in equilibrium.
- $\tilde{\lambda}$  is increasing in  $c$  as well. The increase of the cost will cause manager to care less about the survival till the second stage because even if they try to increase the price, the increase might be still not enough to cover the shock.
- In stakeholder society (here we look into those firms consider debt holder's interest), we could find out that under the payoff monotonic selection progress, the firms that are not profit maximising will still survive and eventually the value of  $\lambda$  of the firms that survive will converge to a unit mass  $\tilde{\lambda}$ . This value is between  $(0, 1)$  and it shows that taking care



of debt holders' interest is not necessarily a sub-optimal strategy. Instead, we shows that the prevalence of stakeholder organisations might be caused by the voluntary choices of the firms. It contradicts the popular idea that those firms are being stakeholder oriented to comply with the regulation of the law. It provides the justification of the existence of stakeholder-oriented economy. It proves that culture and legal system are not the only facts that have the influence on the selection of their corporate governance system. It may as well be the result of the self selection process.

### 3.3.5 Optimal Financial Structure

Analogously, it would be interesting to find out whether there will be an optimal debt amount that in equilibrium would maximise both firms' profit?

The first Modigliani Miller Theorem assumes that a firm's total return  $X$  are unaffected by its financial decisions; investors can borrow and lend on the same terms as firms. Then, in equilibrium, the firm's debt equity ratio can't affect its value.

Will our paper give a result that differs from the popular MM Theorem?

Recall the objective function of stakeholder oriented firms  $i$  and  $j$  with given  $\lambda$  are:

$$Max \lambda[(p_i - c)(a - bp_i + dp_j) + Pr(\tilde{\epsilon} \leq p_i - c)(\pi_2 - D(1 + r))] + (1 - \lambda)Pr(\tilde{\epsilon} \leq p_i - c)D(1 + r),$$

$$Max \lambda[(p_j - c)(a - bp_j + dp_i) + Pr(\tilde{\epsilon} \leq p_j - c)(\pi_2 - D(1 + r))] + (1 - \lambda)Pr(\tilde{\epsilon} \leq p_j - c)D(1 + r).$$

We could insert the equilibrium price we derived before  $\hat{p}_s$  into the actual profit function to replace both  $p_i$  and  $p_j$  from equation (7) and find the fitness function of the firm  $\Omega(D)$  which is a function of parameter  $D$ .

By applying envelope theorem to this equilibrium objective function, and let take the derivative to  $\Omega(D)$  with respect to  $D$ , we could find out the optimal debt amount in stakeholder society

in the equilibrium is:

$$\tilde{D} = \frac{\lambda[(\lambda - 1)(d\pi_2 + 2ad\epsilon + 2cd^2\epsilon) + 8b\epsilon^2\lambda(b - d) + 2bcde(1 + \lambda) + 2b\pi_2\lambda + 2d^2\epsilon^2\lambda + 4b\lambda(a - bc)]}{2(2\lambda - 1)(1 + r)(b - d + d\lambda)}.$$

**Proposition 3** *Assume that two firms compete in price under a stakeholder oriented society we mentioned above and  $\lambda$  is given, we could prove that there exists an optimal level of debt financing  $\tilde{D}$  that will enable both firms to maximise their profit.*

Proposition 3 shows that when  $\lambda$  is large enough, there exists a positive optimal debt level in financing  $\tilde{D}$  to maximise the actual payoff of both firms if all other parameters are given.

In addition, the higher the marginal cost  $c$ , the lower the optimal debt amount will be as the high cost will increase the risk of default and will encourage the firm to lend less.

### 3.3.6 Firm Value

#### 3.3.6.1 Pure Business Environment

The discussion about which corporate governance works better is still hotly debated by scholars. In our case, we try to compare the firm value between stakeholder oriented firms and shareholder oriented firms in different equilibria.

We first look into how the firm value change from a pure profit maximising environment to a stakeholder oriented environment.

From the previous section we could define the firm value as the profit the firm made by

$$\begin{aligned} \Omega &= (p - c)(a - bp + dp) + Pr(\tilde{\epsilon} \leq p - c)(\pi_2 - D(1 + r)) \\ &= -ac - \frac{c - \epsilon}{2\epsilon}\pi_2 + [a + c(b - d) + \frac{\pi_2 - D(1 + r)}{2\epsilon}]p - (b - d)p^2, \end{aligned}$$

and  $p = p_i = p_j$  in equilibrium.

Since

$$\widehat{p}_s = \widehat{p}_2 + \frac{(1-\lambda)D(1+r)}{2\epsilon\lambda(2b-d)},$$

we could rewrite the firm value of stakeholder firm's value as an add up of shareholder firm value and a function of  $D$ :

$$FV_{stake} = FV_{share} + mD^2 + nD,$$

$$m = \frac{-(1-\lambda)(1+r)^2\lambda(2b-d) - (b-d)(1-\lambda)^2(1+r)^2}{4\epsilon^2\lambda^2(2b-d)^2},$$

$$n = 2(b-d)\frac{(1-\lambda)D(1+r)}{2\epsilon\lambda(2b-d)} + [A + c(b-d) + \frac{\pi_2}{2}].$$

Since  $m < 0$  and  $n > 0$  so it is a quadratic function and we could find another point of  $D^*$  that makes  $FV_{stake}$  equal to  $FV_{share}$ .

**Proposition 4** *With marginal cost uncertainty, firms in a stakeholder society where debt holders interest are concerned will have higher firm value if  $0 < D < D^*$  where  $D^* = \frac{-n}{m}$  satisfy  $FV_{stake} = FV_{share}$  and they will have lower firm value if  $D > D^*$ .*

Proposition 4 delivers the idea whether stakeholder orientation will lead to certain gain or loss in firm value compared to shareholder oriented firms. The result is directly sketched by the concave function above: The concern for the debt holders and the rise of the firm value could be achieved at a time. The intuition is easy. When they care about debt holders they will tend to set higher price which will also guarantee their survival during the shock. But when the debt amount exceeds certain level  $D^*$ , caring about debt holder will add burden to the operation of whole company and cause the loss of profit as well.

### 3.4 Conclusion

This paper has reviewed the past approaches to frame the stakeholder capitalism and I try to consider debt holders' interest when we model stakeholder society this time. I model stakeholder firms' objective by using weighted average of shareholder interest and debt holders' payoff and I found out that there would be an optimal weight that should be assigned in stakeholder society equilibrium. Strikingly, we also find out that the firm value would not necessarily drop in stakeholder society than shareholder society which explains why the performance of some European countries might be better than Anglo-Saxon countries. It could also provide some evidence for the bankers that lending money to stakeholder firms would have better guarantee as their policy will be steadier coupled with softer competition.

# Chapter 4

## Governance in Non-Profit Organisations

### *Abstract*

*Profit maximisation firms are the mainstream at present. However due to the law and culture, we could still find a lot of firms that operate rather than just consider shareholders' interest. Here we analyse non-profit organisations that include cooperatives, partnerships, hospitals and universities and see whether they perform better than profit maximisation firms under some circumstances and to see if their choices of being non-profit are voluntarily.*

## 4.1 Introduction

### 4.1.1 Non-profit Organisation

Before 1950, most of the research that had been done on non-profit organisations were focused on the traditional charities with substantial income coming from philanthropic behaviour. However it has changed remarkably recently primarily due to the conspicuous change in hospitals when non-profit hospitals are partially privatised. Over the past three decades, a lot of reasons have played important roles in the change across the Europe. André and Hermann [2010] listed several reasons that drives the change: 1) the increase in health spending due to the growing awareness for patient rights and the extension of coverage in population 2) the economics recession and the increasingly expensive equipment and medication 3) The growing profits expected from the health sector by the multinational health care companies and pharmaceutical companies.

Now we define a nonprofit organisation as an entity that has been formed by a group of people that uses its surplus revenues to further achieve its purpose or mission rather than distributing its surplus income to the organisation's shareholders as profit or dividend. This includes not only the charity organisations but also partnership, cooperatives, hospitals, educational institutions and other organisations that has a goal other than just maximise its profit.

Pauly and Redisch [1973] first proposed an innovative model explaining that non-profit hospitals' objective is not just to maximise the income of physicians or to simply maximise output. Most of the related theoretical research focused on two parts: the theories of the role non-profit organisations and the behaviour of non-profit organisations.

Changes have been conspicuous in other parts of non-profit sectors as well such as higher educations, day-care and nursing home industry. Most of these industries were characterised by a mix of for-profit, non-profit and state-owned firms. These led to substantial amount of work concerning these fields as they received large public subsidies and are strongly affected by public policies.

## **4.1.2 Theories of The Role of Non-profit Organisations**

We adopt the approach from Hansmann [1980] under which firms are divided by 1) their source of income and 2) the way in which they are controlled. Hence firms that received substantial portion of their income will be referred as donative non-profits and firms that get their income mainly from selling goods or service we will call it commercial non-profit firms. Among non-profit firms, patrons with ultimate control over firms are called mutual non-profits and rest of them in which there exist a board will be called entrepreneurial non-profits.

### **4.1.2.1 The Public Goods Theory**

Weisbrod [1975] suggested that non-profits serve as private producers of public goods. He argued that government only provides goods that satisfy the median voter and residual unsatisfied demand are met by the non-profit organisations. His theory shed light on the important phenomenon of the prevalence of some non-profit organisations which provide services that have the characteristics of public goods. For example, the education, child care, medical research provided by non-profit organisations. However, it fails to explain two aspects: one is why only non-profit arises to fill the unsatisfied demand, and another one is the service provided by those non-profit organisation are not all public goods.

### **4.1.2.2 The Contract Failure Theory**

Nelson and Krashinsky [1973] set forth that non-profit organisations arise to deal with the problems when it is hard for customers to judge if inferior services are provided due to the incentives of for-profit firms. Consequently, they held the argument using the example of day-care center that parents might trust a not-for profit more than a proprietary firm. This arises because that those who control the non-profit organisations have no opportunity or incentive to take advantage of customers and are constrained in their ability to benefit personally from providing low quality service.

#### 4.1.2.3 Subsidy Theory

Non-profit firms often benefit from a variety of explicit and implicit subsidies such as exemption from tax, special rates for financing and other favourable treatment. Therefore in industries where both for-profit and non-profit organisations exist, it provides a justification for the proliferation of non-profit firms because non-profit firms are advantaged in those areas according to Fama and Jensen [1983] and we could see the scope of subsidies have adjusted over the years to include the new industries. An empirical study conducted by Hansmann [1987] suggested that income tax exemptions has a conspicuous effect in enhancing the market share of nonprofit firms by comparing cross-sectional data on four industries.

