Studies on Dutch Housing Corporations

Efficiency, Bailout System Effectiveness, and Rent Setting Behaviour

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Publisher: University of Groningen, Groningen, The Netherlands

Printer: Ipskamp Drukkers B.V.

ISBN: 978-90-367-9095-6 / 978-90-367-9094-9 (Ebook)

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Studies on Dutch Housing Corporations

Efficiency, Bailout System Effectiveness, and Rent Setting Behaviour

Proefschrift

ter verkrijging van de graad van doctor aan de
Rijksuniversiteit Groningen
op gezag van de
rector magnificus prof. dr. E. Sterken
en volgens besluit van het College voor Promoties.

De openbare verdediging zal plaatsvinden op

donderdag 15 september 2016 om 11.00 uur

door

Jacob Veenstra

geboren op 5 juni 1987
te Smallingerland

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Acknowledgements

It is curious at the least that it often takes an award-win or a dissertation to express gratitude to persons who deserve it all year through. While writing this, I realize that this is of course not a strict requirement as everybody is free to express as many 'thank yous' as one sees fit. Therefore, it is my own shortcoming to have waited for so long.

The persons I would like to thank could be classified into two groups; those that have supported me in writing the thesis and assisted with invaluable comments in order to improve the end-product, and those who make life itself so valuable. Of course, there is considerable overlap between the two groups, but let's say that without the former this thesis would never have been written, and without the second, I would never have started writing in the first place.

To make a start, I would like to express my great gratitude to my supervisors, Maarten Allers and Hans de Groot. Maarten, you guided me through the first real steps in academic life. You were always one door-knock away to discuss things, and I must say, your analytical ability is still striking to me. Hans, I feel very sorry that you did not get the opportunity to accompany me during the final steps of this process. Despite your unfortunate circumstances, you have not desisted from reading my manuscript with great care and providing useful comments, not being satisfied with a partial or quick solution. This is truly admirable.

My co-authors, Rik Koolma and Bernard van Ommeren have provided a tremendous contribution to this dissertation. Rik, you introduced me to the social housing sector and informed me about all ins and outs of this unique, sometimes opaque sector. Bernard, our conversations really helped me in my writing process, I hope this is mutual. Both Bernard and Rik are champions in 'being available', as if answering my e-mails was their primary task.

I would also like to thank the reading committee; Paul Elhorst, Jos Blank and George de Kam. Each of you shed light from your perspective, which is extremely important for this thesis.

Many thanks go to my other (sometimes former) COELO colleagues, Corine, Tom, Klaas, Bieuwe, Lieneke and Marloes. Bieuwe, we walked nearly exactly the same academic road together for four years, following the same courses, doing similar analyses, and of course sharing a room. Your support and understated humour have provided much to me. I wish you

all the best for the future. Working on other projects within COELO, often unrelated to this thesis, provided exactly the variety that I needed to keep my mind fresh.

The assistance of the secretaries, Lies Baars, Marianne Fry, Martine Geerlings-Koolman, Kimberley Vudinh, Grietje Pol and Ellie Jelsema was of great value. Also, many thanks to everybody working at the SOM-office for being available, often even during holidays. All other colleagues within the Duisenberg building, thanks a lot. I still enjoy the nice atmosphere in the building, which I think should be mainly attributed to those inhabiting it. Saying that a person belongs to the furniture of the Duisenberg building should, to my opinion, be considered a compliment.

Finally, and now we reach the second group of persons, many thanks go to my family and friends. Their great contribution mainly lies in the capability of letting me forget about work, which is sometimes the most productive thing to do. Therefore I end with a big thank you to my mom (Joukje), dad (Gerrit), sisters (Coby and Annet), brother (Pieter), all other family members and friends (in particular Evert, Geert, Jitske, Johan, Lieuwe and Richard). Let's keep on carrying each other.

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Chapter 1

Introduction: The Dutch Housing Market and the Role of Housing Corporations

1.1 Introduction

Few markets are as complex as the housing market. A combination of multiple market failures makes it difficult to reach a satisfactory equilibrium, despite (or because of!) extensive government intervention. Moreover, because problems within the market and the reaction of the government are often country specific, outcomes of research cannot easily be generalized. Therefore, when studying the housing market in a certain country, one has to take into account the specific institutional and sociological setting (Gilderbloom and Appelbaum, 1987). This dissertation focuses on the behaviour of the institutions that are responsible for providing social housing services in the Netherlands; housing corporations.[1]

Before going into the details of this dissertation, we will start with a brief introduction on the arguments for government intervention in housing markets, and then turn to the institutional design of the Dutch housing market. Next, the structure of this dissertation is presented.

1.1.1 Failures of the housing market

There are many reasons why housing markets may fail to reach a satisfactory equilibrium by themselves. Several obstacles towards the social optimum are present (see e.g., Gilderbloom and Appelbaum, 1987; Ménard, 2009; SER, 2010). The most often mentioned causes of market failure are listed below.[2]

- It is likely that there is information asymmetry between suppliers and demanders (for example, the supplier of a house knows more about concealed damages).
- Housing involves external effects. For example, if one household incurs costs to improve livability in a neighbourhood, this will have benefits on other households as well. These benefits are not incorporated by the household that incurs the costs. This leads livability activities to be undersupplied (i.e., free riding). On the other hand, if more households move into a neighbourhood, this may lead to congestion and less open space, yielding a negative externality. Moreover, dwellings in entirely different architectural styles may be built next to each other which may lead to unsightly neighbourhoods.

[1] The terms housing association or housing society are sometimes used as well. In judicial terms, corporations are either foundations or associations. Throughout this book, we will use the term (housing) corporation.
[2] Note that the final three reasons are normative judgments (about fairness) rather than true market failures, often used to justify government intervention in the housing market.

- Often, there is imperfect competition among suppliers, providing possibilities to exploit market power. This leads to lower supply and higher prices.
- Matching supply and demand of housing involves search costs (Ménard, 2009). This leads to the possible existence of multiple equilibria. Moreover, housing is a rigid and heterogeneous good so that substitutes are not always available.
- Housing suppliers may pursue cherry-picking which means that the selection of which tenants are provided a dwelling is not only based on their bidding, but on the 'riskiness' of the tenant as well (Priemus, 2003).
- Housing may be qualified as a merit good which is not valued adequately by consumers.
- The equilibrium on the housing market may be unsatisfactorily from a social point of view, i.e., the price of housing (of a socially desirable quality) may be so high that some people cannot afford it (commodity egalitarianism).

Because of these reasons, market equilibrium in the housing market is likely to be suboptimal. Without intervention, demand and supply of housing may be lower than socially optimal, prices too high and neighbourhoods may become unattractive, due to, e.g., congestion.

1.1.2 Government intervention

In theory, a combination of market failures may require a combination of interventions by the government. The Dutch government intervenes both on the demand and the supply side of the market. The most important interventions are:

- **Physical planning and environmental policies.**
  All areas in the Netherlands have been assigned allocation plans that indicate for what purposes the land may be used. In practice, this means that building is only allowed in places which have been designated as housing areas. This policy is conducted in order to take external effects into account (for example congestion).
- **Fiscal regulations.**
  Interest paid over mortgages can be deducted from taxable income so as to encourage owner-occupied housing. Households in owner-occupied houses are assumed to take better care of their neighbourhoods. In this way, this policy deals with externalities.

- **Maximum rents.**
  Social dwellings (those with a rent level below a certain threshold) have been assigned maximum rents so as to ensure affordability for low income groups. Rent increases have been capped as well.
- **Demand subsidies.**
  Households renting a social dwelling may be provided rent subsidies if their income is sufficiently low. This should stimulate demand and increase affordability.
- **Housing corporations.**
  Nearly all social housing in the Netherlands is provided by non-profit organizations, so-called housing corporations. Although these corporations have been established voluntarily, they have had strong ties with the government for a long-time, both financially and operationally. In effect, this means that housing supply is supported with public resources (i.e., supply subsidies). In this way, corporations can undertake investments that would not be financially rewarding for purely private parties.

The problem with a mix of intervention instruments is that the solution to one problem may impose yet another problem. For example, supply of housing is determined to a large extent by government policies on physical planning. This may lead to reduced supply and, accordingly, higher prices. This, in turn, calls for (extra) supply subsidies. Therefore, according to SER (2010), it is by no means certain that government intervention will succeed in solving all problems and providing the most desirable outcome. That is, even if markets fail, who ensures that the government will do better? Multiple government interventions have been implemented, making the situation even more complicated (Buiter et al., 2006) and not necessarily leading to a reduction in rent levels (Ménard, 2009). To reach a satisfactory equilibrium therefore, market failure has to be weighed against government failure.

As noted, in the Netherlands, social housing is in the hands of housing corporations. This means that, besides government and market parties, there is a third type of organization active in the playing field: the voluntary (or non-profit) organization. This imposes yet another complicating factor. For a long-time, research on the voluntary sector has been neglected (Salamon, 1987) but this is steadily changing.

The government assumes that housing corporations can correct for the shortage of housing supply by making investments that are not profitable for private entrepreneurs. They can do so because (1) they have received government subsidies, (2) they enjoy favourable borrowing

conditions because most of their loans and guaranteed, and (3) they don't have stakeholders that demand financial returns. Also, since corporations originally were founded as voluntarily organizations, it may be assumed that they (still) are led by altruistic motives. Finally, since supply is concentrated (a corporation often possesses multiple houses in the same neighbourhoods), corporations are able to influence livability and keep neighbourhoods attractive. All in all, this should lead to extended supply of decent and affordable housing services.

The Dutch housing market, with such a dominant role for housing corporations is unique from an international perspective. In most other countries, social housing is also supplied by municipal housing companies, cooperative associations and private parties (De Jong and Van der Moolen, 2014). This dissertation will focus on the supply side of the (social) housing market, by investigating the behaviour of housing corporations in the Netherlands. The following section briefly discusses the role of Dutch housing corporations.

1.2 The role of housing corporations

Although legally, housing corporations are privately governed organizations, they are rooted in a long history of government involvement. They can therefore be classified as semi-public (CPB, 2013a) or hybrid (Blessing, 2012) organizations as they operate in the midfield between government, society and market.

Whether or not the Dutch institutional setting with such a dominant role for corporations is a panacea for the problems on the social housing market has been subject of debate for a long time. Although most authors probably agree that the quality of social dwellings is more than satisfactory in the Netherlands, and that corporations are quite effective in fulfilling their task, there also appear to be severe problems (Priemus, 2003). The most often mentioned issue is that corporations lack an incentive to operate efficiently as they are not allowed to appropriate their profits. This concern has become stronger since a few corporations have been involved in incidents of mismanagement, integrity violations, and losses on high risk-projects. According to De Jong (2013), three types of incidents can be distinguished. First of all, some corporations engaged in investments that were too risky. In a few cases, investments were made in non-social housing projects, such as the case of Woonbron (Rotterdam), which invested in a former cruise ship with the idea to renovate it and turn it into a centre for commercial activities (such as congresses) in combination with a 'learning centre' for

students. The costs of renovation proved to be much higher than expected, so that a loss of 227 million euros resulted. Secondly, there has been financial mismanagement and speculation. The most prominent example is the case of Vestia (Rotterdam), which suffered major losses on its derivatives portfolio. This portfolio had become so complicated that nobody was able to interpret the risks properly. Because Vestia was the largest Dutch housing corporation with nearly 90,000 dwellings, and the losses amounted to about 2 billion euros, it is not surprising that this case led to enormous political attention. Thirdly, fraud and self-enrichment has occurred in the corporation sector, e.g. at SGBB Hoofddorp, which saw its former director imprisoned.[3]

Apparently, neither the institutional structure, nor the supervisory parties were capable of preventing these incidents from happening. This led to a widespread belief that something is fundamentally wrong within the sector. Therefore, the Dutch parliament conducted a parliamentary inquiry (Dutch Parliament, 2014) concluding that the current institutional setting gives too much scope for inappropriate behaviour.

Whether the incidents are representative of the sector as a whole is questionable. In recent decades, a lot has been written about the behaviour of corporations. Many authors have expressed their worries about the Dutch situation. The main concern is that corporations are relatively insensitive to both the market and the government, creating possibilities of moral hazard. However, for a long time, empirical research on housing corporations was almost non-existent so that opinions were often based on anecdotal evidence. In the most recent years, however, the pile of empirical work is growing steadily. This dissertation aims to give an empirical foundation to several important issues that corporations have to deal with.

The dissertation focuses on three main subjects that are deemed relevant in the corporation sector:

1. The first part of the dissertation attempts to measure operational efficiency of housing corporations. It is often noted that corporations should be able to reduce costs significantly. Figures of thirty percent potential cost reduction are commonly mentioned, but lack an empirical foundation. Although it will take up more time and combined efforts to come to a ‘perfect’ measure of efficiency, this dissertation provides a thorough empirical approach to approximate efficiency as closely as possible (chaper 2). Accord-

[3] For an overview of the most important incidents, see De Jong (2013) and Dutch Parliament (2014).

ingly, we use the results of this exercise to study the relationship between scale, mergers and efficiency (chapter 3).

2. Secondly, we investigate the financing costs of corporations focusing on the bailout clause that guarantees the bulk of corporation loans (chapter 4).
3. Thirdly, the rent setting behaviour of corporations is discussed answering the question what determines changes in rents (chapter 5).

Figure 1.1 shows the production and decision making process of a housing corporation in a simplified way. The heart of this process consists of two stages. First, corporations manage and improve their housing stock by buying, selling, building, demolishing or improving houses. Next, this stock is used to house tenants. On the financial side, corporations can use either internal or external funding. That is, they have to decide how much to borrow in order to make investments. Borrowing money is relatively cheap for corporations because most of their debt is guaranteed. Finally, corporations will have to decide on the rent levels they demand from their tenants. Hereby, they will have to take into account legislation concerning maximum rent levels and increases, as well as market circumstances and, probably, the behaviour of other corporations. The blue rectangles denote the four stages at which corporations have to make decisions. These are the subjects of our research. The following section will briefly summarize these parts.

