

# Delegation games

Citation for published version (APA):

Akbulut Merchant, C. (2016). *Delegation games: analysis and applications*. [Doctoral Thesis, Maastricht University]. Datawyse / Universitaire Pers Maastricht. <https://doi.org/10.26481/dis.20160330ca>

## Document status and date:

Published: 01/01/2016

## DOI:

[10.26481/dis.20160330ca](https://doi.org/10.26481/dis.20160330ca)

## Document Version:

Publisher's PDF, also known as Version of record

## Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

## General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

[www.umlib.nl/taverne-license](http://www.umlib.nl/taverne-license)

## Take down policy

If you believe that this document breaches copyright please contact us at:

[repository@maastrichtuniversity.nl](mailto:repository@maastrichtuniversity.nl)

providing details and we will investigate your claim.

# Summary

Delegation is the situation in which a person or a group (generally a superior) assigns responsibility and authority to another person or a group (generally a subordinate)<sup>1</sup>. The usage of delegation can be optional, a necessity or an obligation. As an instance, small firms can be simply owner-led and so do not have to delegate managers. Large enterprises have boards which have to delegate managers due to legal, practical and administrative reasons. Indeed, in areas where specific knowledge and expertise are required, delegation is inevitable. However, no matter what the reason is, the good performance of managers and the success of companies are vital elements for firms. Therefore, organizations and researchers always ask: How can we increase the profits of a company? Is there a way to improve the performance of managers? How can a company fulfill certain aims (such as high sales, high market share etc.)? At this point managerial incentives play a key role. As indicated by Armstrong et al. (2007), managerial bonuses can be a way of increasing the motivation, commitment and engagement of employees; moreover, they are a way of realizing certain aims. Besides that, managerial incentives can provide a way of being a winner, a leader in market competition. As an example, take a two-firm industry where one firm is only owner-led and the other firm employs a manager with a reward system based on the firm's sales. Both firms produce homogeneous products and compete à la Cournot. Basu (1995) (by using game theoretic tools) proved that the firm that benefits from the managerial bonuses based on sales would be the winner in the market. Irwin (1991) demonstrated em-

---

<sup>1</sup>Paraphrased definition of Rudani (2013), pg. 277.

pirically that this was the case when the Dutch East India Company beat its British rival in the pepper trade in the 17<sup>th</sup> Century. More examples can be given<sup>2</sup>.

From a game theoretical view, delegation is a strategic tool which can bring pre-commitment, profit, utility, gain and welfare if it is employed properly. The strategic use of delegation was first mentioned by Nobel Prize Laureate Thomas Schelling (1960) in his seminal work “*Strategy and Conflict*”. However, Vickers (1985) was the first researcher who examined the strategic usage of delegation in a mathematical model. Later, Fershtman and Judd (1987) and Sklivas (1987) elaborated on the work of Vickers (1985). In the literature (and in this thesis), their game set-up is referred to as the VFJS model. It is implemented to investigate the effects of strategic delegation on market competition.

In this thesis, we use the VFJS model. We assume that firm owners in a duopoly each hire a manager with a publicly observable contract which is not renegotiable. The remuneration of a manager consists of a fixed part and a bonus (incentive). The bonus is proportional to

$$u_i = \pi_i + w_i B_i.$$

Here,  $\pi_i$  is the profit of firm  $i$ ,  $w_i$  (which is a number) is the *contractual weight* chosen by owner  $i$ , and  $B_i$  is the bonus (incentive) type of manager  $i$ .  $B_i$  can be based on sales, revenues, relative profit or market share. The core of this model is a two-stage game. In the first stage (*contract stage*), the owners choose the contractual weights simultaneously and independently. In the second stage (*market or competition stage*), knowing the results of the first stage, the managers decide on output levels in a Cournot competition simultaneously and independently. Owners aim to maximize their own companies’ profits when they decide on the contractual weight. In contrast, managers aim to maximize their own bonus (i.e.,  $u_i$ ) when they choose output levels. In Chapter 1, we discuss the plausible reasons behind the assumptions of the model set-up.

Using the model set-up of VFJS, this dissertation considers managerial

---

<sup>2</sup>See also the paper of Sengul et al. (2012).

delegation and bonus systems from a game theoretical perspective. It consists of five research projects which are explained in Chapters 2 to 6.