#### 4.1.2.4 Consumer Control Theory

There are some types of non-profits that arise owing to patrons' requirement to take control of the organisations. Such control serves as the purpose of curtailing the monopolistic exploitation of the patrons by the controllers of the firm. We usually call this types of firms mutual non-profit.

Ben-Ner [1986] gave further argument to illustrate three possible circumstances in which consumers desire direct control over the firm. The first is asymmetric information about quality of output. These customers could be the buyers of commodities for family members who have difficulty in evaluating the quality of what they are consuming (day care, nursing homes). The second is when the firm could act as a monopolist and charge a high price if it's not under control of its patrons. Some natural monopoly such as public utility companies will set a price ceiling to avoid monopolist price. The third circumstance is when the firm produces price-excludable collective consumption goods and consumer control will lead to price discrimination and thus higher aggregate welfare than for-profit firms. Some performing arts groups are probably at least made in part with the intention of making it easier for less prosperous individual to attend. Yet most people who attend the art performance are affluent.<sup>1</sup>

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<sup>1</sup>Baumol et al. [1993] suggested high culture performing are non-profit because it would be unthinkable related to commerce.



#### **4.1.2.5 Government Enterprise**

The previous research on non-profit organisations have been focused on the comparison between non-profit versus for-profit form of organisations. Relatively little work has been done contrasting the role of non-profit and governmental enterprise. The reason for the gap in existing theory is due to the fact that contemporary economic theory offers more coherent view of for-profit enterprise than government enterprise. However, some work has been done illuminating various aspects of this field. Nelson and Krashinsky [1973] proposed that government firms have advantage through the use of taxing power and more access to reliable capital. Besides, government enterprise are usually linked to central government to provide goods to government.

### **4.1.3 Theory of Behaviour of Nonprofit Organisations**

#### **4.1.3.1 Optimising Models**

Influenced by neoclassical tradition, most models for non-profit firms have been optimising modes. There is no reason for non-profit to pursue profit maximisation. Instead, most of the non-profit organisations try to maximise the quality/quantity of the service they produce. Models of non-profit that seek those goals have been developed by Newhouse [1970] for hospital and James and Neuberger [1981] for universities. Budget maximisation also serves an important goal for some of the managers as maximising budget will benefit their personal welfare and Tullock [1966] shed light on this aspect.

#### **4.1.3.2 Productive Inefficiency**

Newhouse [1970] emphasised that firms under quality/quantity maximising models usually don't perform as well as for-profit firms. It turns out that quantity, quality or budget maximisation may or may not constitute efficient behaviour for the firm.

They argued that no matter what objectives non-profits are pursuing, they are performing less efficiently owing to the absence of ownership claims to residual earnings.

Alchian and Demsetz [1972] has a clear argument discussing the entrepreneurial non-profit because those who control those organisations will have no pecuniary incentives to minimise costs. Although managers in non-profit organisations might derive utility from having firms produce large amount of output but most of them might are expected to indulge themselves in more relaxed attitude toward their duties.

#### **4.1.4 Main Method and Motivation**

A manager's behaviour is influenced by the incentives given to him and it will induce him to take particular action, which in turn affects his opponent's action as well. Shapiro [1989] proposed the two stage game where a player's decisions in the first stage will affect all players' decision in the second stage game. In managerial incentive game, an owner's optimal choice of managerial incentives will depend on all players' choices.

When the manager appointed is given an objective other than profit maximisation, he will choose the strategy according to the objective function as as well his rivals' strategy.

This chapter tries to analyse non-profit organisations from a new angle. It gives explanation to the proliferation of nonprofit organisations such as partnerships, cooperatives, nonprofit hospitals/educational institutions under duopoly/oligopoly environment. I found out the rationale of staying as a cooperative /partnership in competition, and the optimal choice of objective function in the first stage to generate the maximum profit in equilibrium. I also did similar analysis for hospitals/universities to see how the results vary due to different objectives.

## **4.2 The Model**

### **4.2.1 Baseline under Cournot Model**

Profit maximisation has been reckoned as the cornerstone of economic analysis. Nevertheless, the strategy has not escaped criticism from academics as it neglected the long term existence

of other forms of organisations such as cooperative, partnership, charity organisations. Here, to set a baseline of for-profit firms, we examine a duopoly in which they compete in quantity first.

Assume firm  $i$  and firm  $j$  are producing homogeneous goods and the inverse demand function for both firms could be written as:

$$p = a - b(q_i + q_j), \quad (4.1)$$

where  $q_i$  and  $q_j$  denote the output of each firm,  $a, b > 0$ .

We assume each firm tries to maximise its profit

$$Max [a - b(q_i + q_j) - c]q, \quad (4.2)$$

and  $c$  represents the unit cost of each product, and we assume  $a > c$  for easier analysis later. In equilibrium, both firms will produce:

$$\hat{q} = \frac{a - c}{3b}. \quad (4.3)$$

#### 4.2.2 Cooperatives/Partnerships under Quantity Competition Model

The most common examples of non-profit firms are cooperatives. It was estimated that in 1994, nearly 3 billion people's livelihood was made secure by co-operative enterprise. These enterprises still play significant economic and social roles in the communities. Even now 12% of the employees from G20 countries are from cooperatives and at least 250 million of individuals are working in or within the scope of cooperatives worldwide.

Classic examples of human-capital intensive cooperative industries are law firms, consulting companies and accounting firms. We shall assume the production function is linear as it captures the characteristics of a lot of industries because they have constant return to scale. Assume capital  $K$  are same for both company: The output of the firm  $i$  is  $q_i = f(l)$ . Thus human capital would be the only variable that affects the output.

We assume the objective function of cooperative is to maximise the weighted average of profit per head and total profit:

$$\pi_i = \lambda \frac{(a - b(q_i + q_j) - c)q_i}{f^{-1}(q_i)} + (1 - \lambda)[(a - b(q_i + q_j) - c)q_i], \quad (4.4)$$

$$\pi_j = \lambda \frac{(a - b(q_i + q_j) - c)q_j}{f^{-1}(q_j)} + (1 - \lambda)[(a - b(q_i + q_j) - c)q_j], \quad (4.5)$$

$f^{-1}(q)$  denotes the employees required to produce  $q$  units of output,

$f^{-1}(q) = dq$  in the linear situation,

$\lambda$  denotes the weight that each cooperative assigns to the profit per employee and  $\lambda \in [0, 1]$ .

The value of  $\lambda$  measures the degree to which the organisation is employee oriented.

The board of the organisation chooses  $\lambda$  in the first stage as part of the organisation's strategy.  $q$  is chosen by the manager of organisation to maximise the objective function in the subgame at stage 2.

**Definition 1**  $(\hat{q}_i, \hat{q}_j)$  is a Nash equilibrium in the subgame of managers mentioned above at stage 2 if and only if  $\hat{q}_i = \operatorname{argmax} \pi_i(q_i, \hat{q}_j)$ , and  $\hat{q}_j^* = \operatorname{argmax} \pi_j(\hat{q}_i, q_j)$ .

We could easily derive the best response function for firm  $i$  and firm  $j$ :

$$q_i = \frac{(\lambda - 1)(c - a + bq_j) - \frac{b\lambda}{d}}{2b(1 - \lambda)}, \quad (4.6)$$

$$q_j = \frac{(\lambda - 1)(c - a + bq_i) - \frac{b\lambda}{d}}{2b(1 - \lambda)}. \quad (4.7)$$

To solve the Nash equilibrium, we could express  $\hat{q}_i, \hat{q}_j$  as function of  $(\lambda)$ .

$$\hat{q}_i^* = \hat{q}_j^* = \hat{q}^*(\lambda) = \frac{-(c - a)(1 - \lambda) - \frac{2\lambda}{3d}}{3b(1 - \lambda)} = \hat{q} - \frac{\lambda}{3d(1 - \lambda)}. \quad (4.8)$$

Notice that being in an cooperative environment will lead the firm to producing less under equilibrium. This leads to milder competition compared to the profit maximisation environment.

With the increase of  $\lambda$ , the firm will manufacture less. A less aggressive strategy is taken by the manager when the objective function of the firm differs more from the profit maximisation organisations.

**Proposition 1** *In the duopoly environment where both firms are cooperatives and compete in quantity (they maximise the weighted average of profit and profit per head), i.e.  $\lambda < 1$ , this results in lower output than in standard Cournot model, which deviates even more from social optimum  $\frac{a-c}{2b} > \hat{q} > \hat{q}^*$ .*

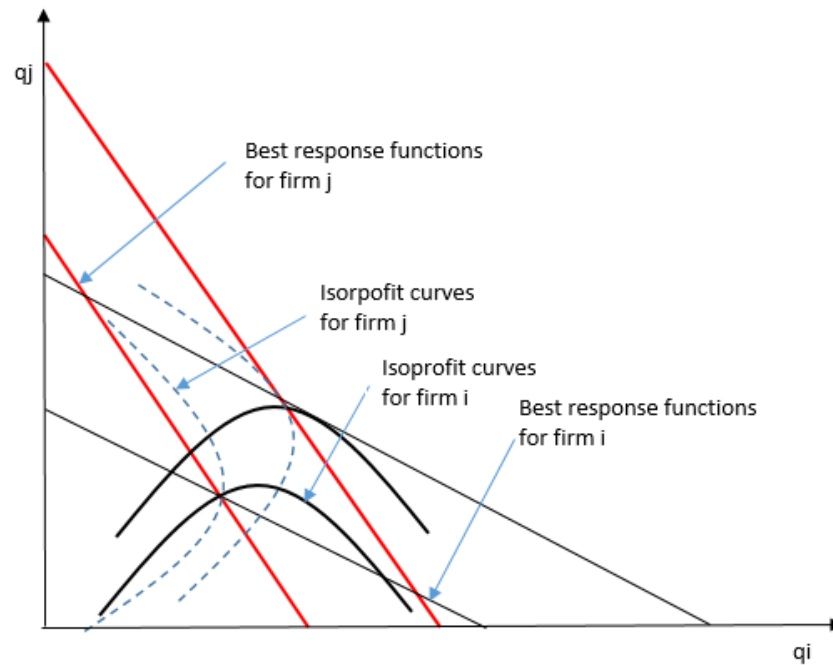


Figure 1

As is shown in Figure 1, two red lines represent the best response functions of firm  $j$  while two black lines denote the best response function of firm  $i$ . The objective function of cooperative will lead to lower output, which is closer to origin. The blue and black dash lines are the isoprofit curves for each firm under Cournot and cooperative quantity competition environment. Cooperatives can increase their profits by choosing smaller  $\lambda$  and shifting the best response function out.