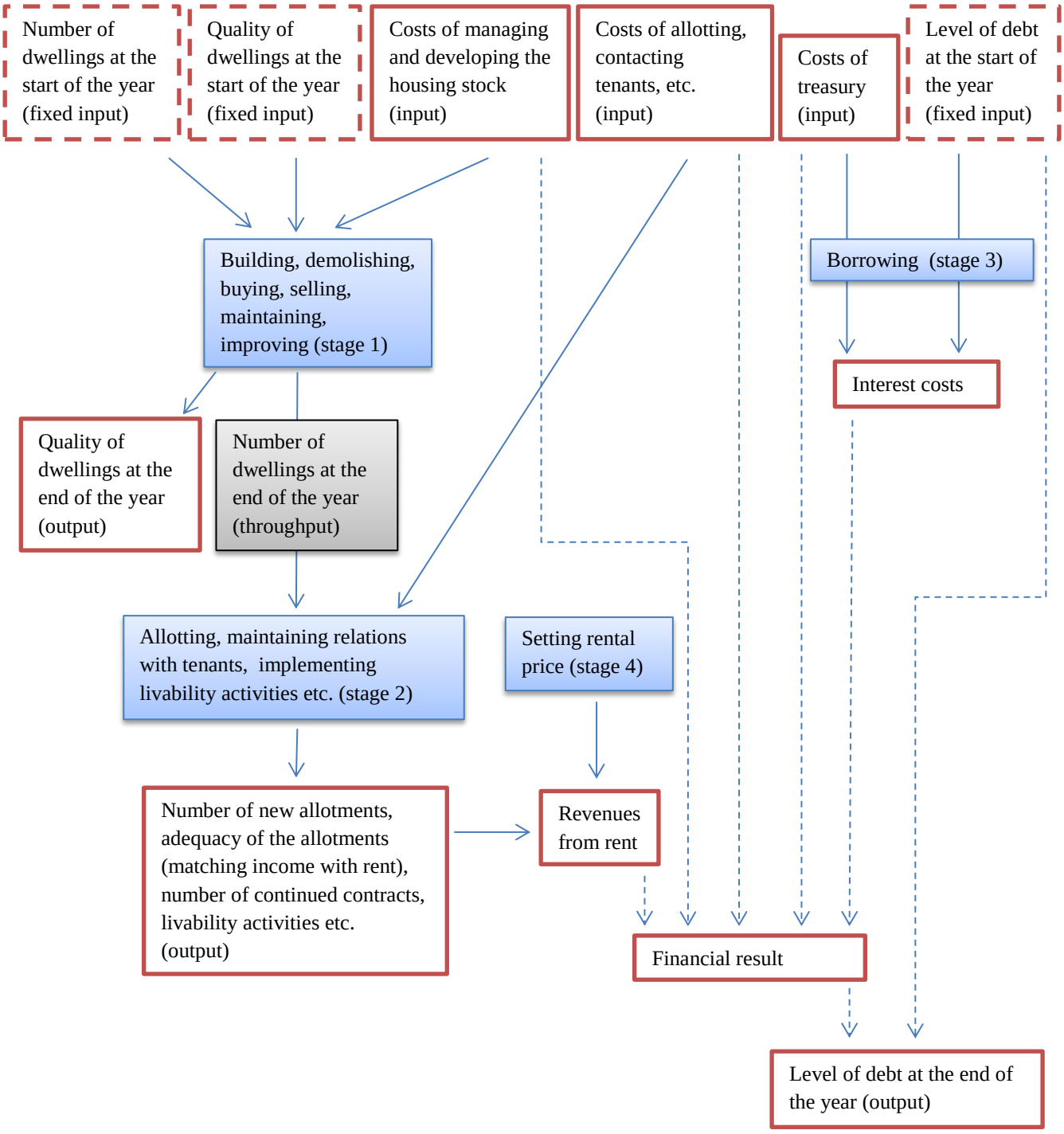
1.2.1 Operational efficiency (stage 1 and 2)

Efficiency measurement within the (semi-)public sector faces several pitfalls and obstacles. At the heart of the empirical problem lies the question of what the organizations under consideration actually produce (i.e., to what purposes do they devote their time and energy?). Because corporations have considerable autonomy in choosing their operations, it is not straightforward to determine what their inputs and – especially – their outputs are. Even if we would reach consensus about this issue, the question is how to give weights to them. This is not straightforward since market prices are absent. Finally, the question is whether appropriate measures of our preferred inputs and outputs are available. Chapter 2 presents a framework of how to deal with these issues and actually implements several models of efficiency measurement.

Chapter 3 investigates the effect of scale increases, and especially mergers, on efficiency. Since the ties between government and corporations were loosened in the mid-nineties of the previous century, a merger boom has ensued in the corporation sector (Crooijmans, 2015).

First of all, we investigate which corporations operate under economies or diseconomies of scale, thereby answering the question what scale level is optimal within the social housing sector. Secondly, a scale increase, and especially a merger, may reduce organizational slack if it leads to the reconsideration of existing practices after the merger. Chapter 3 presents a framework to disentangle these two effects.

Figure 1.1. Production and decision making process of a housing corporation.



1.2.2 The bailout clause (stage 3)

One of the main advantages of corporations over purely private parties is that the bulk of corporation loans is guaranteed by means of an explicit guarantee scheme. This bailout clause is implemented in order to communicate to banks that lending to corporations can be considered to be a risk-free affair. This should minimize interest costs to corporations, leaving more resources available for investment in social housing projects. Chapter 4 empirically investigates the effects of the bailout clause, making use of a unique micro dataset of corporation loans provided by BNG Bank, the largest public sector bank in the Netherlands.

As this dataset comprises both guaranteed and unguaranteed loans, we are able to investigate whether the interest rate between these two groups of loans differs. In this way, we test the credibility of the bailout clause. We also investigate whether corporations succeed in paying the risk-free interest rate on their guaranteed loans, or still pay a premium despite the bailout clause.

1.2.3 Rent setting behaviour (stage 4)

Although corporations have a high degree of autonomy, they do have to take into account the legislation concerning social rents. Rent levels, as well as rent increases, on social dwellings are capped. Only if the quality of a dwelling improves, or if a household leaves a dwelling, an extra rent increase is allowed. Chapter 5 deals with the question to what extent rent levels differ between corporations and whether we can explain differences in rent setting behaviour, by focusing on two main issues. First of all, we study whether quality improvements lead to an equivalent increase in rents. Secondly, we investigate whether corporations mimic the rent increases of neighbouring corporations.

Chapter 2

On the Efficiency of Dutch Housing Corporations[1]

[1] This chapter is based on Veenstra et al. (2013).

2.1 Introduction

The Dutch social housing market is dominated by housing corporations; privately governed organizations executing a set of public tasks. In 2012, 2.2 million dwellings were in the hands of corporations. This boils down to nearly 71 percent of the rental housing stock or one third of the total housing stock in the Netherlands.[2] From an international viewpoint, these figures are remarkably large. According to Priemus (2002), no country in the European Union even comes close to this.

Whitehead and Scanlon (2007) and De Jong and Van der Moolen (2014) show that among a subset of European countries, the Netherlands has the highest percentage of social housing. Social (or public) housing is important in other countries too: it dominates the rental housing markets of England, Austria and Denmark. For other countries, such as Ireland, Germany and Hungary, the social housing market plays only a modest role (Whitehead and Scanlon, 2007). These figures demonstrate that the performance of Dutch housing corporations is of vital importance to the Dutch housing market and, therefore, society.

The Dutch social housing sector currently finds itself in dire circumstances, however. On the one hand, the sector has acquired a bad reputation, because of a few pronounced incidents throughout the last years. There has been a sequence of reports of integrity violations. Furthermore, decision failures have caused losses of billions of euros on high-risk projects and financial derivatives. This led the Dutch Parliament to start a parliamentary inquiry in 2013. Recently, the parliamentary committee concluded that the Dutch government has failed to establish public control of the efficiency of the housing corporations (Dutch Parliament, 2014).

Dutch Parliament (2014) also concluded that although many corporations work hard and act responsibly, the fact that so many incidents took place means that something is fundamentally wrong with the current institutional design. In the long run, the inquiry commission argues, when thinking about how to change the (social) housing market, all options should be considered, including organizing the market via purely private parties, via direct government involvement or via tenants themselves. In the short run, given the current situation, it is necessary to reshape supervision and to establish a change in cultures, according to the commission.

[2] Sources: CorpoData and Statistics Netherlands (CBS).

To increase efficiency, the Dutch central government has formulated the explicit goal that operational expenditures should remain constant for at least four years (Ministry of National and Kingdom Affairs, 2013a). Also, the call for a reform in supervision of the corporations finds increasing response (Hoekstra et al., 2012). Indeed, it appears that supervision was insufficient as it could not prevent the aforementioned incidents (Koolma, 2012; Hoekstra et al., 2012; De Jong, 2013). Schilder et al. (2006) note that, despite the fact that internal and external supervision consists of multiple layers, supervision on the internal efficiency of corporations is lacking.

There are many reasons to suspect that housing corporation efficiency is not optimal. The Dutch government withdrew from active involvement with the sector in the 1990s, which greatly enhanced the autonomy of corporations. The resulting lack of governmental oversight, combined with weak competition and loose corporate governance, allowed housing corporations considerable operational leeway (Dutch Parliament, 2014). Moreover, housing corporations are not allowed to appropriate profits, which further weakens the incentive to operate efficiently (Walker and Murie, 2007).

Priemus (2003), commenting on a first attempt of efficiency inquiry in the Netherlands, pointed out that one cannot justify any kind of reform in the social housing sector because in the current situation "we are under-informed about the efficiency of housing corporations" (p. 269). In a report commissioned by the Dutch Parliament, Conijn (2005) paraphrased this observation. Clearly, there is a need for a coherent measurement of the efficiency of corporations. This chapter attempts to fill this hiatus by delving into the question of how efficiency can be measured. Afterwards, the actual measurement of efficiency is conducted.

Knowledge about the efficiency of corporations is important because of several reasons. In the first place it gives information about which corporations can improve on their efficiency most. That is, it increases the necessity to legitimate itself to the public (De Jong, 2013). This may provide a trigger to increase efficiency, because nobody wants to be at the lower end of the rankings. In a similar way, municipalities are often ranked on the basis of their tax rates (see for example COELO, 2015). Secondly, and more drastic, central government may provide (financial) rewards to efficient organizations (or punish inefficient ones). Thirdly, knowledge about efficiency scores may also serve as input for subsequent research in order to answer the question what the main determinants of efficiency are (see chapter 3). This can inform us about which policy instruments can make the sector more efficient.

This chapter is built up as follows. Section 2.2 gives a description of the institutional framework in which corporations operate. In section 2.3, the main issues concerning the measurement of efficiency for non-private institutions are discussed. An overview of the literature is given in section 2.4. Section 2.5 presents the method of Data Envelopment Analysis, used to conduct efficiency measurements. The data and model specifications are given in section 2.6. Empirical results will be presented in section 2.7. Section 2.8 concludes.

2.2 Institutional context and recent developments

2.2.1 Theoretical framework

Housing corporations may be viewed as public entities, subordinated to a political sponsor (Niskanen, 1994). By grace of a budgetary surplus, they are able to deliver more services than firms in a competitive market or in a monopolistic situation. That is, corporations can undertake unprofitable but socially desirable investments. Niskanen (1994) presumes that by structurally investing the surplus into an extension of its output, public entities can meet the efficiency of firms in a competitive market. However, due to weak competition, efficiency has to be an explicit objective. Operating efficiently enables improving social services by investing the surplus in, e.g., projects to improve livability. This may in turn increase the corporation's prestige and improve the stature of their managers among, e.g., their counterparts at other corporations.

Whether these incentives are sufficiently strong to ensure a satisfactory level of efficiency remains to be seen. The weak influence of ownership in the principal-agency relationship creates occasions for managerial moral hazard. Hirschman (1970) has queried the correlation between the occurrence of surplus and the deterioration of production and service. The budgetary surplus might get lost into organizational slack (Cyert and March, 1963), country club management (Blake *et al*., 1962), management specific investments (Shleifer and Vishny, 1989), and forms of empire building (Rhoades, 1983; Haid, 1997). Loss of organizational purpose impairs not only efficiency, but jeopardizes effectiveness and legitimacy too. This chapter focuses on efficiency.

2.2.2 The Dutch setting

Many countries provide subsidized housing to low-income households. In the Netherlands, the social housing sector is especially large (Smith and Oxley, 2007; Whitehead and Scanlon,

2007). In 2012, there were 381 housing corporations, owning 2.2 million dwellings. As noted in section 2.1, this boils down to 71 percent of the rental housing stock, or nearly one third of the total housing stock.[3]

Dutch housing corporations are private institutions in legal terms, but face the statutory obligation to execute public tasks. They are therefore often denoted as semi-public (CPB, 2013a) or hybrid (Blessing, 2012) organizations. The most salient consequence of their legal structure is the absence of owners, shareholders or influential stakeholders. The corporate governance structure resembles the principal-agency model (Jensen and Meckling, 1976), although the absence of owners allows wealth sharing by managers and members of the organization (Jensen, 2000). Ruled by public law, housing corporations are prohibited to distribute profit ('non-distribution constraint') (James and Rose-Ackerman, 2013). Unlike charitable non-profits, Dutch housing corporations are neither donor-financed nor driven by volunteers. They may be characterized most appropriately as non-profit enterprises (Anheier and Ben-Ner, 2003): professionalized private corporations with a public purpose, and without residual claimants.

Since the government withdrew from active involvement in the sector in the 1990's (see below), corporations have obtained a high degree of autonomy. As a consequence, corporations may lack an incentive to operate efficiently. Apart from the lack of oversight by the government, there are several other important factors that limit housing corporations' incentives to maximize efficiency. The first is the absence of a profit-maximizing objective (Walker and Murie, 2007). Because corporations are not allowed to appropriate their profits, the incentives to control costs are weak. Corporations do of course have to fulfil a 'break-even constraint'. That is, in the long run, benefits will have to equal costs in order to continue operations. This only provides efficiency incentives up and until the break-even point however; reducing costs any further does not yield extra benefits for the corporation. Another is lack of competition. In the Netherlands, social housing is exclusively assigned to housing corporations. There is no market sharing with commercial or cooperative organizations. Because of exploitation schemes where cash flows are negative for the first ten years after construction, entry of new housing corporations is almost impossible. In effect, then, there is a considerable extent of path dependency in the sector. Market forces letting efficient organizations enter the market and inefficient ones exit are non-existent (CFV, 2013a). Competition is

[3] Sources: Statistics Netherlands (CBS).

further weakened by the regional concentration of the housing stock of the different corporations.

The first housing corporations in the Netherlands were founded by volunteers in the middle of the nineteenth century, and operated without government support. The number of housing corporations rose rapidly after the founding of the Housing act (*Woningwet*) in 1901, which enabled corporations to receive financial support from the government under the condition that the organization would act in the public interest only.

State support was gradually reduced throughout the years, however, and the ties between government and corporations have been loosened ever since. The so-called balancing and grossing Act (*Bruteringsoperatie*,[4] Ouwehand and Van Daalen, 2002) in 1995, which converted state loans and future subsidy obligations to lump sums, was the most fundamental reform in forcing the corporations to stand on their own feet. With this operation, state support in the form of subsidies ceased to exist. The lump sum conversion has been very profitable for the housing corporations (Van der Schaar, 2003), and so induced cash windfalls in the sector (Koolma, 2008).