In Chapter 2, we deal with a duopoly where both firms design contracts based on a relative profit bonus system for their own manager. We assume that both firms have different marginal costs. First, we consider the case where firms produce homogeneous goods. We apply the usual solution method which is based on *backward induction*. We show that there is no interior equilibrium in terms of contractual weights, however there is a unique corner equilibrium. We demonstrate that in the equilibrium the efficient firm encourages its own manager to act aggressively by giving the extreme contractual weight (emphasis) on the rival firm's profit. In contrast, the less efficient firm behaves as if it is owner-led. Furthermore, we show that in the equilibrium, even a small difference between marginal costs would make the efficient firm outperform its rival. We extend this analysis by including product differentiation in the model. We show that for strong substitute products, we still reach the aforementioned unique corner equilibrium. In the literature, Miller and Pazgal (2005) examined the same problem for weak substitute and complement products. They found a unique interior equilibrium. In this regard, our first contribution is to enrich the analysis of Miller and Pazgal (2005). Furthermore, we make a comparison between this type of duopoly and a duopoly where all firms are owner-led in terms of Consumer Surplus, Social Welfare and profits. We find that for all product differentiation levels, Consumer Surplus and Social welfare are higher in this manager-led duopoly than the ones in an owner-led duopoly.

In Chapter 3, we study a duopoly where both firm owners employ market share incentives for their own managers' remuneration scheme. We assume that both firms have different marginal costs. Jansen et al. (2007) computed the unique equilibrium for this duopoly where marginal costs are equal. Therefore, we investigate what would happen if there is marginal cost difference. In order to answer this question, we implement the general solution method which is based on *backward induction*. We calculate all equilibrium levels regarding all possible marginal cost differences between firms. We show that for a specific threshold level of the marginal costs' dif-

ference, the efficient firm achieves an (endogenous) Stackelberg Leadership position.

In Chapter 4, we introduce a new solution technique which we call the *geometric approach*. According to the description of Gibbons (1992), the model set-up of VFJS is a dynamic two-stage complete but imperfect information game<sup>3</sup>. As Gibbons (1992) notes, in order to solve this type of game, an analytical approach based on *backward induction* is used. In Chapters 2 and 3, we apply this method. In Chapter 4, we introduce a new solution approach named *geometric approach* to the literature. We show that our new approach fully invokes the idea of *backwards induction*, but enables us to restrict our equilibrium analysis to the quantity plane. In this regard, we demonstrate that this new approach makes the equilibrium computations easier, elegant, more intuitive and shorter. By implementing this new method, we first verify the already known results in the literature. We also apply the new method to the problems which we investigate in Chapters 2 and 3. By doing this, we not only double-check our findings but also see how this method shortens the equilibrium finding process. By considering the literature findings, for different marginal costs, duopolies where at least one firm implements a market share incentive and duopolies where at least one firm implements a relative profit incentive were not studied. In Chapter 4, we fill this lack in the literature. Moreover, we determine the optimal managerial bonus system for owners when there is cost heterogeneity. Therefore, we enrich the analysis of Jansen et al. (2009). In this chapter, we only deal with different marginal costs. However, our technique can also be applied to duopolies where firms have equal marginal costs. The reason why we disregard equal marginal costs is due to the existing findings as in the literature, all possible duopolies vis-à-vis equal marginal costs were already elaborated.

In Chapter 5, we introduce a new managerial bonus type to the literature by providing an economic and intuitive reasoning. We demonstrate the correspondence between this new incentive type and the incumbent relative profit incentive. Therefore, we call it the *modified relative profit* ( $R^m$ ) incentive. We examine how the  $R^m$  bonus interacts with all types

---

<sup>3</sup>See Section 2.2.A in the book of Gibbons (1992).

of incentives under (un)equal marginal costs. As a result, we determine the equilibrium levels of all possible duopolies in which at least one firm employs the  $R^m$  bonus. As to be expected, we make profit comparisons and include this incentive in the search of an optimal bonus for owners.

In Chapter 6, we explore the implications of strategic delegation on international trade: specifically on *strategic trade theory*. To do this, in the same chapter (in the introduction part), we first discuss several trade theories which support either free trade and/or protectionism. At the same time, we describe the well-known *strategic trade theory* proposed by Brander and Spencer (1984, 1985). Strategic trade theory involves the use of tariffs and subsidies to improve social welfare and trade revenues. In our research, we are interested in tariffs, therefore we consider the well-known *optimal tariff model* of Brander and Spencer (1984). Das (1997) is the first researcher who imposed strategic delegation into the optimal tariff model of Brander and Spencer (1984). By working on the model set-up of Das, we investigate how managerial incentives affect the levels of tariffs and home country's welfare. In our analysis we incorporate all managerial incentives (including the new one). We determine which incentive systems and what kind of duopolies provide lower tariffs but higher domestic welfare. In addition, we find the optimal incentive system for owners under tariff policies. We show that delegation could make a balance between free trade and protectionism. Furthermore, in order to increase social welfare in international trade, we suggest the necessity of strategic delegation in addition to tariffs.

This dissertation explores managerial remuneration schemes and their impact on business, market, social welfare and international trade by using game theory. It would be interesting to see the extensions, applications and empirical implication of this research.