### 4.2.3 Price Competition

Bertrand and Edgeworth built models of firms competing by setting prices instead of quantities. Bertrand and Edgeworth criticised the Cournot model after complete silence about Cournot's work for 45 intervening years. The condition for the Cournot equilibrium is that the supply quantities of the homogeneous good to be the choice variables for the competitors. Given the good is homogeneous, one firm could undercut the price even slightly to gain the entire market and this would lead to collusive monopoly or to the competitive pricing at the level of marginal costs. Edgeworth [1897] pointed at the importance of decreasing returns in price competition and gave the idea of product differentiation. Buyers see the product heterogeneous and they would have preference for the product of one seller.

In this section, we examine the scenarios when two cooperatives compete in prices as opposed to quantity. Quantity competition is useful to explain the industries with capacity constraints<sup>2</sup> such as the production of chemicals. Whilst in some other industries such as professional services, price competition might be more suitable to explain the market without strict capacity constraints.

We assume symmetric product differentiation, linear demand, and constant cost. The price charged by each firm is  $p_i$  and  $p_j$ .

$$q_i = a - bp_i + gp_j \quad b, g > 0, b > g$$

$$\pi_i = (p_i - c)(a - bp_i + gp_j), \quad (4.9)$$

$b$  and  $g$  denotes the sensitivity of the demand of one product reacting to its own price and the price of its substitute. We assume  $b > g$  because the demand is more sensitive to its own price.

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<sup>2</sup>Tirole [1988] explained the two stage game when the firm decide its capacity in the first stage and then choose the output in the second stage.

We could simply find out the equilibrium price :

$$\hat{p} = \frac{a + bc}{2b - g}. \quad (4.10)$$

For a cooperative under duopoly price competition, it maximises:

$$\Pi_i = \lambda \frac{(p_i - c)(a - bp_i + gp_j)}{d(a - bp_i + gp_j)} + (1 - \lambda)(p_i - c)(a - bp_i + gp_j), \quad (4.11)$$

$$\Pi_j = \lambda \frac{(p_j - c)(a - bp_j + gp_i)}{d(a - bp_j + gp_i)} + (1 - \lambda)(p_j - c)(a - bp_j + gp_i), \quad (4.12)$$

where output is a linear function of employment, i.e constant return to scale.

$$p^*(\lambda) = \frac{a + bc}{2b - g} + \frac{\lambda}{d(1 - \lambda)(2b - g)} = \hat{p} + \frac{\lambda}{d(1 - \lambda)(2b - g)}. \quad (4.13)$$

When both firms are assigned to same  $\lambda$ , we could see that in equilibrium under price competition environment, it leads to higher price and lower quantity compared to classic Bertrand model. This result is also consistent with the situation under quantity competition.

**Proposition 2** *In a duopoly environment where both firms are cooperatives(they maximise the weighted average of profit and profit per head) and they compete in price, i.e.  $0 < \lambda < 1$ , this results in higher price than in Bertrand model, yet still below the monopoly price.*

The larger the  $\lambda$ , the higher the price under equilibrium. This indicates that the more the company focuses on the profit of each employee, the less aggressive strategy it will take. They will increase the price and soften the competition between these two companies.

## 4.2.4 Mixed Environment

The intuition of previous sections is very clear: Under either price or quantity competition, both cooperatives/partnerships that aim to maximise the weighted average of profit per employee and total profit will slash their output compared to classic Cournot/Bertrand Model. However, In most business environments, different firms will have different preferences when choosing their objective functions. In our model, we first have a look at the asymmetric situation when a cooperative with  $\lambda$  in its objective function compete with a profit maximisation firm in a Cournot model (similar result accessible with Bertrand Model)

### 4.2.4.1 Quantity competition

Under asymmetric quantity competition, firm  $i$  is still the profit maximisation firm with objective function:

$$\pi_i = (a - b(q_i + q_j) - c)q_j.$$

Firm  $j$ 's objective function is to maximise  $\pi_j$  : the linear combination of profit per head and total profit as defined before :

$$\pi_j = \lambda \frac{[a - b(q_i + q_j) - c]q_j}{dq_j} + (1 - \lambda)[(a - b(q_i + q_j) - c)q_j],$$

$\lambda$  was chosen at the first stage of the game by the board of the firm  $j$ .

The reaction functions for these two firms are:

$$q_i = \frac{a - bq_j - c}{2b},$$

$$q_j = \frac{(\lambda_j - 1)(c - a + bq_i) - \frac{b\lambda}{a}}{2b(1 - \lambda)}.$$



In equilibrium:

$$q_j = \frac{cd - ad + 2b\lambda_j + ad\lambda_j - cd\lambda_2}{3bd\lambda_j - 3bd} = \frac{a - c}{3b} + \frac{2\lambda}{3d(1 - \lambda)} = \hat{q} - \frac{2\lambda}{3d(1 - \lambda)},$$

$$q_i = \frac{ad - cd + b\lambda_j - ad\lambda_j + cd\lambda_j}{3bd(1 - \lambda_j)} = \frac{a - c}{3b} + \frac{\lambda}{3d(1 - \lambda)} = \hat{q} + \frac{\lambda}{3d(1 - \lambda)}.$$

**Proposition 3** *Under quantity competition environment where one firm is a cooperative and the other maximises its profit, the profit maximising firm would take advantage of the soft strategy of cooperative, produce more and have more profit than in a pure profit maximising environment. The cooperative under mixed environment will produce less than in pure cooperative environment and have even less profit compared to the profit in a pure cooperative environment.*

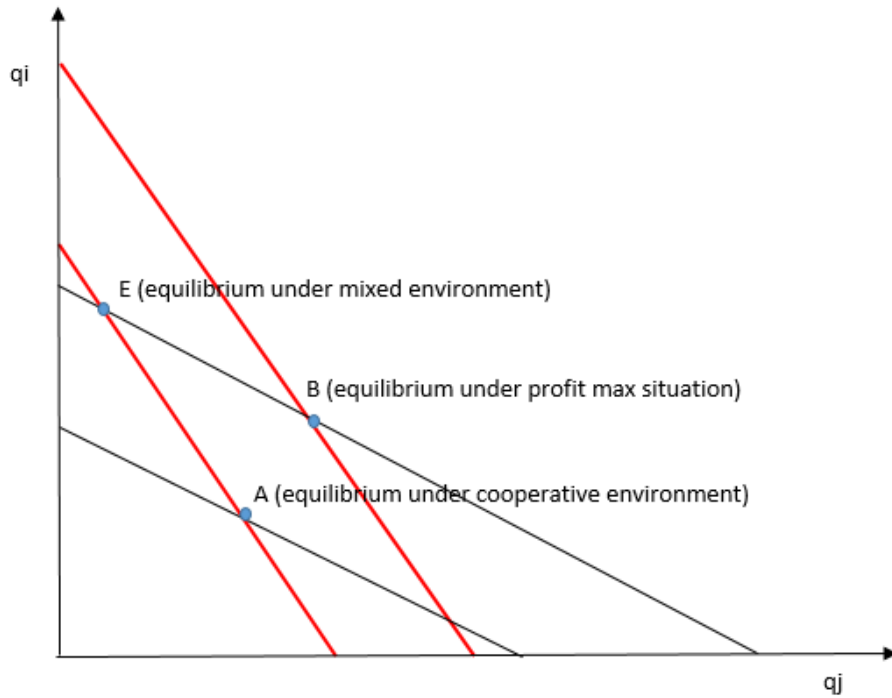


Figure 2

- The cooperative/partnership firm takes milder strategy by producing less compared to the equilibrium when both firms are profit maximising. As is shown in Figure 2, point A is the equilibrium under cooperative environment which is inside of equilibrium of Cournot Model

(Point B). Under mixed environment, the equilibrium point E leads much higher output from the profit maximisation firm and even less output from the cooperative compared to the pure cooperative environment. In the mixed environment, profit maximising firm takes advantage of the lower output of cooperative/partnership and increases its output, as is shown in Figure 2. It further cuts down the output produced by cooperative. The total output will increase compared to in cooperative environment and it will slightly cuts the market price.

- How would the firm value change in a mixed environment? The total output of two firms will drop compared to the profit maximising situation, which in turn will cause the increase of market price. Therefore under mixed environment profit maximising firm can seize higher profit compared to in a pure profit maximising environment by taking advantage of the other cooperative. On the contrary, cooperative under mixed environment will make less profit compared to the situation in a pure cooperative environment because the increasing level of total output will cause decreasing market price and the cooperative itself also produces less than in pure a cooperative environment.
- $d$  measures the labour needed to produce one unit of output .We could also interpret it as a measurement of productivity of this industry. greater value of  $d$  leads to the result that the output under equilibrium will converge to profit maximisation equilibrium. This shed light on the fact that most cooperatives/partnerships exist as small and medium firms.

## 4.2.5 Optimal Governance Strategy for Cooperatives/Partnerships

### 4.2.5.1 The Existence of Optimal $\lambda$ with Same Strategy

Some scholars argue that the choice of  $\lambda$  would vary depending on the preference of the partners/employees of a firm. However, we find that within the same industry, the management strategy of the non profit maximisation organisations are surprisingly similar. Does the coop-

erative firm choose its corporate objective voluntarily or would it rectify its goal over time to achieve the long-run profit maximisation? We first analyse the the situation when  $\lambda$  is given for the firms in same industry.

If we insert equation (8) which is the equilibrium output under cooperative environment into the actual profit function equation (2) under quantity competition environment to yield the same fitness function for both firms:

$$\pi_i = \pi_j = f(\lambda), \quad (4.14)$$

the optimal strategy of choosing  $\lambda$  under quantity competition when  $\lambda$  is fixed:

$$\hat{\lambda}_q = \frac{ad - cd}{ad - cd + 4b}. \quad (4.15)$$

Similarly, if we consider the price competition by substituting equilibrium price under price competition in equation (9) with equation (13), we would get the expression of actual payoff function as a function of  $\lambda$ , and the optimal strategy under price competition is to choose :

$$\hat{\lambda}_p = \frac{(ad + cdg - bcd)g}{(ad + cdg - bcd)g + 2b - 2g}. \quad (4.16)$$

**Proposition 4** *Consider the game above, two not-for-profit organisations compete with each other under duopoly environment and their perceived objective function is a weighted average of actual profit and profit per head given  $\lambda$  is the weight assigned to profit per head. To maximise their actual payoff under equilibrium, there exists an optimal  $\hat{\lambda}$  and  $0 \leq \hat{\lambda} < 1$  they could choose in forming their objective function.*

As we can see from Proposition 4, even though  $\lambda$  is not exogenous, the firm would not act as a profit maximisation firm by setting  $\lambda$  equal to 0. The result shows that the firm would choose a moderate level of  $\lambda$  between  $[0, 1]$  so that in equilibrium both firms can maximise their actual

payoffs.