State aid is currently limited to a few areas where corporations can get a special treatment over private parties so that the advantage of the corporation sector is less prominent than before (European Commission, 2009).[5] The most important advantage that corporations still have compared to private parties, is the existence of a bailout clause on loans. Many loans to corporations are guaranteed by the Guarantee Fund Social Housing (*Waarborgfonds Sociale Woningbouw*, WSW). Moreover, 'reorganization subsidies' may be provided to corporations in case of financial distress. If necessary, the government will act as a lender of last resort. These guarantees ensure that loans can be undertaken at favourable interest rates (see for an elaborate discussion chapter 4). The bailout scheme may further relax the need to operate efficiently, as corporations expect to be rescued in case financial problems arise. A final form of government support is that in some occasions local governments sell land at a discount to corporations as part of social policy (De Kam, 2012).

[4] Officially, this Act is entitled as *'Wet balansverkorting geldelijke steun volkshuisvesting'*, but *'Bruteringsoperatie'* is the most often used term.

[5] Note however that the positive effect of the balancing and grossing Act on the corporation's financial position still implies a clear advantage, but the magnitude is of course fixed. That is, the lump-sum conversion of the balancing and grossing Act led to a substantial improvement in the financial position of the corporations. It is up to the corporations themselves to manage these extra resources in a responsible way.

Operationally, the ties between government and corporations are loose as well. The only binding condition that has to be fulfilled is that housing corporations must use all of their resources for (activities strongly related to) public housing. The government has formulated a set of public tasks or 'performance fields' by means of the Social Housing Management Decree (*Besluit Beheer Sociale Huursector*, BBSH). The most recent version of the BBSH encompasses seven performance fields (see box 2.1). Corporations can freely determine which tasks to give priority. They do not have to account for having reached any of these goals.[6]

Note that since July 1, 2015, the housing Act and the BBSH have been replaced by the new housing Act 2015 (*Woningwet 2015*) and the Decree Accepted Institutions Public Housing (*Besluit Toegelaten Instellingen Volkshuisvesting*, BTIV). These regulations present the changes in legislation that have come into force after the parliamentary inquiry in 2014. Most importantly, the new regulations prescribe that corporations are obliged to separate their entire administration into (1) activities in the service of general economic interest (*Diensten van Algemeen Economisch Belang*, DAEB) and (2) all other activities. Also, supervision is intensified under the new legislation, corporations are now obliged to use market value of property in their balance sheets and the possibilities to conduct livability activities are limited.[7] However, since this dissertation focuses on the years before 2015, we use the BBSH as the basis for our research.

Box 2.1. BBSH performance fields.

1.	Adequate housing of the target group, that is, households with relatively low income.
2.	Preserving the quality of the housing stock.
3.	Improving livability of neighbourhoods.
4.	Providing housing and fostering services to the elderly, the disabled or other persons that are in need of care or guidance.
5.	Preserving financial continuity.
6.	Enabling renters to get involved with corporation policy and administration.
7.	Operating efficiently.

[6] The only exception to this is that since 2011, 90 percent of the new allotments in social dwellings has to be offered to low-income households.
[7] For more information, see for example Woonbond (2015).

Internal supervision of a corporation is in hands of the board of directors. Until July 1, 2015, external financial supervision was a task of the Central Public Housing Fund (*Centraal Fonds Volkshuisvesting*, CFV), an independent public organization. The rest of the external supervision tasks (legality, governance and integrity) were in hands of the central government. Since July 1, 2015 (with the introduction of the new housing Act), all external supervision tasks have been assigned to the newly developed Authority housing corporations (*Autoriteit woningcorporaties*, Aw). Finally, the accountant has a role in checking the balance sheets of the corporation. Supervision of housing corporations has proven to be inadequate (Hoekstra et al., 2012), or at least insufficient to prevent serious incidents that have put a number of corporations in the spotlights in recent years.

2.2.3 The efficiency of non-profit organizations

It is tempting to limit the scope of this chapter to the special position of housing corporations without considering the broader picture. One should note however that corporations are examples of organizational forms of which the lack of efficiency has been seen as one of the crucial issues. Jensen (2000) points out that the existence of 'pure rental firms' gives incentives leading to uneconomical behaviour. In addition, this effect gains strength in the case where entry of new firms is limited. Managers have the dispositional power over housing corporations. Although managers are supervised by a board of directors, there is no real separation of management and ownership. Indeed, the board of directors faces no obligation to justify and explain their findings to stock owners (Van Dijk et al., 2002) or to stakeholders.

Jensen (2000) and Galaskiewisz and Bielefeld (2003) point out that organizations in the non-profit sector cannot pay out any profits.[8] That is, they face a so-called nondistribution constraint (NDC). The NDC – which is also relevant for housing corporations – has both advantages and disadvantages. The main advantage is that there is no pressure to let financial motives get priority over social motives. That is, the clients of such organizations will not be exploited to maximize profits. Rather, as long as the organization is profitable enough to survive, all remaining efforts can be put into their social goals. The other side of the medal is however, that the 'ban on profits' also erodes the incentive to work efficiently as the extra gains of hard work cannot be appropriated by the managers (Hakfoort et al., 2002).

Galaskiewisz and Bielefeld (2003) conduct a meta-analysis on the effect of a profit ban on risk-taking, opportunism and waste. According to the authors, evidence is inconclusive. The

[8] Note that housing corporations do not face an explicit ban on profits but an explicit prescription that all of their capital should be put into use in social housing.

current dominant notion is that in Dutch social housing, the institutional framework has provided too much autonomy letting moral hazard unpunished (Hoekstra et al., 2012; De Jong, 2013; CFV, 2013a). Conijn (1999) also noted that the boundary between efficient expenditures (in the public interest) on the one hand and waste on the other hand is hard to draw. In terms of efficiency measurement we would paraphrase this by stating that it is hard to point out what should be counted as (social) output of a corporation. Because the government gives no strict guidelines on this issue, it is up to the researcher to test several possibilities (see also section 2.6). The next section addresses the problems that arise with measuring the efficiency of organizations active in the public sector.

2.3 Measuring efficiency in the public sector

Recently, estimating the performance of (organizations within) the public sector has received increasing attention. In general, performance is evaluated along two dimensions; effectiveness and efficiency (see Priemus, 2003). Effectiveness is defined as the extent to which certain goals are achieved, whereas efficiency questions whether the production process of the organization doesn't spoil resources (inputs). An organization running optimally should perform well along both lines.

This chapter focuses on efficiency, in short: the ratio between output and input. Measuring the efficiency of organizations in the public sphere faces several obstacles (Stevens, 2005). The main question that arises is: what does a public sector organization actually produce: what are the inputs and outputs of the production process? It is especially hard to distinguish between 'output' and 'outcome'. Outputs are the direct result of the production process, that is; they can be influenced directly by the organization. Outcome is the benefit to society as a result of the outputs. De Witte and Geys (2011) note that outcome is to some extent beyond the control of the organization itself. For example, the number of hours of education is the output of schools. The resulting scores on exams is the outcome which is partly the result of the motivation of students. In short, exogenous characteristics may influence outcome and thus efficiency scores (Muñiz et al., 2006; Ruggiero, 1998). As a second obstacle, once one has identified inputs and outputs, it is hard to give them weights as market prices are absent. Indeed, outputs in the public sector often cannot be expressed in monetary terms. Finally, the question is whether appropriate measures of our inputs and outputs are actually available.

Despite these problems, empirical studies on public sector efficiency are proliferating (e.g., Borge and Haraldsvik, 2009 (care of the elderly); Kalb, 2010 (road maintenance); Adam et al., 2011 (countries); Sørensen, 2014 (local governments)).

Their high degree of autonomy leads Conijn (2005) to conclude that proper measurement of efficiency of housing corporations is impossible. First of all, he states, the BBSH gives so much scope for interpretation that a measuring rod with which to compare the corporations' output is not available. This critique is actually the core problem of all efficiency measurement exertions in the public sector. All autonomously operating bodies lack a clear objective, so that it is up to the researcher to choose proper measures of input and output. Indeed, municipalities, for example, face an even higher degree of autonomy compared to corporations but still, many authors argue that it is possible to conduct empirical research on the efficiency of municipal tasks (see for example Felsö et al., 2012; Van Hulst and De Groot, 2013). This problem does indeed complicate measurements of effectiveness, but not the measurement of efficiency.

Secondly, Conijn argues, efficiency cannot be measured properly because costs cannot be ascribed to separate activities. This argument is also postulated by Sprenger et al. (2008), Hoekstra et al. (2012), and Dorr and Wittenberg (2013). Sprenger et al. (2008) note that in order to assess efficiency of corporations, the method of cost imputation should be altered. That is, currently, corporations record costs on the basis of categories (e.g., wages, maintenance), whereas the authors argue that costs should be linked to activities (e.g., letting dwellings, implementing livability activities).

This problem can be solved or at least alleviated by using methods of frontier estimation where total inputs are linked to total outputs and the model determines the relative weights of them (see section 2.5). Under a few relatively weak assumptions it is possible to determine efficiency this way. The organization under study is thereby treated as a 'black box': inputs go in and outputs come out, but potential sub-processes are not studied explicitly. The main advantage of this method is its simplicity and uniformity. A minimum set of data is required, the way of cost imputation is not important and organizations can be compared easily.

The problem of the method of cost imputation gets more severe in case one wants to measure efficiency of a sub-process, for example, the efficiency in the management of the housing stock. Because we lack precise information on which parts of the (operational) expenditures should be allocated to this sub-process, such a measurement exercise is surrounded by

uncertainty (see also section 2.6.3). Therefore, it could be unwise to split up costs on the basis of the production process as long as more detailed information is unavailable.

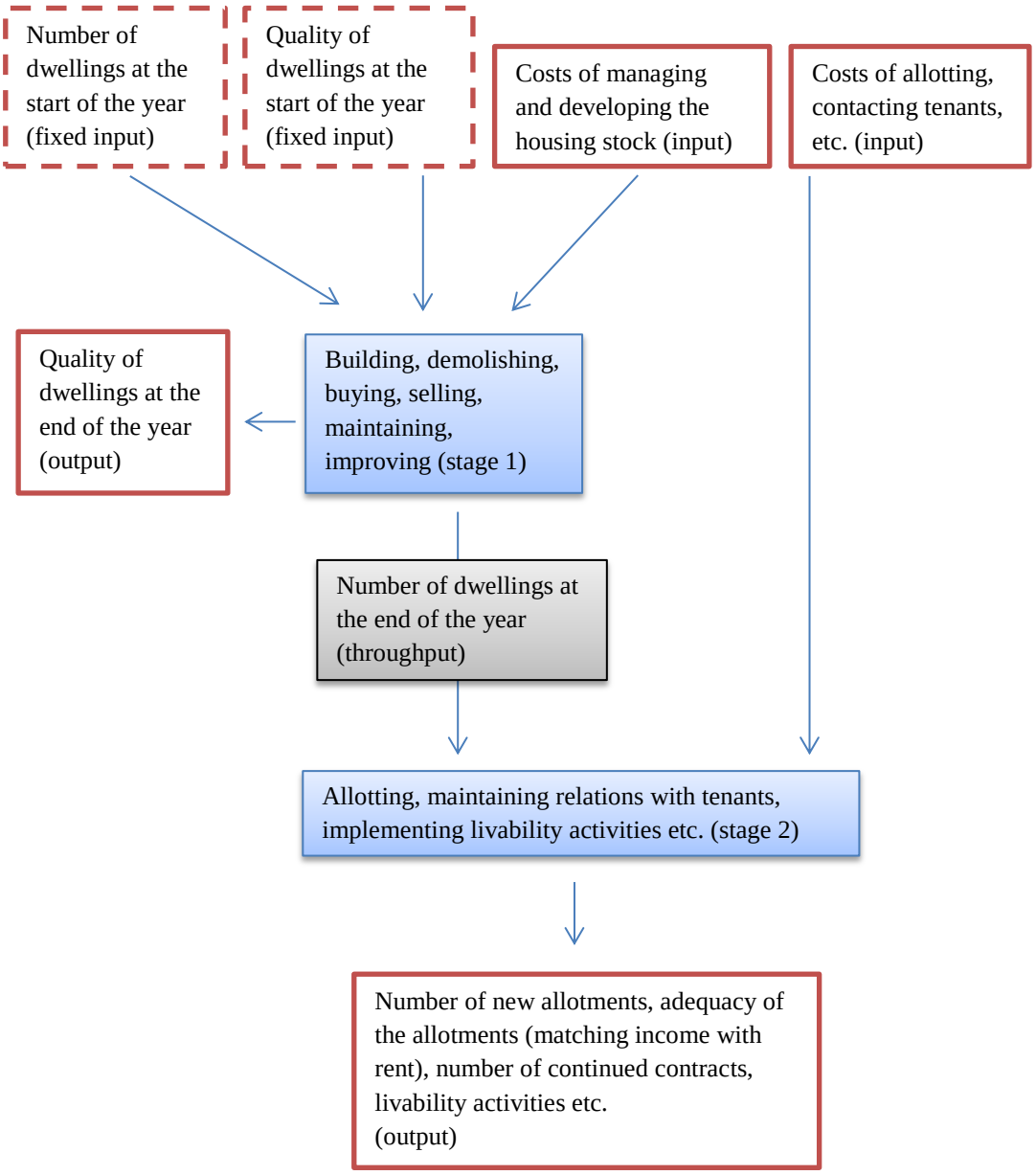
A further problem is that the categorical classification of costs is not uniform (CFV, 2005) so that in the current situation the actual allocation of costs is surrounded with uncertainty as well. To deal with this, we adjust operational expenditures to improve comparability (see also section 2.6.3).

Wolters and Verhage (2001) note furthermore that the estimation of efficiency of housing corporations is being hindered by heterogeneity, for example because of differences in their working area or the composition of the housing stock. Frontier estimation can take such exogenous circumstances into account so that this is also no major objection to the feasibility of empirical research on this issue.

As noted, it is hard to map the 'production' process of organizations in the public sphere. Corporations are not different in that respect. As for most public institutions, the production process could be classified as a two-stage process (see De Witte and Geys, 2011) where in the first stage the corporation creates the facilities that can serve the public, such as building and maintaining a suitable housing stock. In the second stage, actual supply and demand are being brought together so that (hopefully) the social goals that corporations ought to pursue are attained. Steps one and two together, then, lead to the outcome (satisfaction of inhabitants). Figure 2.1 presents this process in simplified form (based on Figure 1.1).

Figure 2.1 shows that inside the black box, two main stages can be distinguished: managing the housing stock and providing services to tenants. This chapter gives a hint at how to take these into account explicitly. Therefore, beside the black box models, this chapter also gives a model where the structure of the production process is taken into account. As noted, for such models, one needs information about cost allocation. These models should therefore be considered with caution as this information is not perfect. These models are mainly of theoretical importance; they indicate how the black box model could be refined if better data were available.

Figure 2.1 (based on Figure 1.1). Production process of a housing corporation.