- because  $b, d > 0$ , we could prove that both  $\lambda_p$  and  $\lambda_q$  are between  $(0, 1)$ , which is contradictory to the neoclassical opinion that both firms in the same industry would be better off by having  $\lambda$  equal to zero to maximise their actual profit if the firms had the freedom to choose  $\lambda$ .

See Appendix A for proof.

- In quantity competition model, the more sensitive the market price is to the output, the smaller  $\lambda_q$  is. This indicates that the firm will care less about profit per employee when  $b$  increases, both firms act closer to profit maximisation as the price is very elastic. it will lead to higher output level that closer to profit maximisation level.
- In price competition model, similar results apply. The increasing sensitivity of the demand change to its own price will lead smaller  $\lambda$ . The firm tends to behave more like a profit maximising firm if the market is very sensitive to its price. Similarly, the rising unit cost and smaller intercept of demand function will both lead to lower  $\lambda$ . Intuitively, both factors will add pressure to the firms' operation and leave the firm smaller space to perform deviated from profit maximising level even if in a cooperative/partnership environment. In addition, the sensitivity of the demand change to opponent's price will not necessarily lead to higher or lower  $\lambda$ . Instead, it depends on the value of  $a$ . A large intercept can alleviate the impact that big  $d$  brings. The more difficult the work is (more employees required to complete one project), the bigger  $\lambda$  it is if  $a > bc - cg$ . The increasing number of employees will decrease the profit per head and make it less important in the objective function.

#### 4.2.5.2 The Existence of $\lambda$ with Different Strategies

In previous part, we discussed the situation given that both firms choose the same  $\lambda$  under cooperative/partnership environment. However, in most situations, we find the strategies of

firms differ even if they are the same form of organisations. It is interesting to analyse this situation.

We assume firm  $i$  and firm  $j$  has freedom to choose  $\lambda_i$  and  $\lambda_j$  in the cooperative business environment under quantity competition and their objective functions are:

$$\pi_i = \lambda_i \frac{[a - b(q_i + q_j) - c]q_i}{dq_i} + (1 - \lambda_i)[(a - b(q_i + q_j) - c)q_i],$$

$$\pi_j = \lambda_j \frac{[a - b(q_i + q_j) - c]q_j}{dq_j} + (1 - \lambda_j)[(a - b(q_i + q_j) - c)q_j].$$

If we apply the similar method from above to find out the best response function for both firms:  $q_i(\lambda_i, p_j)$  for firm  $i$  and  $q_j(\lambda_j, p_i)$  for firm  $j$ . In equilibrium, the output they produce will be  $\hat{q}_i(\lambda_i, \lambda_j)$  and  $\hat{q}_j(\lambda_i, \lambda_j)$ . If we use backward induction to decide the the  $\lambda$  that the firm would choose to maximise its actual profit given another firm's choice of  $\lambda$ , firm  $i$  should maximise:

$$[a - b(q_i + q_j) - c]q_i$$

.

By substituting  $q_i$  and  $q_j$  in the equation with  $\hat{q}_i(\lambda_i, \lambda_j)$  and  $\hat{q}_j(\lambda_i, \lambda_j)$  and take FOC with respect to  $\lambda_i$ , we could find out the firm  $i$ 's choice of  $\lambda_i(\lambda_j)$ . Similarly, if we analyse it from firm  $j$ 's perspective, we could find its choice of  $\lambda_j(\lambda_i)$ . In equilibrium, both firms will choose same  $\lambda$ :

$$\hat{\lambda} = \frac{ad - cd}{ad - cd - 5b}.$$

- When both firms chooses its  $\lambda$  on their own, we find it differs from  $\lambda_p$  we found previously when we assume both firms choose same strategy. Interestingly,  $\frac{ad - cd}{ad - cd - 5b}$  doesn't fall into the interval  $(0, 1)$ .
- When a firm moves from profit maximising firm to a cooperative, its profit will fall.

Therefore the way to increase its profit is to move in the opposite direction and that

explains why the equilibrium  $\lambda$  might have negative sign.

- When the market price is very sensitive to the output, both firms would act aggressively and voluntarily become profit maximising firms. However, when the demand is less elastic ( $b$  is small), both firms would tend to maximise their profit per employee.

While the corporate form dominates across manufacturing, technology, and many service industries, partnership/cooperatives have been prominent in human-capital-intensive professional services such as law, accounting, investment banking, management consulting, advertising and medicine, pointed out by Levin and Tadelis [2005].

Why is it so difficult for another form of organisation to break the wall and to survive in the market? Goldman Sachs went public in 1999 after rejecting several earlier proposals for public offering<sup>3</sup>. Most senior partners think that it will damage reputation of the firm and lower the quality of the service it provides. Another example is from the leading consulting firm Booz Allen Hamilton dissolved its partnership and went public in 1970 but bought back its shares and became a private partnership again. The examples show that in a pure partnership environment, the firm that deviates from its original form would usually not benefit from this action.

My results show that it is very likely there exists an optimal  $\lambda$  in specific cooperative/partnership industry over the years' negotiation and operation. The value is closer to  $\lambda_p$  and any firm that deviates from it would cause the loss of the balance in the industry and fiercer competition.

Another reason might be that in certain industries, customers care about both the quality and the price. For profit firms usually hold the reputation for caring less of the quality compared to non-profit firms. This partly explains why those human-resource intensive firms suffer great loss after they tried to change their forms to for profit.

If we look into the countries with most cooperatives, quite a few small countries are among the top 10 list such as Finland, Switzerland, Norway, Denmark, Ireland and Luxembourg. It might imply that the prevalence of cooperatives in these countries might be the result of lack of

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<sup>3</sup>Actually, the performance of the banking industry has been poor since the partnership was abandoned. However, they needed to raise more capital to pay for the raising cost.

competition. In big countries where international firms are popular, the balance of cooperatives are easily broken.

## 4.2.6 Firm Value

Proposition 4 indicated that there exists one optimal  $\lambda$  that both firm should choose to maximise their actual payoff given their objective functions is a weighted average of total profit and profit per head. Could this explain the prevalence of cooperative in some countries? Will a firm actually makes more profit in a cooperative environment? Here, we analyse the actual profit each type of firm can make under different environments as a measure of its firm value.

### 4.2.6.1 Profit Maximisation Environment

From equation (3), we could derive the output under equilibrium and the therefore the actual profit is to replace  $q$  in profit function with  $\hat{q}$ .

$$\pi_{profitmax} = \frac{(a - c)^2}{9b} \quad (4.17)$$

### 4.2.6.2 Pure Cooperative Environment

A pure cooperative here may be defined as a environment where both firms only try to maximise their profit per head. Hence their objective function could be written as:

$$Max \frac{[a - b(q_i + q_j) - c]q_i}{dq_i}. \quad (4.18)$$

This implies that if a firm is a pure cooperative, then its objective function is to maximise its unit price of its output. In Cournot model, it tends to produce as little as possible to get higher price. It's consistent with the fact that pure cooperatives have relatively smaller size and tend to charge higher price than market price.

#### 4.2.6.3 Weighted Average Cooperative

As we noticed in real business world, a great amount of traditional cooperatives deviate from the pure cooperative mode. Instead, they are pursuing a mode that is between profit maximisation and profit per head maximisation. e.g. John Lewis, Cooperative. Past decades have witnessed the trend when a growing number of cooperatives seek to privatise part of their shares and to become more competitive in the market.

One explanation for the trend could be that the advancement of the technology enables the wider access to information, which reduces the problem of asymmetric information about the quality of the goods when customers choose the goods.

By substituting the quantity in profit function with  $\hat{q}(\lambda)$ , we could derive the profit each firm could make under this quantity competition environment:

$$\hat{q}(\lambda) = \hat{q} - \frac{\lambda}{3d(1-\lambda)},$$

$$\hat{q} = \frac{a-c}{3b},$$

$$q_m = \frac{a-c}{4b},$$

$$\hat{q}_s = \frac{a-c}{2b},$$

$\hat{q}_s$  denotes social optimal output and  $q_m$  denotes monopolist output.

In equilibrium, we could find out the profit they make under equilibrium given the out put is  $\tilde{q}$ :

$$[a - 2b\tilde{q} - c]\tilde{q}.$$



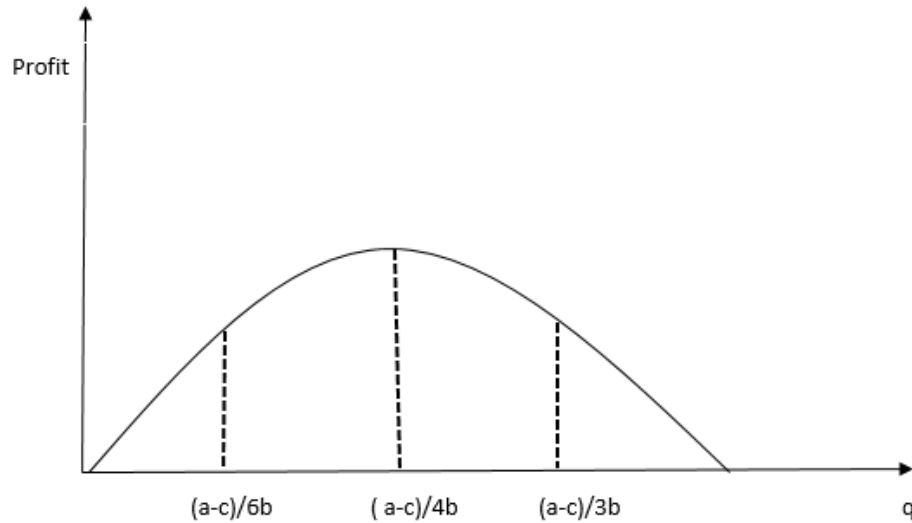


Figure 3

As is shown in Figure 3, when the firm produces  $\frac{a-c}{4b}$ , it could bring the largest profit. Under profit maximising environment, both firms will produce  $\frac{a-c}{3b}$ . Obviously, when the equilibrium output  $\hat{q}(\lambda)$  is between  $\frac{a-c}{6b}$  and  $\frac{a-c}{3b}$ , cooperatives actually perform better than profit maximising firms. On the contrary, if  $\hat{q}(\lambda)$  is even smaller than  $\frac{a-c}{6b}$ , we would find that the cooperatives are not performing as well as the profit maximising firms.

Analogously, similar analysis applies to the price competition. The price charged by cooperative/partnership is

$$\hat{p}(\lambda) = \hat{p} + \frac{\lambda}{d(1-\lambda)(2b-g)}.$$

**Proposition 5** *When two firms compete under either price competition or quantity competition, there exists an  $\lambda^*$  when  $0 < \lambda < \lambda^*$ , the firm value of cooperative is higher than profit maximisation firm and when  $\lambda^* < \lambda < 1$ , the firm value of cooperative is smaller than a profit maximising firm.*

Proposition 5 indicates that under pure business environment, cooperatives will not necessarily perform worse than profit maximising firms. In fact, we could find out the value of

a cut-off  $\lambda$ . It indicated that when the firms in a cooperative environment take into account profit per employee to a certain extent, the firm actually would be better off compared to being a profit maximising firm. The market structure formed by both forms is very similar to collusion under this situation. We now assume that  $\lambda$  is a value negotiated before by multiple parties - both firms, the employees, the regulators under specific cultural and legal environment and it eventually converged to this value. The value of  $\lambda$  is  $\frac{(a-c)d}{2b+(a-c)d}$  and we find that several factors will affect this value. The increasing sensitivity of the market price to the output would reduce the value of  $\lambda$  and push both firms to act more like a profit maximising firm as the demand is more elastic. On the contrary, the increasing  $d$  measures the the average employees it requires to produce one unit of output. The increasing number of employees required would lower the absolute value of profit per employee, hence leads to larger  $\lambda$ .

## 4.3 Extension

### 4.3.1 Hospitals and Universities

Apart from cooperatives/partnerships, the public sector is another major area where not-for-profit exist. Most of the universities and hospitals are purely funded by public.<sup>4</sup> Most of the organisations are aim to both provide more service and maximise their finance. We assume their objective functions are to:

$$Max \lambda q_i + (1 - \lambda)[a - b(q_i + q_j) - c]q_i.$$

Take the first order condition of objective function, The best response function of firm  $i$  is:

$$q_i = \frac{\lambda + (1 - \lambda)(a - bq_j - c)}{2(1 - \lambda)}.$$

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<sup>4</sup>Even the most prestigious private universities like Harvard receive substantial government grants

We also check the second order condition of to make sure it is always smaller than 0 so the maximum is achieved.

And the equilibrium is:

$$\hat{q}_h = \frac{a-c}{3b} + \frac{\lambda}{3(1-\lambda)b}.$$

Apparently, public sectors produce more than profit maximising firms, and further deviate from the monopolist output that maximises their total profit, but still below the social optimal  $\frac{a-c}{2b}$ .

In terms of the actual firm value (actual profit), we find out that organisations like universities and hospitals will definitely make less profit than the traditional profit maximising ones as they produce more than monopolist and Cournot output.

Either the profit per employee or the total output that is considered in the objective function can be seen as an externality here. Taking into account profit per employee by partnerships/cooperatives can be seen as a negative externality which leads to lower output than equilibrium, while assigning weight to the total output provided can be seen as a positive externality which will increase the actual output.

Only the not for profit organisations that are mainly run by the government or charity will set objectives with its focus on quantity along with profit. Only by doing this could they increase the quantity and to get closer to social optimal output.

### 4.3.2 Multiple Competitors

We only examined the cases when two firms are competing above for simple analysis and would this result hold if there exists multiple firms competing with each other?

To look into the situation, we assume that there are  $N$  firms in cooperative market,  $N = \{1, 2, 3, \dots, n\}$ . The total output of the market  $Q = \sum q_i$  and other settings are same as previous and they compete in quantity.

The inverse demand function of firm  $i$  is :

$$p_i = a - bQ = a - b\Sigma q_i.$$

The profit maximising firms' objective functions is:

$$\pi_i = q_i(a - bQ - c)$$

And cooperatives' objective functions is:

$$\Pi_i = \lambda \frac{\pi_i}{dq_i} + (1 - \lambda)\pi_i = \frac{\lambda(a - bQ - c)}{d} + (1 - \lambda)(a - bQ - c)q_i.$$

To find the best response function of firm  $i$ , we should take the FOC of  $\Pi_i$ :

$$\frac{\partial \Pi_i}{\partial q_i} = \frac{-b\lambda}{d} + (1 - \lambda)[(a - bQ - c) + q_i(-b)].$$

In symmetric equilibrium,  $Q = nq_i$  and each firm produces the same output. Hence,

$$\hat{q}_{multi} = \frac{-\lambda}{d(1 - \lambda)(n + 1)} + \frac{a - c}{b(n + 1)}.$$

To prove that there exists optimal  $\lambda$  for every firm to agree with to maximise their own profit, we believe they will form a organisation more like a cartel where all the firms collude.

Under this situation, they should maximise:

$$\Sigma \pi_i = \Sigma \hat{q}^*(a - bn\hat{q}^* - c),$$

$$\hat{q}^* = \frac{a - c}{2bn}.$$

If there exists optimal  $\lambda$  for them to choose,  $\hat{q} = \hat{q}^*$ . And we could prove the existence of

the  $\lambda$  under this situation.

**Proposition 6** *When  $n$  firms compete with each other in quantity under cooperative environment given  $\lambda$  and  $0 \leq \lambda < 1$ , all the firms will produce same output equals to  $\hat{q}_{multi}$  and there always exists an optimal  $\lambda$  for them to choose to maximise their own profit.*

- Obviously, the increasing number of firms will reduce the equilibrium output for each firm.
- The total output given the optimal  $\lambda$  is constant equal to  $\frac{a-c}{2bn}$ . The increasing number of firms will lead to smaller optimal  $\lambda$  which indicates that the rising number of firms will not only lower the output, but also the weight they put on profit per employee in the objective function. Apparently, the large numbers of competitors will push the firms to choose being more like profit maximising as it becomes more like perfect competition.

### 4.3.3 Non-linear Cost Functions

In the previous model, we discussed the situation where the cost function of the firm is linear for the purpose of simple analysis. One major drawback of this approach is that it lacks generosity. The findings might be more interesting if we take different cost functions into consideration.

Previously, Kaneda and Matsui [2003] have assumed three strict conditions to ensure the existence and uniqueness of Nash equilibrium. Cornes et al. [2005] made the following much weaker assumptions in order to ensure existence and uniqueness of Nash equilibria in pure strategies:

If the objective function of firm  $i$  is:

$$\Pi_i(x_i, X, \lambda_i) = \lambda_i F_i(x_i, X) + (1 - \lambda_i)[P(X)x_i - C_i(x_i)],$$

where  $\theta \in [0, 1]$  is the weight assigned on the objective other than profit.  $X$  presents the total output of the market that comprises  $n$  firms.

**Assumption 1**  $\Pi_i \in C^2$  for  $\forall_i \in I$ , where  $I$  is the set of firms.

The first-order condition associated with the maximisation of  $\Pi_i$  is given by

$$\frac{\partial \Pi_i(x_i, X, \lambda_i)}{\partial x_i} \leq 0.$$

We denote the FOC of  $\Pi_i$  with respect to  $x_i$  as  $\gamma_i(x_i, X, \lambda_i)$ .

**Assumption 2** For  $\forall I$ , if  $(x_i, X)$  satisfies  $0 < x_i \leq X$  and  $\gamma_i(x_i, X, \lambda_i)$ , then

$$\frac{\partial \gamma_i(x_i, X, \lambda_i)}{\partial x_i} < 0.$$

**Assumption 3** For  $\forall \in I$ , if  $(x_i, X)$  satisfies  $0 < x_i < X$  and  $\gamma_i(x_i, X, 0) = 0$ , then

$$x_i \frac{\partial \gamma_i(x_i, X, \lambda_i)}{\partial x_i} + X \frac{\partial \gamma_i(x_i, X, \lambda_i)}{\partial X} < 0.$$

In our case,  $P(X) = a - bX$  and  $F_i = \left(\frac{a-bX}{d}\right) - \frac{C(x_i)}{dx_i}$ .

See appendix D for detailed conditions required for our case.

Assumption 1 guarantees that the weighted marginal utility and the difference between slope of demand function and marginal average cost is smaller or equal to 0.

When firm  $i$  produces a positive amount of output, that is, an interior solution exists, since  $\gamma_i(\cdot)$  is continuously differentiable due to A3.

Assumption 3 implies that if one or more firms has a positive monopoly output in equilibrium, which ensures that the summation of the respective share functions<sup>5</sup> exceeds one at some level of the industry output.

Assumption 1 indicated that when  $a(1 - \lambda_i) + \lambda_i \frac{C(x_i)}{x_i^2}$  is big enough and  $C(x_i)$  is small, there might not have any solution.

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<sup>5</sup>If for any value of  $X \geq 0$ , there exists a unique value  $x_i^{BR} = r_i(X, \lambda_i)$  such that  $x_i^{BR}$  is a best response to  $X - x_i^{BR}$ , then the function  $r_i(X, \lambda_i)$  is the replacement function of firm  $i$ . Then for all  $X > 0$ , the function  $s_i(X < \lambda_i) = r_i(X, \lambda_i)/X$  is the share function of firm  $i$

Assumption 2 requires  $C''(x)$  and  $(1 - \lambda_i)(-b)$  to be large,  $C'(x_i)$  to be small. In our case, we assume that Assumption 2 holds.

**Proposition 7** *Assume there are  $n$  firms competing in quantity under cooperative environment and firms' cost function are non-linear and  $C'(q) > 0$ , if  $C''(q)$  is sufficiently smaller than 0, Assumption 2 will not hold, and there will not exist unique Nash equilibrium output.*

Proof see Appendix D.

When we assumed linear cost function in previous sections, it is very much like the reality in particularly industries. Partnership firms like consulting firm, law firms and auditing firms have constant marginal cost and our analysis relied heavily on this. Now we attempt to look into the situations when the cost function is non-linear. Interestingly, we found that when the marginal cost decreases at fast speed, it is very likely that there doesn't exist a unique Nash equilibrium. On the contrary, when the cost function is convex, there exists a unique equilibrium output in most cases. Usually the decreasing marginal cost shows that the firm will benefit from increasing its scale.