2.4 Literature review of empirical studies

Research attempting to measure the effectiveness and efficiency of Dutch housing corporations is scarce. De Graaf et al. (2001) conduct a Data Envelopment Analysis (see section 2.5) on a subset of housing corporations in 1998 in order to measure the 'policy efficiency' of corporations. The authors conclude that a large part of the corporations they studied performed optimally and that the gains that could be achieved by improvement of the performance of other corporations were limited. However, the researchers acknowledge that these results should be interpreted with caution. They argue that data availability should be improved in order to refine measures of inputs and outputs. De Graaf et al. (2001) also note

that, because corporations are not given explicit goals to accomplish, it is hard to quantify their performance. Finally, their method of data revision and processing reduces the dataset to a small sample, containing only ten percent of the population. This raises the question whether the conclusions would still stand when using a more extended dataset and a slightly different specification.

Our method differs in five ways from the research of De Graaf et al. (2001). First of all, this chapter uses a broad panel data set covering twelve years of data instead of one cross-section, so that the change in productivity can be assessed. Secondly, our method of combining other data sources with the dataset of corporations is different, leaving the entire population of corporations intact. Thirdly, in addition to the black box model we estimate a network model as well. Fourth, we propose a different specification of certain output parameters. That is, whereas De Graaf et al. (2001) include relative output measures, we opt for absolute measures. Finally, we impose several robustness checks (using different subsets of inputs and outputs, checking for data outliers and accounting for exogenous variables).

Hakfoort et al. (2002) incorporate the research of De Graaf et al. (2001) in a broader project attempting to give an overview of the social housing sector and the role of corporations. They conclude that the current environment will not automatically give the right incentives to perform efficiently. This statement is thus somewhat conflicting with the results of the actual efficiency scores found by De Graaf et al. (2001), which were relatively high.[9]

Dreimüller et al. (2013) calculate potential efficiency gains via a completely different approach. The authors indicate that substantial savings should be attainable in the social housing sector if corporations would conform themselves to the model of the 'Management corporation' *(Regie-corporatie)*. Such a corporation would focus primarily on efficiency and would outsource for example maintenance and building activities. The authors do not mention potential objections against outsourcing such as imperfect contracts, irrationality, opportunism of market players and the specificity of the tasks that will be outsourced (see among others Wolters and Verhage, 2001).

[9] In principle the two findings can be reconciled. As a Data Envelopment Analysis measures relative efficiency, it could be the case that differences in efficiency are small, whereas the sector as a whole is operating inefficiently. Intuitively however, one would expect that if efficiency is low in absolute terms, relative efficiency scores should reveal a substantial spread.

Dorr and Wittenburg (2013) conclude on the basis of a case study of a single corporation that cost savings of about 30 percent should be attainable if purchasing practices are managed adequately and overhead is reduced. The authors implicitly suggest that such savings should be attainable for other corporations as well. Although large differences between corporations exist, they expect that all corporations could move towards a common best practice with these proposed reforms.

Koolma (2008, 2010) presents a set of general findings that support the notion that efficiency in the social housing sector could be enhanced. Koolma indicates that large differences in both cost levels and goal accomplishment exist. He adds that investments of corporations do not track forecasts in housing market conditions, that is, local shortages or surpluses of dwellings are not always taken into account adequately. Thus indeed, corporations do not seem to feel the direct pressure of market forces. Finally, CFV (2005) notes that operational expenditures show an increasing trend since 2002.

In short therefore, there seems to be reason to believe that 'substantial' efficiency gains should be attainable in the sector. At the same time, we note that since the subject of efficiency receives more and more attention throughout the last years, triggered by the public indignation about the aforementioned incidents, efficiency may have become a more important issue for corporations. Indeed, an inquiry by Nieboer and Gruis (2016) reveals that cost savings and efficiency were more important issues in 2013/2014 than in 2010. The appeal by Dutch Parliament (2014) to behave responsibly and efficiently may also have had a positive effect. Further, the economic crisis has increased the pressure to keep social housing affordable. Finally, since 2013, corporations have been confronted with the introduction of a 'landlord-tax' (*Verhuurderheffing*)[10] which is implemented in order to improve the budget balance of the Dutch central government. This puts extra pressure on the costs of corporations. These matters may have improved efficiency throughout the most recent years.[11]

[10] For more information, see: http://www.rijksoverheid.nl/onderwerpen/huurwoning/verhuurderheffing.

[11] Note that our research period runs from 2001 to 2012, and the landlord-tax and the parliamentary inquiry were implemented in 2013 and 2014 respectively. Therefore, we are not yet able to measure the effects of these aspects on efficiency.

2.5 Methodology

In the literature on efficiency measurement, the method of frontier analysis is the most common. Frontier analysis can be both parametric (for example Stochastic Frontier Analysis, SFA) or non-parametric (for example Data Envelopment Analysis, DEA). Both methods share the feature that they construct a best practice frontier on the basis of the data used by the researcher.[12] SFA (Aigner et al., 1977; Meeusen and Van den Broeck, 1977) constructs this frontier by means of econometric estimation of a production (or cost) function. One needs input price data to this end, and assumptions about the functional form. DEA solves a set of linear programming problems to obtain the frontier. Both methods have their advantages and disadvantages. Which of the two methods is most appropriate depends on the setting.

The main advantage of DEA is that one does not need to specify a functional form of a production (or cost) function. Especially in the public sector, it is often problematic to find out how the relation between input and output should be modelled. Pestieau (2009) notes that DEA needs only a few weak assumptions (free disposability and the choice between convexity or proportionality in returns to scale). Another advantage of DEA is that a certain efficiency score can always be traced back for each decision making unit (dmu). That is, DEA indicates which linear combination of dmu's (also known as 'peers') outperforms the dmu under consideration. In this way, decision makers can always reproduce the result.[13]

The major disadvantage of DEA is that it fails to account for noise in the data. Indeed, all differences in cost levels that cannot be explained by either exogenous circumstances or differences in output levels are labelled as inefficiency. Therefore, the impact of outliers in the dataset on the results might be considerable. This is especially relevant for outliers being highly efficient as such outliers may shift the best practice frontier, influencing the efficiency scores of other observations as well. Note, however, that this issue may be less severe than expected. Indeed, we just noted that the efficiency scores can be traced back very easily by examining the peers. If all dmu's receive their efficiency score, they can check the validity of this by examining their peers more thoroughly. If a peer appears to have unrealistic data, it can be removed from the frontier and the efficiency score can be re-estimated. This procedure can be repeated until the dmu under consideration receives a plausible score.

[12] For a more extensive overview of different techniques, see Blank and Valdmanis (2013).
[13] This is especially relevant from a policy perspective. If a dmu turns out to have a low efficiency score, policy makers can call the dmu to account. It could be that the dmu is able to give a solid explanation for its inefficiency. This could even lead to a reconsideration of the model in some instances.

We use DEA as the method of determining efficiency. As noted above, the production function in the public sector is hard to identify explicitly, because the process consists of multiple stages (see Figure 2.1). Also, the functional form of the production process is unclear, so that a parametric estimation may easily be misspecified. Moreover, since we do not have data on input prices, the function would be incorrectly specified. Therefore it is hard to estimate the true production function, so a non-parametric method like DEA is preferred.[14] Hereafter, the method is discussed in more detail.

2.5.1 Data Envelopment Analysis

Data Envelopment Analysis[15] was introduced by Charnes et al. (1978) who based their method on the ideas of Farrell (1957). The method constructs the best practice frontier of a group of dmu's by solving a set of linear programming problems. This frontier consists of all combinations of inputs and outputs that are deemed to be efficient. Consequently, every dmu is compared to this frontier to determine its efficiency. If a dmu is located on the frontier, it is said to be (relatively) efficient. The best practice frontier thus consists of the envelopment of all the efficient dmu's. The inefficient dmu's lie inside the frontier. The further away from the frontier the less efficient it is.

The linear programming problem in the input oriented setting, following the notation of Coelli (1996), reads:

$$\begin{aligned} &min_{\theta_i,\lambda}\ \theta_i \\ &s.t. \\ &\boldsymbol{X\lambda} \leq \boldsymbol{x_i}\theta_i \\ &\boldsymbol{Y\lambda} \geq \boldsymbol{y_i} \\ &\boldsymbol{\lambda} \geq 0 \end{aligned} \tag{2.1}$$

Here θ_i denotes the efficiency score of dmu *i*, and $\boldsymbol{x_i}$ and $\boldsymbol{y_i}$ are, respectively, the input and output vectors of dmu *i*. $\boldsymbol{X}$ and $\boldsymbol{Y}$ are the input and output matrices for the entire set of dmu's. Finally, $\boldsymbol{\lambda}$ is a vector of weights to be determined in the optimization problem, so that $\boldsymbol{X\lambda}$ and $\boldsymbol{Y\lambda}$ is the weighted sum of, respectively, inputs and outputs of a 'virtual dmu'. In the model, we thus search whether there exists a possibility to 'defeat' dmu *i*, by constructing a virtual dmu, being a linear combination of all existing dmu's.

[14] Note however, that we do implement an SFA in chapter 3 as a robustness check, since using DEA-scores for inferences may lead to incorrect estimates (see e.g., section 3.3.2).

[15] For a more elaborate explanation of the basic principles of Data Envelopment Analysis, see Coelli (1996). For a more extensive overview of the features of Data Envelopment Analysis, see Cooper et al. (2004). In this chapter, we only discuss the features of DEA that are relevant in this specific context.

The virtual dmu needs to meet the requirements that it produces at least as many outputs and uses no more inputs compared to dmu *i*. If we fail to construct a virtual dmu that meets these requirements, the efficiency score obtains its maximum value of 1. The efficiency score θ_i reveals by how much total input of dmu *i* could decrease without decreasing output. It could be interpreted as a 'measure of defeat'. Not only does the virtual dmu succeed in producing the same amount of output as dmu *i*, it needs only a fraction of θ_i of inputs to do so. Thus, an efficiency score for a dmu of 0.75 means that all its inputs could be reduced by 25 percent without reducing output. In a similar way, one could also choose an output orientation where the efficiency score can be interpreted as the percentage with which output could increase without increasing input.

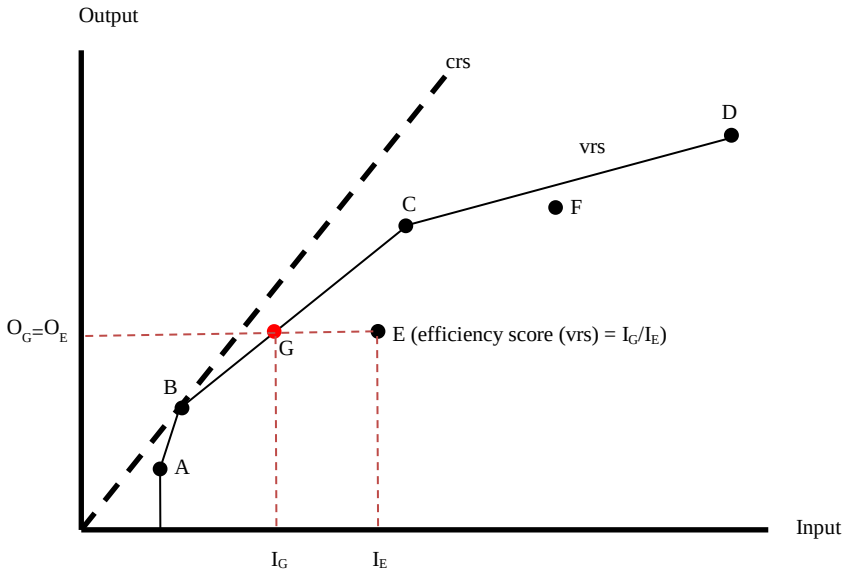
With DEA, it is therefore not necessary to impose any weights on inputs and outputs before-hand. That is, because different inputs and outputs cannot always be added up or compared a priori, the model determines the weights that the virtual dmu receives. It is in general, however, possible to construct an extra constraint on the weights. We could for example allow for a variable returns to scale (vrs) technology, as opposed to the constant returns to scale (crs) approach, by adding the constraint:

$$\boldsymbol{\lambda}'\mathbf{1}_{\boldsymbol{N}} = 1 \tag{2.2}$$

Where $\mathbf{1}_{\boldsymbol{N}}$ is a vector of ones. Intuitively, equation 2.2 prescribes that the 'virtual dmu' should be of the same size as the dmu under consideration. Without this extra constraint (i.e., under the crs-specification) it is implicitly assumed that the relation between input and output is linear. Geys and Moesen (2009) note that "Such an assumption may be valid over limited ranges of production, but is unlikely to be justifiable in general" (pp. 7). As Dutch housing corporations operate on various levels of scale, we present the results of a vrs-specification. Chapter 3 will focus in more detail on the differences between crs- and vrs-efficiency.Figure 2.2 presents a simple example with one input and one output. Under the crs-specification, we assume that the dashed line represents the technology within the sector (i.e., each point on this line should be technically attainable). In this case, dmu B is the only one with a maximum efficiency score. Under a vrs-specification, the solid line represents the technology in the sector, so that A, C and D are technically efficient as well. Dmu E and F are classified as inefficient in both instances, but the distance to the frontier (i.e., the extent of inefficiency) is higher under crs.

Having constructed the best practice frontier, efficiency scores for all dmu's can be calculated. Consider dmu E for example. Under vrs, we assume that it is possible to construct a virtual dmu labelled as G, being a linear combination of B and C. Comparing E with G, we see that E is performing worse as it needs more input to produce the same output. In fact, E should be able to reduce inputs with an amount I_E-I_G without reducing output, meaning that its efficiency score is I_G/I_E.

Figure 2.2. DEA with one input and one output.