Our findings suggest that whether a firm will form as a partnership/cooperative is strongly related to its cost function. When the firms' returns to scale are increasing which is common in most industries, they tend form a corporate organisation that maximises its profit rather than an non-profit organisation. Cooperatives/partnerships usually appear in industries with constant or positive marginal cost. Such as: retailing, farmers' cooperative<sup>6</sup>, law and consulting firms.

#### 4.3.3.1 Examples of Non-Linear Cost Functions

In support of Proposition 7, two examples where two firms compete with each other are shown below:

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<sup>6</sup>Farmers cooperatives have increasing returns to scale in the local market.

First case is when the cost function is convex and here we simply use

$$C(q_i) = cq_i^2$$

as the cost function of individual firm. The objective function of the cooperative firm  $i$  with weight  $\lambda$  is to

$$\max \lambda \frac{(a - b(q_i + q_j))q_i - cq_i^2}{dq_i} + (1 - \lambda)[(a - b(q_i + q_j))q_i - cq_i^2].$$

The best response function of firm  $i$  is

$$q_i = \frac{-(b\lambda - ad + c\lambda + bdq_j + ad\lambda - bdq_j\lambda)}{2bd + 2cd - 2bd\lambda - 2cd\lambda}.$$

And the second order condition holds as  $-b < b + c$ . We could find the symmetric solution for firm  $j$  and there exists an explicit solution in equilibrium:

$$q_{convet}^{\hat{}} = \frac{\frac{\lambda}{d}(-b - c) + (1 - \lambda)a}{(1 - \lambda)d(3b + 2c)}.$$

As long as  $\frac{\lambda}{1 - \lambda} < \frac{ad}{b + c}$ , there exists a unique positive Nash equilibrium that both firms will choose.

The second case is when the cost function is concave and for simple analysis, we assume the cost function for both firms are

$$C(q_i) = c \ln q_i,$$

and the objective function for firm  $i$  is to

$$\max \lambda \frac{(a - b(q_i + q_j))q_i - c \ln q_i}{dq_i} + (1 - \lambda)[(a - b(q_i + q_j))q_i - c \ln q_i].$$



If we check A1 under this condition:

$$(1 - \lambda)(-bq_i + a - b(q_i + q_j) - \frac{c}{q_i}) + \frac{\lambda}{d}(-2b - \frac{c}{q_i^2} + \frac{c \ln q_i}{q_i^2}),$$

A1 requires the first order condition of the objective of this cooperative to be smaller than 0 when  $q_i$  is positive. However, when  $\lambda$  and  $c$  is sufficiently large, this assumption doesn't hold. It is also the reason why there's no explicit solution for the equilibrium output in this case.

#### 4.3.4 Comparative Analysis for the Same Demand Parameters under Quantity and Price Analysis

We have analysed both the situation of quantity and price competition previously and concluded that: either way, cooperative environment will soften the competition, push up the market price and lower the total output.

In this part, we will have a closer look at the comparative analysis of two types of competition using the same demand parameters.

##### 4.3.4.1 Quantity Competition

We assume there are two firms in the market competing with each other and they produce differentiated goods with marginal cost 0. Firm  $i$  and  $j$  have inverse demand curves:

$$p_i = \alpha - \beta q_i - \gamma q_j, \tag{4.19}$$

$$p_j = \alpha - \beta q_j - \gamma q_i, \tag{4.20}$$

respectively.  $\beta > 0$  and  $\beta^2 > \gamma^2$  which implies the output of one firms is more sensitive to its own market price than the price of another firm. The objective function of the firm is to:

$$\max \lambda \frac{(\alpha - \beta q_i - \gamma q_j)q_i}{dq_i} + (1 - \lambda)[(\alpha - \beta q_i - \gamma q_j)q_i].$$

Take the FOC of the objective function, and we could find the best response function of firm  $i$ . Also similar for firm  $j$  due to the symmetry. The equilibrium output in quantity competition is:

$$q_{\hat{cournot}} = \frac{\alpha}{2\beta + \gamma} - \frac{\lambda\beta}{d(1 - \lambda)(2\beta + \gamma)}.$$

#### 4.3.4.2 Price Competition

In the price competition, the system of inverse demand function given by (19) and (20) is equivalent to the following pair of demand functions:

$$q_i = a - bp_i + mp_j, \quad (4.21)$$

$$q_j = a - bp_j + mp_i, \quad (4.22)$$

where  $a = \frac{\alpha(\beta - \gamma)}{\beta^2 - \gamma^2}$ ,  $b = \frac{\beta}{\beta^2 - \gamma^2}$ ,  $m = \frac{\gamma}{\beta^2 - \gamma^2}$ . The objective function of the firm is to:

$$\max \lambda \frac{(p_i - c)(a - bp_i + mp_j)}{dq_i} + (1 - \lambda)[(p_i - c)(a - bp_i + mp_j)].$$

If both firms try to maximise its objective function, we could find the equilibrium price:

$$p_{\hat{bertrand}} = \frac{\alpha(\beta - \gamma)}{2\beta - \gamma} + \frac{\lambda(\beta^2 - \gamma^2)}{(1 - \lambda)d(2\beta - \gamma)}.$$

To compare the quantity and market price under same parameter demand function, we could

easily get the market price under quantity competition:

$$p_{\widehat{cournot}} = \frac{2\beta}{2\beta - \gamma} + \frac{\lambda\beta(\alpha + \beta)}{d(1 - \lambda)(2\beta + \gamma)}$$

$$p_{\widehat{cournot}} - p_{\widehat{bertrand}} = \frac{\alpha\gamma^2}{4\beta^2 - \gamma^2} + \frac{\lambda(\beta + \gamma)\gamma^2}{(1 - \lambda)d(4\beta^2 - \gamma^2)} > 0$$

- The market price is higher under quantity competition than price competition when the demand function has same parameter. It shows that even if the form of cooperative will soften the competition under both price and quantity competition, the cooperative under quantity competition will still act softer than in price competition.
- The increase of  $\lambda$  will enlarge the gap between the market price under price and quantity competition. The emphasis placed on the profit per employee will cause the cooperatives' behaviors to deviate from each other depending on whether they are in price or quantity competition.
- The more differentiated the goods are, the smaller the difference between market price. When the prices are independent ( $\gamma = 0$ ), the price is equal to zero.

## 4.4 Conclusion and Further Ideas

This paper looks into an important part in the economy which has been overlooked-non-profit organisations. We borrowed the optimising model to analyse two types of non-profits: cooperatives/partnerships and universities/hospitals. In the model, we assume their objectives are weighted average of profit and profit per employee/quantity. If both firms are assigned the same weight, we can prove that in cooperative/partnership environment, there exists optimal weight planned ahead that could maximise the actual profit of each firm compared to the situation when the firm is a profit maximising firm. This is due to cooperatives/partnerships will produce less than profit maximising firms and there exists a weight  $\lambda$  that allows them to produce monopolist

level to maximise its actual payoff. On the contrary, hospitals/universities will produce more than the profit maximising level, hence making strictly less profit. We could also see the factors other than profit considered as externalities to explain the deviation from profit maximising output.

In addition, we also made extension to the case of price competition, and the case where  $n$  firms are competing in quantity. We find the results are consistent with the duopoly quantity competition case. We also find that whether a firm will form a non-profit firm is highly depending on the shape of the cost function. When the return to scale is increasing, which means the cost function is concave, firms tend to be profit maximising. But when the cost function is linear or convex, we see increasing presence of existence of cooperatives/partnerships.

We noticed that most of the firms that adopted cooperative/partnership as its organisational form are in the industry where the quality of the goods matters and it is only partially observable. Not-for-profit sometimes works as a signal to demonstrate the high quality of the product and service the firm could provide. It would be interesting to look into the existence of not for profit firms from the perspective of information asymmetry in the future.

## Appendix 4.A

$$f'_q(\lambda) = \frac{cd - ad + 4b\lambda + ad\lambda - cd\lambda}{9d^2(\lambda - 1)^3} = \frac{(cd - ad)(1 - \lambda) + 4b\lambda}{9d^2(\lambda - 1)^3}$$

As  $\lambda$  is between  $(0, 1)$ ,  $(\lambda - 1)^3$  is smaller than 0.  $(c - a) < 0$  as we assumed, therefore as the increase of  $\lambda$ ,  $(cd - ad)(1 - \lambda) + 4b\lambda$  starts from  $cd - ad < 0$  when  $\lambda = 0$  and then increase to  $4b\lambda$  when  $\lambda = 1$ . In terms of  $f'(\lambda)$ , it is a monotonic decreasing function that starts with a positive value and then drop to 0, and then below 0. So we could prove the existence of an optimal value of  $\lambda$  that would maximise the actual payoff when it is chosen by both firms. Similar proof for the existence of  $\lambda_p$ .

## Appendix 4.B

To find out the  $\lambda$  that enables cooperatives to perform better than profit maximising firms, we need to guarantee:

$$\begin{aligned} \frac{a - c}{6b} &< \frac{a - c}{3b} - \frac{\lambda}{3d(1 - \lambda)} < \frac{a - c}{3b} \\ 0 < \lambda &< \frac{(a - c)d}{2b + (a - c)d} \end{aligned}$$

## Appendix 4.C

If  $\hat{q} = \hat{q}^*$ ,

$$\frac{a - c}{2bn} = \frac{-\lambda}{d(1 - \lambda)(n + 1)} + \frac{a - c}{b(n + 1)}$$

When  $n \geq 2$ ,  $2n \geq n + 1$ , and because  $\frac{\lambda}{1 - \lambda} > 0$ , we could prove that there exists the optimal  $\lambda$  when we extend the situation to  $n$  firms.

## Appendix 4.D

To satisfy A1:

$$\frac{\partial \Pi_i}{\partial x_i} = (1 - \lambda_i)[-bx_i + a - bX - C'(x_i)] + \frac{\lambda_i}{d}[-2b - \frac{C'(x_i)}{x_i} + \frac{C(x_i)}{x_i^2}] < 0$$

To satisfy A2, when  $\frac{\partial \Pi_i}{\partial x_i} = 0$ ,

$$\frac{\partial \gamma_i}{\partial x_i} = (1 - \lambda_i)[-b - C''(x_i)] + \frac{\lambda_i}{d}[\frac{-C'''(x_i)x_i}{x_i^2} + \frac{2C'(x_i)}{x_i^2} - \frac{2C(x_i)}{x_i^3}] < 0$$

To satisfy A3, when  $\frac{\partial \Pi_i}{\partial x_i} = 0$ ,

$$x_i \frac{\partial \gamma_i}{\partial x_i} + X \frac{\partial \gamma_i}{\partial X} < 0$$

# Bibliography

Anat R Admati, Paul Pfleiderer, and Josef Zechner. Large shareholder activism, risk sharing, and financial market equilibrium. *journal of Political Economy*, 102(6):1097–1130, 1994.

Philippe Aghion and Patrick Bolton. An incomplete contracts approach to financial contracting. *The review of economic Studies*, 59(3):473–494, 1992.

Philippe Aghion and Jean Tirole. Formal and real authority in organizations. *Journal of political economy*, 105(1):1–29, 1997.

Armen A Alchian. Uncertainty, evolution, and economic theory. *The Journal of Political Economy*, pages 211–221, 1950.

Armen A Alchian and Harold Demsetz. Production, information costs, and economic organization. *The American economic review*, 62(5):777–795, 1972.

Franklin Allen, Elena Carletti, and Robert Marquez. Stakeholder capitalism, corporate governance and firm value. *Corporate Governance and Firm Value (September 16, 2009)*. EFA, 2007.

Franklin Allen, Elena Carletti, and Robert Marquez. Stakeholder capitalism, corporate governance and firm value. 2009.

Gregor Andrade, Mark L Mitchell, and Erik Stafford. New evidence and perspectives on mergers. 2001.

- Christine André and Christoph Hermann. Privatization of healthcare in europe. Technical report, Working paper of the CNRS-Paris and FORBA-Vienna, 2010.
- Lucian Arye Bebchuk and Jesse M Fried. Executive compensation as an agency problem. *The Journal of Economic Perspectives*, 17(3):71–92, 2003.
- Jeremy Bacon and James K Brown. Corporate directorship practices: Membership and committees of the board. Conference Board, 1975.
- George P Baker, Michael C Jensen, and Kevin J Murphy. Compensation and incentives: Practice vs. theory. *The journal of Finance*, 43(3):593–616, 1988.
- William J Baumol, William G Bowen, et al. *Performing arts-the economic dilemma: a study of problems common to theater, opera, music and dance*. Gregg Revivals, 1993.
- Lucian Arye Bebchuk and Mark J Roe. A theory of path dependence in corporate ownership and governance. *Stanford law review*, pages 127–170, 1999.
- Avner Ben-Ner. Nonprofit organizations: Why do they exist in market economies. *The economics of nonprofit institutions: Studies in structure and policy*, pages 94–113, 1986.
- George J Benston and Robert L Hagerman. Determinants of bid-asked spreads in the over-the-counter market. *Journal of Financial Economics*, 1(4):353–364, 1974.
- Nittai Bergman, Yaacov Bergman, et al. Ecologies of preferences with envy as an antidote to risk-aversion in bargaining. Technical report, mimeo, The Hebrew University of Jerusalem, 2000.
- Adolf A Berle Jr. For whom corporate managers are trustees: a note. *Harv. L. Rev.*, 45:1365, 1931.
- Marianne Bertrand and Sendhil Mullainathan. Are ceos rewarded for luck? the ones without principals are. *The Quarterly Journal of Economics*, 116(3):901–932, 2001.



- Sanjai Bhagat and Roberta Romano. Event studies and the law: Part ii: Empirical studies of corporate law. *American Law and Economics Review*, 4(2):380–423, 2002.
- Bernard S Black. Shareholder activism and corporate governance in the united states. 1998.
- Bernard S Black and John C Coffee. Hail britannia?: institutional investor behavior under limited regulation. *Michigan Law Review*, 92(7):1997–2087, 1994.
- Tomer Blumkin, Yoram Y Margalioth, and Adi Sharoni. The signaling role of corporate social responsibility. 2014.
- Patrick Bolton, Von Thadden, et al. Blocks, liquidity, and corporate control. *The Journal of Finance*, 53(1):1–25, 1998.
- Werner FM Bondt and Richard Thaler. Does the stock market overreact? *The Journal of finance*, 40(3):793–805, 1985.
- Audra L Boone, Laura Casares Field, Jonathan M Karpoff, and Charu G Raheja. The determinants of corporate board size and composition: An empirical analysis. *Journal of Financial Economics*, 85(1):66–101, 2007.
- James A Brander and Tracy R Lewis. Oligopoly and financial structure: The limited liability effect. *The American Economic Review*, pages 956–970, 1986.
- Richard Brealey, Hayne E Leland, and David H Pyle. Informational asymmetries, financial structure, and financial intermediation. *The journal of Finance*, 32(2):371–387, 1977.
- James A Brickley, James S Linck, and Jeffrey L Coles. What happens to ceos after they retire? new evidence on career concerns, horizon problems, and ceo incentives. *Journal of Financial Economics*, 52(3):341–377, 1999.
- Saeyoung Chang and David Mayers. Managerial vote ownership and shareholder wealth: Evidence from employee stock ownership plans. *Journal of Financial Economics*, 32(1):103–131, 1992.

- Ronald Harry Coase. The problem of social cost. *The journal of Law and Economics*, 56(4): 837–877, 2013.
- Robert Comment and G William Schwert. Poison or placebo? evidence on the deterrence and wealth effects of modern antitakeover measures. *Journal of Financial Economics*, 39(1):3–43, 1995.
- Arnold C Cooper, Carolyn Y Woo, and William C Dunkelberg. Entrepreneurs’ perceived chances for success. *Journal of business venturing*, 3(2):97–108, 1988.
- Richard Cornes, Roger Hartley, et al. The geometry of aggregative games. *University of Nottingham*, 2005.
- Harold Demsetz. Why regulate utilities? *The Journal of Law and Economics*, 11(1):55–65, 1968.
- Mathias Dewatripont and Jean Tirole. A theory of debt and equity: Diversity of securities and manager-shareholder congruence. *The Quarterly Journal of Economics*, 109(4):1027–1054, 1994.
- Kathryn L Dewenter and Vincent A Warther. Dividends, asymmetric information, and agency conflicts: Evidence from a comparison of the dividend policies of japanese and us firms. *The Journal of Finance*, 53(3):879–904, 1998.
- Douglas W Diamond. Financial intermediation and delegated monitoring. *The review of economic studies*, 51(3):393–414, 1984.
- E Merrick Dodd. For whom are corporate managers trustees? *Harvard law review*, 45(7): 1145–1163, 1932.
- Colleen A Dunlavy. Corporate governance in late 19th century europe and the us: the case of shareholder voting rights. *Comparative Corporate Governance. The State of the Art and Emerging Research*, pages 5–40, 1998.

- Timothy Dunne, Mark J Roberts, and Larry Samuelson. Patterns of firm entry and exit in us manufacturing industries. *The RAND journal of Economics*, pages 495–515, 1988.
- Francis Y Edgeworth. La teoria pura del monopolio. *Giornale degli economisti*, pages 13–31, 1897.
- Oliver Falck and Stephan Heblich. Corporate social responsibility: Doing well by doing good. *Business Horizons*, 50(3):247–254, 2007.
- Eugene F Fama and Michael C Jensen. Agency problems and residual claims. *The journal of law & Economics*, 26(2):327–349, 1983.
- Larry Fauver and Michael E Fuerst. Does good corporate governance include employee representation? evidence from german corporate boards. *Journal of Financial Economics*, 82(3):673–710, 2006.
- Chaim Fershtman and Kenneth L Judd. Equilibrium incentives in oligopoly. *The American Economic Review*, pages 927–940, 1987.
- Chaim Fershtman and Yoram Weiss. Why do we care what others think about us? *Economics, values, and organization*, pages 133–50, 1998.
- Julian Franks and Colin Mayer. Hostile takeovers and the correction of managerial failure. *Journal of Financial Economics*, 40(1):163–181, 1996.
- Elmar Gerum and Helmut Wagner. Economics of labor co-determination in view of corporate governance. *Comparative Corporate Governance: The State of the Art and Emerging Research (Oxford University Press, UK)*, pages 341–360, 1998.
- Robert Gibbons and Kevin J Murphy. Relative performance evaluation for chief executive officers. *ILR Review*, 43(3):30–S, 1990.
- Robert Gibbons and Kevin J Murphy. Optimal incentive contracts in the presence of career concerns: Theory and evidence. *Journal of political Economy*, 100(3):468–505, 1992.

Gary Gorton and Frank A Schmid. Universal banking and the performance of german firms. *Journal of Financial Economics*, 58(1):29–80, 2000.

Sanford J Grossman and Oliver D Hart. Takeover bids, the free-rider problem, and the theory of the corporation. *The Bell Journal of Economics*, pages 42–64, 1980.

Sanford J Grossman and Oliver D Hart. The costs and benefits of ownership: A theory of vertical and lateral integration. *Journal of political economy*, 94(4):691–719, 1986.

Werner Güth and Menahem Yaari. An evolutionary approach to explain reciprocal behavior in a simple strategic game. *U. Witt. Explaining Process and Change—Approaches to Evolutionary Economics. Ann Arbor*, pages 23–34, 1992.

Chris Guthrie, Jeffrey J Rachlinski, and Andrew J Wistrich. Inside the judicial mind, 86 *cornell l. Rev*, 777:784, 2001.

Brian J Hall and Jeffrey B Liebman. Are ceos really paid like bureaucrats? *The Quarterly Journal of Economics*, 113(3):653–691, 1998.

Henry Hansmann. The effect of tax exemption and other factors on the market share of nonprofit versus for-profit firms. *National Tax Journal*, pages 71–82, 1987.

Henry Hansmann. The ownership of enterprise harvard university press cambridge. *MA, London Google Scholar*, 1996.

Henry Hansmann and Henry Hansmann. *The ownership of enterprise*. Harvard University Press, 2009.

Henry B Hansmann. The role of nonprofit enterprise. *The Yale law journal*, 89(5):835–901, 1980.

Milton Harris and Artur Raviv. Corporate control contests and capital structure. *Journal of financial Economics*, 20:55–86, 1988.