2.5.2 Nondiscretionary inputs

It may be the case that a dmu does not have full control over all inputs. Such nondiscretionary (or fixed) inputs do influence the level of output, but cannot be altered by the dmu during the period over which the efficiency score is calculated. Banker and Morey (1986) extend the linear programming problem so as to take this issue into account. If we denote nondiscretionary inputs as $\boldsymbol{q_i}$, we add to equation (2.1) (and (2.2)):

$$\boldsymbol{Q\lambda \leq q_i} \tag{2.3}$$

2.5.3 Exogenous variables

To some extent, inefficiency is beyond the control of the decision making unit, because it may be (dis)advantaged by exogenous circumstances (e.g., adverse climate conditions, weak soil structure). Therefore, efficiency scores that are not corrected for relevant exogenous variables might be misspecified. Several methods to adjust efficiency scores are available (see Ruggiero, 1998 and Muñiz et al., 2006). Ruggiero (1998) also proposes an additional method

himself. In the first step, an ordinary DEA is carried out. Accordingly, regression analysis is being used so as to determine which exogenous factors influence the efficiency score:

$$Efficiency = \beta_0 + \sum_{r=1}^{R} \beta_r z_r + \varepsilon \tag{2.4}$$

where z_r $(r = 1, \dots, R)$ are the exogenous variables to be taken into account. Secondly, a variable Z is created that indicates to what extent a corporation is (dis)advantaged.

$$Z = \sum_{r=1}^{R} \beta_r z_r \tag{2.5}$$

Finally, we rerun the first-stage DEA, adding the constraint:

$$\lambda_j = 0 \; if \; Z_i > Z_j \tag{2.6}$$

Intuitively, adding this constraint means that a corporation can now only be compared to corporations that are not exogenously advantaged. In other words: advantaged corporations are being dropped from the frontier.[16,17]

2.5.4 Malmquist indices

The model specification above only deals with cross-section efficiency measurement. That is, for each year a separate frontier is constructed and efficiency scores are calculated on the basis of that frontier. Such a calculation does not give interpretations of how efficiency evolves over time. For example, one cannot simply conclude that a corporation with an efficiency score of 0.6 in the first year and 0.8 in the second has increased its productivity.[18] It

[16] One might note that the difference between nondiscretionary inputs and exogenous variables is vague or arbitrary. In fact, both comprise exogenous factors that do influence the production process but are beyond the control of the dmu. Indeed, in many instances the two factors are treated alike. The main difference is however that for the nondiscretionary inputs, convexity is assumed to hold whereas this is assumed not to hold for the exogenous factors. That is, for nondiscretionary inputs, it is assumed that linear combinations of dmu's can be constructed, whereas it is assumed that this is not possible for the exogenous factors. In our case, we assume this difference is relevant (see section 2.6.3).

[17] We round off Z however to deal with problems of infeasibility. Indeed, note that under the method of Ruggiero (1998) the dmu with the most disadvantaged position is efficient by definition as it cannot be compared with any other dmu. The dmu with the second-most disadvantaged position is very likely to be efficient as it can only be compared with the corporation with the most disadvantaged position. Because we believe that in our case a minor change in exogenous variables is not crucial for efficiency, we round off variable Z in order to categorize each corporation into one of twelve clusters. Corporations in the same cluster are assumed to have comparable exogenous circumstances.

[18] Note that in DEA, both the concepts of efficiency and productivity are used. Efficiency always refers to the performance of a dmu compared with other dmu's, in a certain year. When examining multiple years, we use the concept of productivity increases. A productivity increase can be the result of an efficiency increase, but can also

may just as well be the case that (all) other corporations perform worse, so that the efficiency frontier has shifted inwards.

Overall, there is no blue-print for how to deal with panel data in DEA (see Hjalmarsson et al., 1996). It is clear, however, that in order to make intertemporal comparisons possible, the comparison material (i.e., the frontier) has to be fixed. The most common method to do so is by using the Malmquist index (see Färe et al., 1994 or Coelli, 1996). The Malmquist index is calculated by comparing two production points of a dmu while keeping the frontier fixed. The index is defined as:

$$M = \left[\left(\frac{TE_{t+1,t}}{TE_{t,t}}\right)\left(\frac{TE_{t+1,t+1}}{TE_{t,t+1}}\right)\right]^{1/2} \tag{2.7}$$

where M is the total change in efficiency of a dmu and $TE_{t+1,t}$ is the efficiency score for a certain dmu where the input/output vector in period *t+1* is compared to the technology in period *t*. The index is thus the geometric mean of two measures of efficiency change (one relative to the frontier in year *t*, and the other relative to the frontier in year *t+1*).[19]

2.5.5 Network model

As noted in section 2.3, the standard DEA procedure treats the dmu as a 'black box' where input goes in and output comes out. In many cases however, the production process consists of multiple stages/processes that are connected via 'intermediate inputs'. This holds for corporations as well (see Figure 2.1). A network model takes these intermediates into account explicitly. Therefore, a black box or aggregated approach potentially misses efficiency leaks that a network model does capture. An in-between solution of treating the sub-processes separately is also not optimal (Tone and Tsutsui, 2009). Tone and Tsutsui (2009) therefore propose a network model that takes the connection between multiple stages into account. A network model has the disadvantage that more precise information is needed about the inner structure of the production process. Because in our case this information is imperfect, this chapter uses a network specification in only one model. As noted in section 2.3, these models are mainly of theoretical importance and the results should be interpreted with caution.

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be the result of technological progress (so that all dmu's become more productive, but relative efficiency does not necessarily change). See section 3.3.4.

[19] An example may clarify the calculation of the Malmquist index. Suppose dmu *i* has an efficiency score of 0.6 in year t_0. Now, suppose we were to take the input output mix of dmu *i* in year t_1, but keep the frontier fixed. If the efficiency score has increased to 0.75, we can interpret this as an increase in productivity of $\frac{0.75-0.60}{0.60} = 25\%$, because we have used the frontier of t_0 twice. Note that, alternatively, we could use the frontier of t_1 both times just as well. Now, if this option would yield an increase of 30 percent, the Malmquist index would be calculated as $\sqrt{1.25 * 1.30} \approx 1.27$. This would indicate that total factor productivity change is 27 percent.

2.6 Data and model specification

2.6.1 Data

Corporations are obliged to file their financial and operational statements, the formats of which are prescribed by law. These accountability reports are checked and put in a database (*CorpoData*), by the central government agency Central Public Housing Fund (*Centraal Fonds Volkshuisvesting*, CFV). This agency has provided us with a dataset for the years 2001-2010 that comprises all corporations. Among other things, the dataset contains information on new allotments (i.e., the allocation of dwellings to new clients), financial issues and the number and types of dwellings in possession. For 2011 and 2012 we make use of publicly available data from the Central Public Housing Fund.

2.6.2 Output measures

As noted, the main point of concern in public sector efficiency measurement is the proper specification of output parameters. In general, for a variable to be useful as an output measure, it needs to fulfil three requirements (see box 2.2).

In theory, a model specification should include all variables that fulfil these three requirements. In practice however, not all requirements will be met (perfectly). Therefore, in most cases it will be open to debate which variables should be included as outputs, implying that there is no single optimal model.

Box 2.2. Requirements for output measures in the public sector.

1. The variable must be measurable and be measured.
2. The variable should be influenced by input. Thus: if input increases, the output should increase as well, ceteris paribus. This means that the output measure should be at least partly under control of the dmu itself.
3. The variable has to add to social welfare (i.e., the more of it, the better (ceteris paribus)).

Hereafter we will discuss the possible model specifications in the case of housing corporations. In order to measure performance, we need to determine along which lines we judge corporations. As noted, corporations do not face clearly defined tasks. The goals formulated in the BBSH give a guideline, however, of which elements are deemed to be relevant by the central government. The BBSH holds for all corporations. Also, many corporations follow these BBSH fields explicitly in their annual reports. As noted in section 2.2.2, the BBSH

comprises seven performance fields. Below we discuss which output measures we consider to be suitable on the basis of these fields. Thereafter, the model specifications are discussed.

> *Performance field 1:*
> *Adequate housing of the target group, that is, persons with incomes within the boundaries of the rent benefit.*

Social housing is the 'core business' of housing corporations. Therefore, there is no doubt that this field should be incorporated. Note that this performance field covers two dimensions. First of all, corporations should provide housing to persons who are part of the target group, that is; persons with incomes within the boundaries of the rent subsidy.[20] Secondly, persons should be housed adequately. This means that the rent tenants have to pay has to be in line with their income. To put it simple, low income persons should be housed in cheap dwellings. We could say therefore that every household is classified in one of the following four categories.

A. *Low income, low or middle rent (adequate)*[21,22]
B. *Low income, high rent (too expensive)*
C. *High income, high or middle rent (adequate)*
D. *High income, low rent (too cheap)*

One could debate about the question which categories should be counted as outputs in social efficiency measurement. Indeed, it is questionable whether social housing for high income groups essentially is a 'good thing'. For example, one might argue that housing high income earners in cheap dwellings (category D) does more harm than good. Indeed, this inadequate housing prevents persons with a low income to live there, which may result in queuing up. Housing high income earners can be justified, however, if the dwelling would otherwise remain vacant, or if this is done to prevent segregation of neighbourhoods. In our main model, we include all four categories. This gives as outputs:

[20] For single person households, the threshold income of the rent subsidy in 2011 is € 21,625 (age below 65) or 20,325 (age over 65). For multi person households this is € 29,350 (<65) and € 27,750 (>65).
[21] We define 'low income' as income within the boundaries of the rent benefit, and 'high income' as income too high to receive rent benefit. The distinction between low, middle and high rent is based upon the 'Rent subsidy Act'(*Wet op de huurtoeslag*). In 2012, dwellings with a rent lower than 366.37 euros are classified as low-rent dwellings, middle-rent dwellings have a rent between 366.37 and 561.98 euros, and high-rent dwellings have a rent of 561.98 euros or higher. Source: CFV (2013b).
[22] Note that one may argue that housing a person with a low or high or income in a dwelling with a middle rent could also be considered as an inadequate allotment. However, the CFV/Aw considers such allotments as adequate.

$$Output_{1.1} = Adequate\ housing\ (A + C)$$
$$Output_{1.2} = Inadequate\ housing\ (B + D)$$

Note that in this case we split up the output by distinguishing between adequate and inadequate allotments. The idea is that adequate housing may demand more input (time and resources) than inadequate housing.

Note that these outputs only deal with allotments in year *t*, that is; they reveal the number of new clients. However, the bulk of the dwellings will simply be rented by the same household as in the previous year. To take this into account, we construct an additional measure, namely the total number of continued contracts.

$$Output_{1.3} = Continued\ contracts$$

The extent to which existing contracts between corporations and tenants consist of adequate housing is beyond the control of the corporation. For example, if the income of an existing tenant increases beyond the threshold of the rent subsidy, he or she cannot be forced to move out by the corporation.

Performance field 2:
Preserving the quality of the housing stock.

Preserving the quality of the housing stock can also be classified as a core social housing task. In order to operationalize this performance field we opt for two different perspectives. First of all, the quality of the dwellings can be measured by means of the so-called Housing valuation scheme (*Woningwaarderingsstelsel*, WWS). The WWS assigns points to each dwelling on the basis of, among others, the number of rooms, the way the dwelling is heated and the size of the dwelling (see also chapter 5). A higher score means a better intrinsic quality. This gives the following output:

$$Output_{2a} = Average\ WWS\ points$$

Note that we should distinguish between the concepts of 'real' housing improvements and 'ordinary' maintenance. The first case comprises investments in order to improve the facilities of the dwellings (for example, placing an extra toilet or building a carport). Maintenance deals with the costs made in order to conduct repairs and for exterior paintwork for example. Unlike housing improvements, maintenance does not alter the intrinsic quality of dwellings so that

the number of WWS-points does not change. Therefore, this measure does not take differences in maintenance quality into account.

Quality could alternatively be measured using house prices.[23] Output 2b does exactly this. In principle, differences in maintenance are taken into account when determining housing valuation. One should note, however, that not only the quality of the dwelling influences its value, but so does the attractiveness of the location. We will therefore correct the values of the dwellings for the price of the location. That is, the value of dwellings in areas with above (below) average land prices will be corrected downwards (upwards). Because reliable data on the value of corporation dwellings is available from 2005 onwards, we will leave the years 2001-2004 out of consideration. The attractiveness of the location is based upon the estimated price of a dwelling with standard characteristics for different municipalities. We assume that if a similar dwelling is more expensive in one municipality than in another, this reflects differences in location attractiveness (or land price). Note that this calculation is based upon owner-occupied housing. It could be the case, at least in theory, that the land price for owner-occupied housing differs from that of rental housing. Better data is unavailable however. Appendix 2.A shows the details of this calculation.

$$Output_{2b} = Average\ value\ of\ dwellings\ corrected\ for\ land\ price$$

Performance field 3:

Improving livability of the neighbourhoods.

This performance field (which has been added to the BBSH in 1997) encourages corporations to look after the quality of living in the neighbourhoods in which they hold possession.[24] The operationalization of this field into an output is not straightforward. First of all, the distinction between output and outcome is a bit arbitrary. Strictly spoken, the activities that corporations employ in the domain of livability are the output, the level of livability that this yields forms the outcome. This outcome may also be influenced by other factors such as the municipal policy on livability and the (economic) circumstances in the region. That is, one could question whether the second requirement (in box 2.2) for output measurement is fulfilled satisfactorily by taking a measure of livability as output. However, because direct output measures are unavailable, we have to rely on an outcome measure.

[23] In the Netherlands, all houses are being valued by means of the Act 'Valuation real estate' (*Wet Waardering onroerendezaken*, Woz). Our dataset contains the Woz-values of all dwellings of the corporations.

[24] Recently, central government has presented plans in order to reduce livability activities of corporations (see Ministry of National and Kingdom Affairs, 2013b).

The Ministry of National and Kingdom Affairs has developed a score on livability called the '*Leefbaarometer*' ('livabilometer').[25] The livabilometer gives both a general score on livability and separate scores on six sub-dimensions. These sub-dimensions are (1) the composition of population, (2) social relationships, (3) public space, (4) safety, (5) availability of facilities and (6) housing stock.[26] The latter dimension is the one on which corporations probably have most influence as it measures the extent to which the housing stock is balanced concerning the types and ages of the dwellings. The idea is that if neighbourhoods are dominated by a certain type of dwelling such as gallery flats, livability is lower. The indicator 'housing stock' also takes prices and dates of construction of the dwellings into account. If we only take into account this sub-dimension, and thus remove the dimensions which are (largely) exogenous to corporations, we are left with the measure over which corporations have the most control.

$$Output_3 = Livabilometer\ score\ on\ 'housing\ stock'$$

Data on livability is available for the years 2002, 2006, 2008 and 2010.

Performance field 4:

Providing housing and fostering services to the elderly, the disabled or other persons that are in need of care or guidance.

This performance field (that was added to the BBSH in 2001) shows a certain overlap with the first field. Indeed, the first field takes all allotments into account, including the elderly and other special groups. One could note however that if the housing of those target groups demands more input than 'ordinary' households, the outputs should be split up so as to control for this. Outputs 1.1 and 1.2 could be reformulated as follows:

$$Output_{1.1'} = Adequate\ housing\ (age < 65)$$
$$Output_{1.2'} = Inadequate\ housing\ (age < 65)$$

[25] Because data on livability is presented on postal code level, we converted the measures to the scale of corporations by means of taking a weighted average. One might argue that this gives an attribution problem. Suppose that corporation X is very small and operates in only one postal code area that is dominated by another corporation (Y). When assigning a livability score to corporation X, the only option is to take the livability score in the area where it operates. However, this score might be determined to a great extent by the livability activities employed by corporation Y leaving a misspecified score. We argue that, because the scale of postal code areas is very small, this problem of attribution should not be a major issue. Moreover, a better method is unavailable.

[26] These sub-dimensions are further divided into 49 indicators. These indicators include both (subjective) judgments of inhabitants and measures on their actual behaviour. See Leidelmeijer et al. (2008) for a more extensive discussion of the sub-dimensions and indicators.