- Oliver Hart and John Moore. Property rights and the nature of the firm. *Journal of political economy*, 98(6):1119–1158, 1990.
- Oliver Hart and John Moore. The governance of exchanges: members' cooperatives versus outside ownership. *Oxford review of economic policy*, 12(4):53–69, 1996.
- Frank Heflin and Kenneth W Shaw. Blockholder ownership and market liquidity. *Journal of Financial and Quantitative Analysis*, 35(4):621–633, 2000.
- Aviad Heifetz, Chris Shannon, and Yossi Spiegel. The dynamic evolution of preferences. *Economic Theory*, 32(2):251–286, 2007.
- Benjamin E Hermalin and Michael S Weisbach. Endogenously chosen boards of directors and their monitoring of the ceo. *American Economic Review*, pages 96–118, 1998.
- David Hirshleifer and Anjan V Thakor. Managerial performance, boards of directors and takeover bidding. *Journal of Corporate Finance*, 1(1):63–90, 1994.
- Ulrike Hoffmann-Burchardi. *Dual-class shares, initial public offerings and the market for corporate control*. PhD thesis, London School of Economics and Political Science (United Kingdom), 2000.
- Bengt Holmström. Managerial incentive problems: A dynamic perspective. *The review of Economic studies*, 66(1):169–182, 1999.
- Bengt Holmstrom and Steven N Kaplan. Corporate governance and merger activity in the us: Making sense of the 1980s and 1990s. Technical report, National bureau of economic research, 2001.
- Bengt Holmström and Jean Tirole. Market liquidity and performance monitoring. *Journal of Political Economy*, 101(4):678–709, 1993.
- Estelle James and Egon Neuberger. *The university department as a non-profit labor cooperative*. Springer, 1981.

- Michael C Jensen. Agency costs of free cash flow, corporate finance, and takeovers. *The American economic review*, 76(2):323–329, 1986.
- Michael C Jensen. Value maximization, stakeholder theory, and the corporate objective function. *Journal of applied corporate finance*, 14(3):8–21, 2001.
- Michael C Jensen and William H Meckling. Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of financial economics*, 3(4):305–360, 1976.
- Michael C Jensen and Kevin J Murphy. Performance pay and top-management incentives. *Journal of political economy*, 98(2):225–264, 1990.
- Yawen Jiao. Stakeholder welfare and firm value. *Journal of Banking & Finance*, 34(10):2549–2561, 2010.
- Kose John and Yiming Qian. Incentive features in ceo compensation in the banking industry. 2003.
- Mitsuhiro Kaneda and Akihiko Matsui. Do profit maximizers maximize profit? divergence of objective and result in oligopoly. *Unpublished manuscript*, 2003.
- Steven N Kaplan and Per Strömberg. How do venture capitalists choose investments. *Working Paper, University of Chicago*, 121:55–93, 2000.
- David Kelsey and Frank Milne. Market distortions and corporate governance. 2005.
- David Kelsey and Frank Milne. Externalities, monopoly and the objective function of the firm. *Economic Theory*, 29(3):565–589, 2006.
- Jonathan Levin and Steven Tadelis. Profit sharing and the role of professional partnerships. *The Quarterly Journal of Economics*, 120(1):131–171, 2005.
- Michael Magill, Martine Quinzii, and Jean-charles Rochet. A theoretical foundation for the

- stakeholder corporation. Technical report, Discussion paper, electronic copy available at <http://www.econ.ucdavis.edu/faculty/fzquinzi>, 2011.
- Henry G Manne. Mergers and the market for corporate control. *Journal of Political economy*, 73(2):110–120, 1965.
- Wayne H Mikkelson, M Megan Partch, and Kshitij Shah. Ownership and operating performance of companies that go public. *Journal of financial economics*, 44(3):281–307, 1997.
- Merton H Miller and Franco Modigliani. Dividend policy, growth, and the valuation of shares. *the Journal of Business*, 34(4):411–433, 1961.
- Frank Milne. Corporate investment and finance theory in competitive equilibrium. *Economic Record*, 50(4):511–533, 1974.
- Franco Modigliani and Merton H Miller. The cost of capital, corporation finance and the theory of investment. *The American economic review*, pages 261–297, 1958.
- Herve Moulin. Dominance solvability and cournot stability. *Mathematical social sciences*, 7(1): 83–102, 1984.
- J Harold Mulherin and Annette B Poulsen. Proxy contests and corporate change: implications for shareholder wealth. *Journal of Financial Economics*, 47(3):279–313, 1998.
- Stewart C Myers. Determinants of corporate borrowing. *Journal of financial economics*, 5(2): 147–175, 1977.
- Richard Nelson and Michael Krashinsky. Two major issues of public policy: Public policy and organization of supply. *Public subsidy for day care of young children*, pages 32–55, 1973.
- Joseph P Newhouse. Toward a theory of nonprofit institutions: An economic model of a hospital. *The American Economic Review*, 60(1):64–74, 1970.

- Steven Ongena and David C Smith. What determines the number of bank relationships? cross-country evidence. *Journal of Financial Intermediation*, 9(1):26–56, 2000.
- Stuart Oskamp. Overconfidence in case-study judgments. *Journal of Consulting Psychology*, 29(3):261, 1965.
- Marco Pagano and Ailsa Röell. The choice of stock ownership structure: Agency costs, monitoring, and the decision to go public. *The Quarterly Journal of Economics*, 113(1):187–225, 1998.
- Marco Pagano and Paolo F Volpin. The political economy of corporate governance. *The American Economic Review*, 95(4):1005–1030, 2005.
- Mark Pauly and Michael Redisch. The not-for-profit hospital as a physicians' cooperative. *The American Economic Review*, 63(1):87–99, 1973.
- Rafael La Porta, Florencio Lopez-de Silanes, Andrei Shleifer, and Robert W Vishny. Law and finance. *Journal of Political Economy*, 106(6):1113–1155, 1998.
- Michael E Porter. Capital disadvantage: America's failing capital investment system. *Harvard Business Review*, 70(5):65–82, 1992.
- Alex Possajennikov. On the evolutionary stability of altruistic and spiteful preferences. *Journal of Economic Behavior & Organization*, 42(1):125–129, 2000.
- Stephen D Prowse. Institutional investment patterns and corporate financial behavior in the united states and japan. *Journal of Financial Economics*, 27(1):43–66, 1990.
- O Rieckers and G Spindler. Corporate governance: Legal aspects [in:] j. krahnert, r. schmidt (eds.), *the german financial system*, 2004.
- Roberta Romano. The shareholder suit: litigation without foundation? *Journal of Law, Economics, & Organization*, 7(1):55–87, 1991.



- Eugene V Rostow. To whom and for what ends is corporate management responsible. *The corporation in modern society*, 4, 1959.
- J Edward Russo and Paul JH Schoemaker. Managing overconfidence. *Sloan Management Review*, 33(2):7–17, 1992.
- Larry Samuelson and Jianbo Zhang. Evolutionary stability in asymmetric games. *Journal of economic theory*, 57(2):363–391, 1992.
- David Scharfstein. Product-market competition and managerial slack. *The RAND Journal of Economics*, pages 147–155, 1988.
- Thomas C Schelling. 1960. the strategy of conflict. *Cambridge, Mass*, 1960.
- G William Schwert. Hostility in takeovers: in the eyes of the beholder? *The Journal of Finance*, 55(6):2599–2640, 2000.
- Carl Shapiro. Theories of oligopoly behavior. *Handbook of industrial organization*, 1:329–414, 1989.
- Roy Shin. Strategies for economic development under decentralization: a transformation of the political economy. *International Journal of Public Administration*, 24(10):1083–1102, 2001.
- Andrei Shleifer and Lawrence H Summers. Breach of trust in hostile takeovers. In *Corporate takeovers: Causes and consequences*, pages 33–68. University of Chicago Press, 1988.
- Andrei Shleifer and Robert W Vishny. Management entrenchment: The case of manager-specific investments. *Journal of financial economics*, 25(1):123–139, 1989.
- Andrei Shleifer and Robert W Vishny. A survey of corporate governance. *The journal of finance*, 52(2):737–783, 1997.
- Elsbeth Steenland, Jan Leer, Hans van Houwelingen, Wendy J Post, Wilbert B van den Hout, Job Kievit, Hanneke de Haes, Hendrik Martijn, Bing Oei, Ernest Vonk, et al. The effect of a

- single fraction compared to multiple fractions on painful bone metastases: a global analysis of the dutch bone metastasis study. *Radiotherapy and Oncology*, 52(2):101–109, 1999.
- Jeremy C Stein. Takeover threats and managerial myopia. *Journal of Political Economy*, 96(1): 61–80, 1988.
- Ola Svenson. Are we all less risky and more skillful than our fellow drivers? *Acta Psychologica*, 47(2):143–148, 1981.
- Shelley E Taylor and Jonathon D Brown. Illusion and well-being: a social psychological perspective on mental health. *Psychological bulletin*, 103(2):193, 1988.
- Richard H Tilly. Banking institutions in historical and comparative perspective: Germany, great britain and the united states in the nineteenth and early twentieth century. *Journal of Institutional and Theoretical Economics (JITE)/Zeitschrift für die gesamte Staatswissenschaft*, pages 189–209, 1989.
- Jean Tirole. *The theory of industrial organization*. MIT press, 1988.
- Gordon Tullock. Information without profit. *Public choice*, 1(1):141–159, 1966.
- John Vickers. Delegation and the theory of the firm. *The Economic Journal*, 95:138–147, 1985.
- Baoshu Wang et al. China’s new company law and securities law: An overview and assessment. *Australian Journal of Corporate Law*, 19(2):229–242, 2006.
- HT Warshaw. The distribution of corporate ownership in the united states. *The Quarterly Journal of Economics*, 39(1):15–38, 1924.
- Neil D Weinstein. Unrealistic optimism about future life events. *Journal of personality and social psychology*, 39(5):806, 1980.
- Burton Allen Weisbrod. *Toward a theory of the voluntary non-profit sector in a three-sector economy*. Institute for Research on Poverty, University of Wisconsin–Madison, 1975.

Oliver E Williamson. The economics of governance: framework and implications. *Zeitschrift für die gesamte Staatswissenschaft/Journal of Institutional and Theoretical Economics*, (H. 1):195–223, 1984.

Erkan Yalcin and Thomas I Renström. Endogenous firm objectives. *Journal of Public Economic Theory*, 5(1):67–94, 2003.

Masaru Yoshimori. Whose company is it? the concept of the corporation in japan and the west. *Long Range Planning*, 28(4):2–44, 1995.

Luigi Zingales. In search of new foundations. *The journal of Finance*, 55(4):1623–1653, 2000.