For housing of the elderly, we introduce the following outputs:

$$Output_{4.1} = Adequate\ housing\ (age > 65)$$
$$Output_{4.2} = Inadequate\ housing\ (age > 65)$$

Note that 'adequate' housing in this case, still aims at adequacy with respect to incomes. Unfortunately, no information is available to find out whether persons are housed in the right type of dwelling. From 2007 onwards there is information about the allotments of 'special target groups'. If we assume that these groups demand more input from the corporation, we may add:

$$Output_{4.3} = Housing\ of\ special\ target\ groups$$

We may also state that it is appropriate to split up the continued contracts into households in (1) dwellings suitable for the elderly and handicapped ('special dwellings') and (2) all other dwellings. Tenants in special dwellings may demand more time and energy from the corporation staff because they need more (different) services than others. Unfortunately, we do not know which persons are housed in the different types of dwellings. We could approximate this by reformulating output 1.3 into:

$$Output_{4.4} = Continued\ contracts\ (ordinary\ dwellings)$$
$$Output_{4.5} = Continued\ contracts\ (special\ dwellings)$$

Finally, corporations also play a role as intermediary party in the arrangement of housing, health care and well-being contracts between health care suppliers and clients of corporations. Therefore, we may also include:

$$Output_{4.6} = Number\ of\ health\ care\ arrangements$$

Performance field 5:

Preserving financial continuity.

Koning and Van Leuvensteijn (2010) note that preserving financial continuity is merely a precondition for operations, instead of an actual social goal. That is, it is questionable whether a better financial position indeed adds to social welfare (third requirement in box 2.2). This question cannot be given a clear answer. If a corporation lowers its debt, it will have lower interest payments in subsequent years, which means that lower rents suffice to cover costs. Also, corporations are interconnected through their mutual support by means of a bailout clause (see chapter 4). So a worsening of the financial position of a corporation may increase

the probability that other corporations will have to bail out the corporation. If all corporations were to behave irresponsibly, the system would be no longer sustainable, imposing high costs for society. So to have a satisfactorily financial position could be considered to be desirable from a social perspective.

To conclude therefore, whether or not 'preserving financial continuity' should be seen as output is ambiguous. Still, for completeness we will include this output in a sub-model.

$$Output_5 = Level\ of\ equity\ at\ the\ end\ of\ the\ year$$

Performance field 6:

Giving renters the opportunity to get involved with policy and administration.

In order to take customer satisfaction into account, we make use of the data from the Quality Center Housing Corporations Rental Sector (*Kwaliteitscentrum Woningcorporaties Huursector*, KWH). The KWH measures customer satisfaction along nine dimensions (e.g., satisfaction with repairs, assistance in finding a new dwelling).[27] A corporation is however not obliged to take part in the KWH. In 2012, 149 corporations participated in the KWH. Data on KWH indicators are available for 2005-2012. However, in 2005-2011, measurements were conducted irregularly. Since 2012, all dimensions are being measured for all participating corporations. Moreover, between 2011 and 2012 the exact definitions of the indicators changed so that comparisons over time are hard to make. This comparison is hindered further, since the group of participants has not been constant throughout the years. In conclusion, it is hard to construct proper measurements of customer satisfaction, meaning that the first requirement in box 2.2 is not always fulfilled. Still, we conduct an efficiency measurement for 2012, including as output:

$$Output_6 = Customer\ satisfaction\ with\ service\ provision\ (average\ of\ all\ dimensions)$$[28]

[27] Because satisfaction with repairs is also included, this measure also partly covers the BBSH field 'Preserving the quality of the housing stock'.

[28] Taking a simple average implicitly assumes that all dimensions are equally important. Including the dimensions separately as nine different outputs would introduce the problem of overspecification however (i.e., many outputs combined with a relatively small sample renders many decision making units efficient. See Borge and Naper, 2005).

Performance field 7:

Conducting business in a frugal and efficient way.

The final BBSH-field captures the idea that a corporation should not spoil resources unnecessarily and should thus operate efficiently. This field is obviously no direct output of the production process, but rather a precondition.

In short, for many performance fields, which – if any – output measures to include is open to debate. Table 2.1 gives a few descriptive statistics concerning the aforementioned measures. Table 2.1 also presents some data on cost levels and exogenous circumstances. Table 2.2 summarizes the outputs and presents which requirements for proper output measurement (given in box 2.2) are (or aren't) met.

Table 2.1. Descriptive statistics (averages over the years).

	N	Years	Average	Standard deviation	Minimum	Maximum
Adequate housing (<65)	462	2001-2012	320	563	0	5,716
Inadequate housing (<65)	462	2001-2012	38	80	0	728
Adequate housing (>65)	462	2001-2012	54	107	0	1,621
Inadequate housing (>65)	462	2001-2012	9	29	0	452
Continued contracts (ordinary dwellings)	462	2001-2012	3,988	6,627	0	60,257
Continued contracts (special dwellings)	462	2001-2012	651	1,463	0	24,425
Average WWS-points	454	2001-2012	133	14	72	179
Average value of dwellings corrected for land price	389	2005-2012	160	34	24	292
Livabilometer (score on housing stock)[a]	481	2002,2006, 2008,2010	1	21	-47	43
Health care arrangements	467	2001-2010	432	2405	0	23,706
Level of equity	466	2001-2012	52,415	96,646	-43,924	815,449
KWH score on customer satisfaction[b]	149	2012	7.78	0.23	7.08	8.33
Personnel expenditures (in 1,000 euros)	463	2001-2012	2,697	4,858	0	42,771
Maintenance expenditures (in 1,000 euros)	466	2001-2012	5,598	9,000	9	72,234
Other operational expenditures (in 1,000 euros)	465	2001-2012	2,983	5,864	0	58,029
Housing management costs (in 1,000 euros)[c]	371	2008-2010	11,248	24,277	-27,480	275,933
Average age of dwellings (in years)	466	2001-2012	32	8	2	62
Soil quality[d]	427	2001-2012	1.10	0.14	1	1.69

[a] On a scale of -50 to 50.
[b] On a scale of 1 to 10.
[c] Housing management costs may become negative if the proceeds of revenues from selling dwellings outweigh the costs of building and purchasing. In some cases, total input even becomes negative. Although in principle, DEA can deal with negative inputs, we have removed these observations for convenience in order to eliminate the possibility of obtaining negative efficiency scores.
[d] A higher number means a worse soil quality. To be specific, soil quality varies between a value of 1 (only high quality soil) and 2.10 (only peaty soil). Before 2007, peat had a value of 1.60 however.

Table 2.2. Output indicators.

	Is variable measured?	Is variable influenced by input?	Does increase in variable increase social welfare?
Adequate housing (<65)	Yes	Yes	Yes
Inadequate housing (<65)	Yes	Yes	Yes
Adequate housing (>65)	Yes	Yes	Yes
Inadequate housing (>65)	Yes	Yes	Yes
Continued contracts (ordinary dwellings)	Yes	Yes	Yes
Continued contracts (special dwellings)	Yes	Yes	Yes
Average WWS-points	Yes	Yes	Yes
Average value of dwellings corrected for land price	Yes	Partly	Yes
Livabilometer (score on housing stock)	Imperfect	Partly	Probably
Health care arrangements	Yes	Yes	Yes
Level of equity	Yes	Partly	Doubtful
KWH score on customer satisfaction	Imperfect	Yes	Yes

2.6.3 Model specification

As becomes clear from the previous section, the choice of input and output parameters is not clear cut so several (sub)models to measure efficiency could be constructed. This section develops 9 different models.

- Model 1a is our basic model. It relates operational expenditures to total new allotments (split up into four categories), continued contracts (split up into two categories) and the quality of the dwellings. Model 1b includes only adequate allotments to test the robustness of the results with respect to the choice of important outputs. Model 1c is similar to model 1a but includes allotments of special target groups as a separate output.
- Model 2 is similar to model 1a but includes housing management costs as input.
- Model 3 is similar to model 1a but uses the estimated value of the dwellings as quality indicator instead of WWS-points.
- Model 4 is similar to model 1a but includes the livability score and the number of health care arrangements as outputs.
- Model 5 is similar to model 1a but includes the level of equity as output.
- Model 6 is similar to model 1a but includes customer satisfaction as output.
- Model 7 is similar to model 2, but the costs are split up into two stages according to Figure 2.1 (i.e., managing the housing stock (stage 1) and all other activities such as allotting tenants and maintaining customer relations (stage 2)).

Most of the models thus take operational expenditures as input measure. Operational expenditures consist of (1) wages and salaries, (2) maintenance costs and (3) other operational expenditures. Operational expenditures have however been adjusted (so as to increase

comparability) in the following way. 'Activated production for the benefit of the own company' has been subtracted from (1). 'Reimbursements' and 'other operational revenues' have been subtracted from (3). Consequently, all measures have been multiplied by a factor that indicates the share of costs that is spent on dwellings. In this way, we correct for the fact that many corporations also take on (commercial) activities that fall outside the scope of this study. Inputs are corrected for inflation (and expressed in euros of 2012) to ensure comparability over the years.[29]

Models 2 and 7 also include net costs on housing management activities in the input. This is calculated as the sum of (1) land acquisition costs, (2) building costs, (3) demolishing costs, (4) selling costs, (5) house acquisition costs and (6) costs of quality improvements, minus (7) the revenues of dwellings sold. In principle, this should give information on the investment that the corporation makes in order to increase the quality and quantity of its housing stock. We note, however, that corporations do not follow uniform procedures in their accounting principles concerning these costs. For example, costs may be spread differently throughout the years. Also, data is available for 2008-2010 only. Therefore, this model gives only crude approximations. More research needs to be done in order to increase the comparability of the data. Model 7 gives an illustration of a network model that explicitly takes the two stages of production into account (see Figure 2.1). With current data, only a rough indication is possible. We assume that maintenance costs, housing management costs and half of the personnel costs are used to manage the housing stock (stage 1) and that all other costs are used for allotments, customer contact etc. (stage 2).[30] For more information on the accounting system of corporations, see Appendix 2.B.

Further, the number and the quality of the dwellings at the start of the year is included as a nondiscretionary input in all models. Model 5 includes the equity position at the start of the year as a nondiscretionary input as well. Finally, the average age of the housing stock and the

[29] Wages and salaries have been corrected by means of the wage index, all other cost categories have been corrected by means of the consumer price index. Both indices are obtained through Statistics Netherlands (CBS).
[30] The idea behind this is that all 'other current costs' comprise overhead costs, reimbursements to commissioners and (voluntary) directors, other personnel costs, general costs, business costs, costs of deliveries and other services and external project costs (see also Van den Berge et al., 2013). Most of these costs are general costs and have no direct link with the management of the housing stock. Therefore, we assign these to stage 2. Personnel costs are used for both stages of production. Current data does not give information about which share of personnel costs is related to the separate stages. Therefore, we use a rough approximation by assuming that half of the personnel costs are devoted to stage 1 and the other half to stage 2. As noted, models 2 and 7 are mainly of theoretical importance and results should be interpreted with caution.

soil quality[31] are included as exogenous variables, because corporations with an older housing stock and those operating in areas with a bad soil quality are found to be disadvantaged.[32] We have used the method of Ruggiero (1998) to construct a Z-variable that indicates to which extent a corporation is (dis)advantaged (see section 2.5.3). As noted in footnote 17, this variable is rounded off in order to deal with problems of feasibility. Still, the combination of including nondiscretionary inputs and exogenous variables may give rise to problems of infeasibility. The (dis)advantages of this approach are discussed in box 2.3.

Recall that we opt for a vrs-specification throughout this chapter (see section 2.5.1) so that we measure (pure) technical efficiency. Finally, all models are input-oriented. Table 2.3 summarizes the inputs and outputs per model.

Outliers have been identified by calculating superefficiency scores. The superefficiency of dmu *i* is found by calculating its efficiency score after removing dmu *i* from the best practice frontier. In this way, the efficiency score of a dmu may exceed 1 (if this dmu outperforms the rest). A very high superefficiency score for a dmu indicates that including this dmu, leads to a substantial outward shift of the best practice frontier, thereby affecting efficiency scores of many other dmu's. We have removed all corporations (about 10 per year) with an initial superefficiency score of 3 or higher.[33]

[31] Part of the Netherlands consists of sinking marshland, which results in relatively high maintenance costs.
[32] Recall from footnote 16 that the main difference between nondiscretionary inputs and exogenous factors is that for nondiscretionary inputs, convexity is assumed to hold whereas this is assumed not to hold for the exogenous factors. For example, if corporations A and B start with 10 and 20 dwellings respectively, and have an output of 30 and 40, we assume that it would be technically possible to reach an output of 35 ((30+40)/2) if the initial number of dwellings is 15 ((10+20)/2). For the exogenous variables, this kind of assumption is not made.
[33] Different thresholds do not lead to changes in the main conclusions.

Table 2.3. Model specifications.

Model	Model 1a, 1b and 1c (2002-2012) and (2007-2010 for 1c)	Model 2 (2008-2010)	Model 3 (2005-2012)	Model 4 (2002, 2006, 2008, 2010)	Model 5 (2002-2012)	Model 6 (2012)	Model 7 (2008-2010)
Output	-Adequate housing (age<65) -Inadequate housing (age<65) (not for 1b) -Adequate housing (age>65) -Inadequate housing (age>65) (not for 1b) -Continued contracts (ordinary dwellings) -Continued contracts (special dwellings) -Average WWS-points -Special target groups (1c only)	See model 1a	Similar to model 1a, but Average WWS-points replaced by: -Value of dwellings corrected for land price)	See model 1a + -Livabilometer housing stock -Health care arrangements	See model 1a + -Level of equity end of year	See model 1a + -KWH score customer satisfaction	See model 1a (output split up)
Input	-Operational costs	See model 1 + -Housing management costs	See model 1	See model 1	See model 1	See model 1	Stage 1: 0.5*personnel costs + maintenance costs + housing management costs Stage 2: 0.5*personnel costs + other operational costs
Input (fixed)	-Number of dwellings start of year -Quality of dwellings start of year	See model 1	-Number of dwellings start of year -Value of dwellings start of year	See model 1	See model 1 + -Level of equity start of year	See model 1	See model 1
Exogenous	-Average age of dwellings -Soil quality	See model 1	See model 1	See model 1	See model 1	See model 1	See model 1

Box 2.3. Nondiscretionary inputs, exogenous variables and infeasibility in DEA.

Figure 2.1 shows that in the case of housing corporations, the number and quality of the dwellings at the start of the year is given (i.e., exogenous). Therefore, in principle, these should be classified as nondiscretionary – or fixed – inputs (section 2.5.2). Having (too many) fixed inputs may render problems of infeasibility however. To illustrate this, suppose corporation A has an average of 100 WWS-points at the start of the year (fixed input) and 110 WWS-points at the end of the year (output). Suppose it has spent €50 (input) to attain this quality increase.

Such a corporation can only be denoted as inefficient if we can find (or construct) another corporation that increases its quality from '100 or less' towards '110 or more' WWS-points, while spending less than €50. It may be the case that such a corporation cannot be constructed just because other corporations all start with more than 100 WWS-points. In this case, corporation A is efficient by definition. However, there may exist a corporation (corporation B) increasing its quality from 130 to 160 WWS-points, spending only €10. Intuitively, we would say this corporation outperforms A but it does not meet the requirements of the model. If – alternatively – we would calculate a model where the output is the change in WWS-points and the input is the amount spent, corporation A (increase of 10 WWS-points) would be defeated by B (increase of 30 WWS-points). The disadvantage of this method is however that it may be over simplistic: it assumes that increasing quality is a linear process (i.e., it assumes that an increase in quality from 100 to 110 costs just as much as an increase from 130 to 140). In approximation this may be true, but if not, some corporations will be falsely labelled inefficient.

To summarize, both methods have their pros and cons. **A model with fixed inputs** has the advantage that comparisons are fair, but the disadvantage that some dmu's are rendered as efficient by definition. **The simple model without fixed inputs** has the advantage that all dmu's can be compared to each other but the disadvantage that comparison may be unfair.

Note that if we add exogenous factors to the model (see section 2.5.3) as well, the comparison dataset is reduced even more. That is, corporation A can only be compared with those corporations that have less advantaged circumstances. This would increase the problems of infeasibility even more. In short therefore, because in our models, both nondiscretionary inputs and exogenous factors are used, some corporations will be labelled as efficient by definition. Therefore, our models could be seen as conservative.

2.7 Results

Table 2.4 presents the main results. The average efficiency scores for most models fluctuate around 0.85 which means that on average, it should be possible to reduce costs by 15 percent without decreasing output. Per definition, models with more outputs and/or less observations give higher efficiency scores (Nunamaker, 1985). In fact, model 6 runs the risk of over-identification: too many outputs relative to observations (see Borge and Naper, 2005). Because the models also include nondiscretionary inputs and scores are corrected for exogenous factors, the models are – if anything – conservative (see also box 2.3). Model 7 on the other hand, provides the lowest average efficiency scores. Indeed, a network model is able to find efficiency leakages that a black-box model potentially misses. However, in our specific case, we should be cautious because the network model might suffer from data infeasibility (see section 2.6.3).

In order to test the robustness of the results, Table 2.5 gives the average deviation among the models. This is calculated by taking the absolute differences of the efficiency scores of two different models for each observation and afterwards taking averages. Table 2.5 indicates that deviations fluctuate between 0.04 and 0.15 for most models. However, model 2 and especially model 7 show a much larger deviation. This means that when including costs of managing the housing stock into the model, as we do in both of these models, one has to consider carefully whether the data is of sufficient quality, since it can influence results strongly. More research needs to be done to solve this issue. Within the current setting, we would classify these models as insufficiently creditworthy.

Table 2.4. DEA results under vrs-specification.

Model:	**1a**	**1b**	**1c**	**2**	**3**	**4**	**5**	**6**	**7 (aggregate)**	**7 (stage 1)**	**7 (stage 2)**
N	392	392	406	277	398	408	389	140	274	274	274
Average efficiency	0.88	0.86	0.86	0.84	0.85	0.86	0.90	0.96	0.53	0.40	0.66
Standard deviation	0.16	0.17	0.16	0.23	0.17	0.18	0.16	0.10	0.24	0.26	0.22
Minimum efficiency	0.28	0.27	0.24	0.19	0.32	0.30	0.34	0.61	0.19	0.05	0.21
% With maximum efficiency	53%	45%	46%	59%	42%	50%	61%	74%	6%	11%	18%
% of corporations removed[a]	2%	2%	2%	3%	2%	1%	3%	5%	3%	3%	3%

The table gives averages for all relevant periods.

[a] In most cases, about 5 percent of the corporations have a superefficiency score higher than 1, 1 percent has a score higher than 2, and 1 percent has a score higher than 3. However, when removing all observations with a score higher than 3, a new round of calculations may reveal new corporations with a score higher than 3, since the best practice frontier changes. Therefore, multiple rounds of DEA are needed to remove outliers.

Table 2.5. Average deviation among models.

	Model 1a	**Model 1b**	**Model 1c**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**
Model 1a	0	0.03	0.03	0.11	0.08	0.12	0.10	0.06	0.34
Model 1b		0	0.05	0.12	0.08	0.14	0.12	0.06	0.32
Model 1c			0	0.11	0.06	0.11	0.12	n.a.	0.33
Model 2				0	0.12	0.18	0.16	n.a.	0.29
Model 3					0	0.15	0.14	0.09	0.32
Model 4						0	0.06	n.a.	0.31
Model 5							0	0.03	0.36
Model 6								0	n.a.
Model 7									0

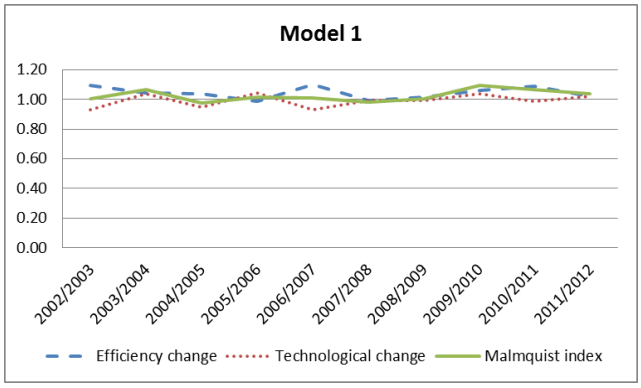
To compare efficiency changes over time, Figure 2.3 presents the Malmquist indices for a few models. It is found that the aggregate Malmquist index (i.e., total factor productivity change; the solid green lines in Figure 2.3) is close to 1 for all years. This indicates that there is hardly any change in productivity throughout the years. From 2009 onwards however, it seems that an upward trend in productivity has set in, of about five to ten percent per year.

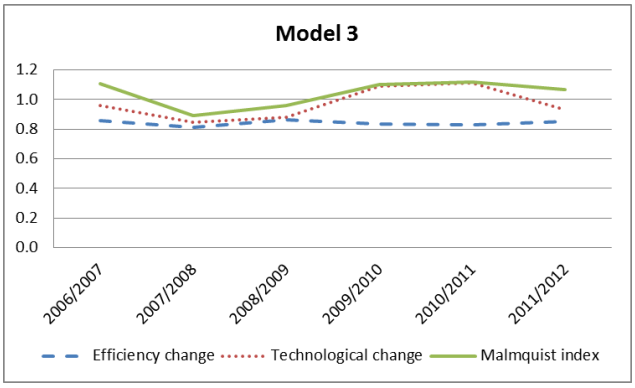
The finding of such a large a productivity increase may seem surprising, since different authors found absent or much smaller productivity increases for many parts of the Dutch (semi-)public sector (Kuhry and De Kam, 2012; selection of IPSE-studies[34]). Furthermore, the productivity increases for corporations seem rather large for a sector that has not been subject to major shocks in technology. Note however that because Data Envelopment Analysis does not allow for white noise, a few deviations in the dataset may have a strong impact on the Malmquist indices. Also, we do not perfectly correct for differences in input prices. Instead, we have corrected costs for inflation. However, the development of prices in the housing sector may differ from the general development in wages and prices. This means that numbers should always be interpreted with caution and one will have to look at the long-term trend to reach more robust conclusions.[35] Chapter 3 elaborates further on Malmquist indices.

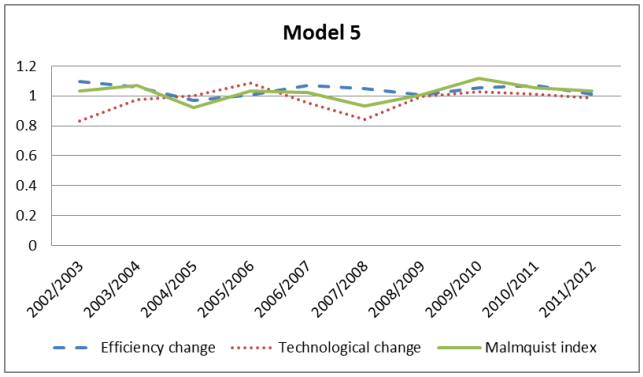
[34] IPSE has published a wide variety of studies on efficiency (trends) in the public sector (see http://www.tbm.tudelft.nl/over-faculteit/afdelingen/values-technology-and-innovation/secties/economie-van-technologie-en-innovatie/innovaties-publieke-sector-efficientie-studies/onderzoek/publicaties/onderzoeksrapporten/). The majority of the studies published after 2011 shows negative productivity trends. Productivity increases are sometimes found but never exceed three percent. Note however that these studies do not use DEA to assess efficiency (see also footnote 35).

[35] Indeed, in DEA, Malmquist indices of this magnitude are not unique. Johnes (2006) comes up with average Malmquist indices of about 1.1 for the English education sector in 2002, Kaditi and Nitsi (2009) find an average Malmquist index of 1.14 for Greek farms in 2002 and Arjomandi et al. (2011) mention average Malmquist indices of 0.89 to 1.28 for Iranian banks between 2003 and 2008.

Figure 2.3. Malmquist indices.







2.8 Conclusion

It is often noted that Dutch housing corporations lack incentives to operate efficiently as they are not allowed to appropriate their profits. Also, competition is weak and entering the social housing market is almost impossible. Finally, supervision has proven to be insufficient in the past. Empirical research on this issue is scarce however. This chapter provides an attempt to fill this hiatus by estimating the efficiency of housing corporations by means of a Data Envelopment Analysis (DEA). This method allows us to conduct such a measurement with the limited information that is available.

Another main advantage of efficiency measurement with DEA is that a certain efficiency score can always be traced back (i.e., it reveals by which other dmu's, the dmu under consideration is 'defeated'). If a corporation can provide a valid explanation of why its efficiency score is unfair, the model may be reconsidered.

It is difficult to construct an optimal model. Opinions may differ about which outputs should be included in the model. Also, data availability is not optimal within the current setting. The

greatest problem is that corporations do not register housing management costs (i.e., costs for building, buying, etc.) uniformly. More effort needs to be done on this issue.

These difficulties lead us to conclude that there is not a single optimal model. Therefore, we constructed multiple sub-models. Which model should be selected to base final conclusions on depends on subjective issues. Questions have to be answered about what should be counted as inputs and outputs.

Average pure technical efficiency appears to be around 0.85 for most models. This implies that, on average, corporations should be able to reduce costs by at least 15 percent without reducing output. Note that these figures reflect relative efficiency scores. It could well be the case that corporations that are relatively efficient (those on the best practice frontier) are able to improve their efficiency as well. Also, we use models that are rather conservative. This means that our scores indicate the efficiency potential that is minimally attainable.

To measure the change in efficiency over time, Malmquist indices are calculated. The results reveal that – on average – there has not been a structural change in efficiency in most years. From 2009 onwards however, the Malmquist indices reveal an annual increase in productivity of about five to ten percent. This implies that an upward trend may have set in. Only time will tell whether this trend will continue.

Appendix

2.A Construction of output 2b

Output 2b (see section 2.6.2) is defined as the average value of dwellings, corrected for the land price. The output is constructed as follows. First of all, we calculate a so-called 'land price index' for each municipality in the Netherlands. To this end, we make use of a hedonic regression conducted by Allers and Vermeulen (2013, 2016) on the basis of micro data on housing transactions obtained from the Dutch association of Realtors (*Nederlandse Vereniging van Makelaars o.g. en vastgoeddeskundigen,* NVM). This dataset comprises information about the transaction price, location of the house and an extensive list of (physical) characteristics of the dwelling, such as the size, the number of rooms, and maintenance condition. With this data, it is possible to correct (owner-occupied) housing prices for differences in these physical characteristics. For a more elaborate explanation about this method, see Allers and Vermeulen (2013). In this way, we can estimate the price of a house with average characteristics, per year and per municipality. This price reflects the attractiveness of each location. That is, the land price index of municipality *a* is now calculated as the price of a dwelling with standard characteristics in municipality *a* (P_a^s) divided by the nation-wide average price of such a dwelling ($\bar{P}^s$).

Finally, these measures are converted from the municipality level to the level of corporations by means of weighted averages. For example, a corporation with 20 dwellings in municipality *a* and 80 in municipality *b* has a land price index of $L = \left(\frac{20}{100}\right)\frac{P_a^s}{\bar{P}^s} + \left(\frac{80}{100}\right)\frac{P_b^s}{\bar{P}^s}$. Output 2b is now calculated as the average value of the corporation dwellings, divided by L.

2.B Accounting principles of housing corporations

The accounting system of the corporation sector makes a distinction between the 'profit and loss account' and the 'cash-flow account'. The profit and loss account presents the revenues and expenditures of the corporations that have been imputed to a certain year. The cash-flow account deals with cash inflows and outflows in a certain year. Tables 2.B.1 and 2.B.2 give an overview of the elements of the sheets. The main difference between the two is that investments, for example made to build new dwellings, show up in the cash-flow sheet immediate-

ly. These cash-flows are often being depreciated over several years so as to smoothen the expenditures however. Therefore, an investment may show up as depreciation in the profit and loss account for several years. Depreciation may therefore not only differ because of investments, but also because corporations may have different recovery periods.

Table 2.B.1. Profit and loss account of corporations in 2010.

Revenues	**Expenditures**
Rents	Depreciation
Reimbursements	Other value-mutations of (im)material fixed assets
Government contributions	Ground rent
Sale of dwellings	Personnel expenditures
	Wages and salaries
	Social expenditures
	Pension expenditures
Changes in work in progress	Maintenance expenditures
Activated production for the benefit of the own company	Unusual value-mutation in current assets
Other operational revenues	Other operational expenditures
	Sector specific tax

The inputs we use in our models (personnel expenditures, maintenance costs and other operational expenditures) are obtained from the profit and loss accounts. For models 2 and 7, cash-outflows from investment activities are included as well. As an alternative, one could also choose to include depreciation as an input (which is more smooth). We have chosen not to do so, since depreciation in year *t* depends heavily on past decisions (i.e., investments) which cannot be influenced in the current year anymore.

Table 2.B.2. Cash-flow sheet of corporations in 2010.

Operational activities		**Investment activities**	
Inflows	**Outflows**	**Inflows**	**Outflows**
Rents	Ground rent	Receipts from sale of current dwellings	Expenditures for newly built dwellings
Reimbursements	Personnel costs	Receipts from sale of existing dwellings	Expenditures for housing improvement
	Wages and salaries		
	Social costs		
	Pension costs		
Government contributions	Maintenance costs	Receipts from sale (other)	Acquisition of dwellings
Other operational receipts	Other operational expenditures	Receipts from financial fixed assets	Expenditures for demolition of dwellings
Interest receipts	Interest expenditures		Other investments
	Sector specific tax		External costs of selling current dwellings
	Livability expenditures (excluding investments)		Expenditures for financial fixed assets
	Corporate income tax		

Chapter 3

Scale, Mergers and Efficiency[1]

[1] This chapter is based on Veenstra et al. (2016).

3.1 Introduction

In many public service sectors, the optimal scale of operations is an important point of discussion, considering the vast literature on this issue (see e.g., Holzer et al., 2009; Leithwood and Jantzi, 2009; Blank et al., 2011). This chapter investigates the impact of increasing scale and merging of housing corporations on their efficiency. The last decades have seen many mergers of corporations in the Netherlands, and more are to be expected. If mergers do not appear to have desirable consequences, this would call for a more critical inspection of merger proposals. Previous studies failed to find consistent evidence in favour of mergers.

The fact that mergers are not always driven by efficiency considerations is illustrated by the existence of many alternative merger motivations that have been put forward in the literature: herding (Devenow and Welch, 1996), reputational herding (Scharfstein and Stein, 1990), hubris (Roll, 1986), entrenchment (Shleifer and Vishny, 1989), empire building (Rhoades, 1983) and institutional isomorphism (DiMaggio and Powell, 1983). Indeed, several surveys show that only a minority of the mergers within the Dutch social housing sector was explicitly motivated by efficiency considerations (Van Bortel et al., 2010).

In theory, the effect of increasing scale on efficiency is ambiguous. In principle, according to Bogetoft and Wang (2005), a merger can be beneficial (or detrimental) for three reasons. First of all, a merger increases scale. If the production technology is characterized by economies of scale, increasing scale would improve efficiency. On the other hand, if there are diseconomies of scale, a merger will have a negative effect. Bogetoft and Wang (2005) call this the ‘scaling or size effect’. Usually, it is assumed that small organizations operate under economies of scale, which means that increasing scale will reduce average costs because fixed costs are spread over a larger output, and because of specialization due to a better division of labour. On the other hand, if an organization grows too large, diseconomies of scale may set in due to increasing numbers of management layers and weaker connections with customers. As a result, the unit cost of public services is often assumed to be u-shaped, reflecting economies of scale (downward sloping average costs) for units below a certain critical size and diseconomies of scale for larger organizations. If this is indeed the case, it is the task of the organization to strike the golden mean.

Secondly, A merger might lead to a reconsideration of operating practices because a new management team is brought in, or because the organizations are able to learn from each other's practices. Existing organizations usually have well established ways of doing things, even though more efficient practices have become available (technological progress). A merger, bringing together organizations used to doing things in different ways, forces them to reconsider procedures and operations and to learn from each other. This may result in the adoption of more efficient practices (see also Hansen et al., 2014). Thus, mergers might increase pure technical efficiency. We label this reasoning as the 'shake-up hypothesis'. On the other hand, increasing scale through merging may reduce competition, which may increase organizational slack (CPB, 2013b) and therefore decrease pure technical efficiency.

Thirdly, a merger combines two sets of inputs and outputs into one set. It might be that the mixture of this new set is more favourable (i.e., more balanced) than the original sets. Bogetoft and Wang (2005) call this the 'harmony, scope or mixture effect'.

Mergers can have negative temporary effects as well. New office buildings might be needed, IT-systems have to be integrated, and so on. Mergers and the uncertainties surrounding them may also have disruptive (i.e. shake-up) effects on managerial behaviour and organizational outcomes (Andrews and Boyne, 2012). Therefore, to obtain a complete picture of the relationship between scale and efficiency, it is essential to study a sufficiently long period and to distinguish between static and dynamic effects.

In this chapter, first, we consider the presence of scale (dis)economies in the Dutch public housing sector, thereby answering the question what scale level is most suitable in this sector. Next, we adopt a dynamic viewpoint so as to assess the impact of increasing scale on organizational slack. Breaking down productivity changes into (1) changes in pure technical efficiency, (2) technological change and (3) a scale effect enables us to make this distinction.

We find that most corporations operate under diseconomies of scale, implying that decreasing scale would increase scale efficiency. Concerning the effect of merging on pure technical efficiency, evidence is mixed. A non-parametric approach (Data Envelopment Analysis) seems to support the shake-up hypothesis, but this cannot be confirmed by a parametric approach (Stochastic Frontier Analysis). Therefore, the negative effects of scale increases seem to dominate.

The chapter is set up as follows. Section 3.2 gives a description of recent trends and reviews the literature on merging in the social housing sector. Methodological issues concerning both Data Envelopment Analysis and Stochastic Frontier Analysis are discussed in section 3.3. The model specifications are provided in section 3.4. Results are given in section 3.5. Section 3.6 concludes.

3.2 Recent developments and previous research

3.2.1 Scale and mergers

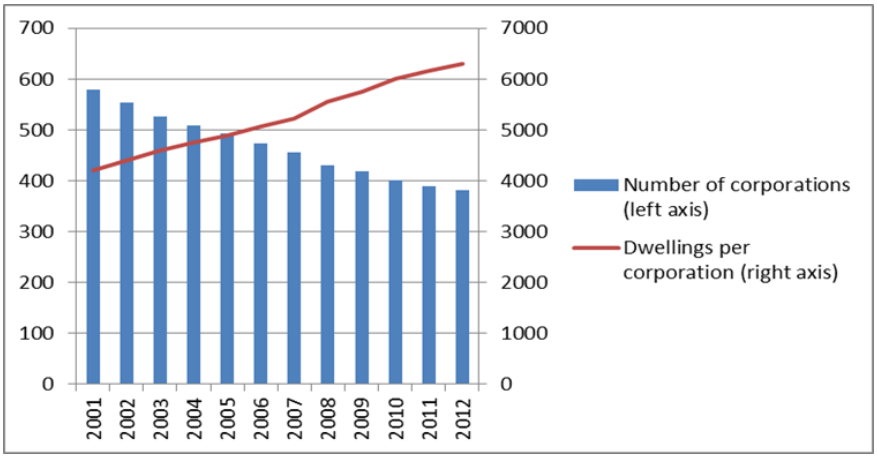
In many areas of public service provision, the trend of increasing the scale of operations is dominant. Whether we are examining education institutions, hospitals or local governments, recent decades show an ongoing process of mergers and amalgamations so that services are provided by fewer, but larger, organizations (Blank et al., 2011). This also applies to Dutch housing corporations.

The last decades have shown a boom in merger activity among corporations. In particular, merger activity increased sharply in the mid-nineties. Most authors agree that this trend was ignited by changes in legislation that gave corporations considerably more autonomy, but also forced them to stand on their own feet. As a response, "most housing associations (…) changed their legal status from associations to (non-profit) corporations" (Koopman et al., 2008, p. 1). According to Koopman et al. (2008), this ignited the merger boom in the years hereafter.

Already in 1994, the National housing council predicted the number of corporations to decline from over 900 to 400 within a few years.[2] The process appeared to be somewhat less abrupt than expected, however. It took until 2010 before this figure was actually reached. The total number of corporations declined from to 858 in 1985 to 381 in 2012.[3] Because the total housing stock in the hands of corporations remained fairly constant, the number of dwellings per corporation increased sharply. Figure 3.1 illustrates this for 2001-2012.

[2] Source: "Aantal corporaties zal door fusies halveren" (1994).
[3] If we were to include 'municipal housing companies', which provided part of the social housing in the twentieth century, the total number was 1,152 in 1985. Nowadays, all social housing is in hands of corporations. Source: Hakfoort et al. (2002).

Figure 3.1. Total number of housing corporations, and average number of dwellings per corporation, 2001-2012.



3.2.2 Literature review

The trend to increase the scale of production is apparent in many areas of public service provision. The question is whether these institutions have been growing towards an optimal scale level, or whether overshooting may have occurred. In the private sector, efficiency considerations are usually the driving forces behind mergers. Indeed, a firm operating inefficiently is the perfect candidate for a takeover if the management of another firm knows how to improve efficiency and thereby stockholders value (CPB, 2013b).[4] In the (semi-) public sector, mergers may have multiple goals.

Indeed, for corporations, reasons to merge are diverse and specific targets are rarely provided (Koolma, 2008). That efficiency would increase as a result of mergers was usually taken for granted. Motives given for housing corporation mergers are quite heterogeneous: improving market position (Van Veghel, 1999; Cebeon, 2006; Koolma, 2008), increasing professionalism (Van Veghel, 1999), improving efficiency (Cebeon, 2006; Koolma, 2008) or resolving financial problems (Koolma, 2008; Veenstra et al., 2013). Only a minority of the mergers was explicitly motivated by taking advantage of scale economies (Van Bortel et al., 2010). This confirms the notion that for Dutch corporations, efficiency has long not been recognized as a major issue. For English housing associations on the other hand, efficiency appeared to be a more important motive (Van Bortel et al., 2010).

[4] However, even in the private sector failure rates among mergers appear to be high (Cartwright and Schoenberg, 2006; Crooijmans, 2015).

A remarkable finding by Van Veghel (1999) is that the bulk of housing corporation merger negotiations fail somewhere along the way. Breakdown of negotiations is however mainly due to differences in company cultures, or personal issues (see also Koolma, 2008).

Studies on the effects of increasing scale and merging do not find conclusive evidence. Based on a cross section of housing corporations in 2002, Koolma (2008) and Koolma et al. (2013) find evidence suggesting that larger corporations face higher costs than their smaller counterparts, whereas there is only a weak effect of the scale level on the scope of their portfolio management and no effect on the level of investments. This suggests that many corporations operate at diseconomies of scale. This observation affirms the findings of Schellevis and Van der Weyden (1987) who find a positive relation between size and average costs as well.

According to CFV (2005), between 2000 and 2003, large corporations and merged corporations had relatively high average operating costs. Van Bortel et al. (2010) discuss the motivations, expected effects, and actual outcomes of mergers of housing associations in the Netherlands and England by reviewing existing research, and adding a few new insights. One of the main new findings is that (in the Dutch case) customer satisfaction drops directly after a merger, but rises sharply in the next few years. The authors further conclude that larger organizations are more active home-builders. Efficiency gains of increasing scale are not found. Overall, according to the authors, comparing mergers is complicated as mergers are driven by different motives and objectives, and therefore there is no single measure on which to judge the corporations' performance. This does not mean, however, that one cannot investigate the effects on a socially desirable goal, such as efficiency.

Cebeon (2006) investigates the effects of mergers in the Dutch housing corporation sector, by comparing the difference in characteristics between subsets of corporations that did and did not merge. In general, the merged corporations are larger, make larger investments, have more possession in urban areas, but do not differ in terms of their geographical location and financial position. Because the authors only give descriptive statistics, one cannot tell whether these differences are significant. Additionally, the authors conduct a qualitative analysis, focusing on a diverse subset of 15 corporations that have merged in the recent past. Goals of the merger appeared to be both financial (increasing market power, increasing efficiency, lowering risk, combining poor with rich organizations) and operational (improving adjustment to local circumstances, increasing scale in order to conduct large projects). In general, corporations state that most of the goals that were formulated in advance were actually

attained. The only goal that had not been fully achieved was an increase in efficiency. Indeed, most corporations showed an increase in number of employees as well as total expenditures after the merger.

Mullins (2006) indicates that, within the English social housing market, there is a belief that efficiency gains from increasing scale (and merging) can be obtained. Not all English housing associations agree on this however (Mullins, 2007). Lupton and Kent-Smith (2012) argue that there is hardly any relation between average costs and scale of English housing associations, and that the effects of mergers are ambiguous as well. However, a few case studies investigated by Lupton and Kent-Smith (2012) indicate that mergers can be successful, but this success is most probably caused by the merger changing internal processes instead of a scale effect. A merger therefore does not automatically improve performance. The authors provide the example of two already large English housing associations merging into a very large organization. The merger process was characterized by a clear view of increasing efficiency, with a focus on communication and consultation with all stakeholders. Centralization of functions also appeared to contribute to efficiency. The question is of course whether these efficiency gains could also have been realized without the merger. That is, is it the scale increase that gave rise to the efficiency gains, or the organizational change and increased focus on efficiency, or both?

The aforementioned studies have in common that they mainly focus on short-term effects of mergers or investigate only a small sample of corporations. A more coherent approach is applied by Van den Berge et al. (2013) who conduct a longitudinal analysis based upon all Dutch corporations. They find no significant effects of merger activity on current costs, neither in the short run, nor in the long run. Splitting up mergers in terms of size or financial position does not increase significance. Overall then, the effect of mergers on costs is ambiguous. The often mentioned notion that merged corporations have higher costs than their unmerged counterparts is affirmed, but the authors emphasize that this is not a direct cause of the mergers. The authors acknowledge, however, that such results do not indicate whether or not mergers are favourable in terms of effects on efficiency, as they do not include output measures into their models.

In another recent study, Crooijmans (2015) investigates the relation between mergers and several measures that serve as proxies for productive efficiency and finds hardly any significant relationships. Crooijmans (2015) provides four possible explanations why mergers might

not lead to value creation. First of all, the management of the merging process might fail. Secondly, the technology in the sector might be insensitive to scale (i.e., there are neither economies nor diseconomies of scale). Thirdly, mergers may be ignited by strategic rather than economic motives. Finally, Crooijmans (2015) argues, corporations may mimic each other or follow the national merger trend.

This chapter focuses on the first two explanations given by Crooijmans. The observation that mergers often occurred for other reasons than efficiency leads us to suspect that some corporations may have grown too big and therefore operate under diseconomies of scale because of the merger. Simultaneously, as noted in section 3.1, mergers may have an effect on the internal organization as it forces organizations to reconsider existing practices. Therefore, whether or not mergers were beneficial within the recent past remains unclear. The next section presents a framework meant to deal with these issues.

3.3 Methodology

3.3.1 Mergers and efficiency

As noted in section 3.1, a merger may influence efficiency via (1) a scale effect, (2) an effect on pure technical efficiency and (3) a mixture effect. In this chapter, we will investigate the first two effects of mergers among Dutch housing corporations.

We will ignore potential mixture effects of mergers and thus focus on the effects on scale efficiency and pure technical efficiency. Since we use only one input in our model, mixture gains could only be achieved by mixing of outputs. However, since corporations do not engage in activities that have a very different character, we assume that potential gains from mixing are negligible. Moreover, to the best of our knowledge, current software doesn't allow for a straightforward implementation of mixture effects. In the next section, our approach is presented.

3.3.2 Scale efficiency and pure technical efficiency

In order to distinguish between the scale effect and the pure technical efficiency effect, we decompose total factor productivity change into (1) pure technical efficiency change, (2) technological change and (3) a scale effect. Such a decomposition may be conducted both by means of a Data Envelopment Analysis (DEA) and a Stochastic Frontier Analysis (SFA).

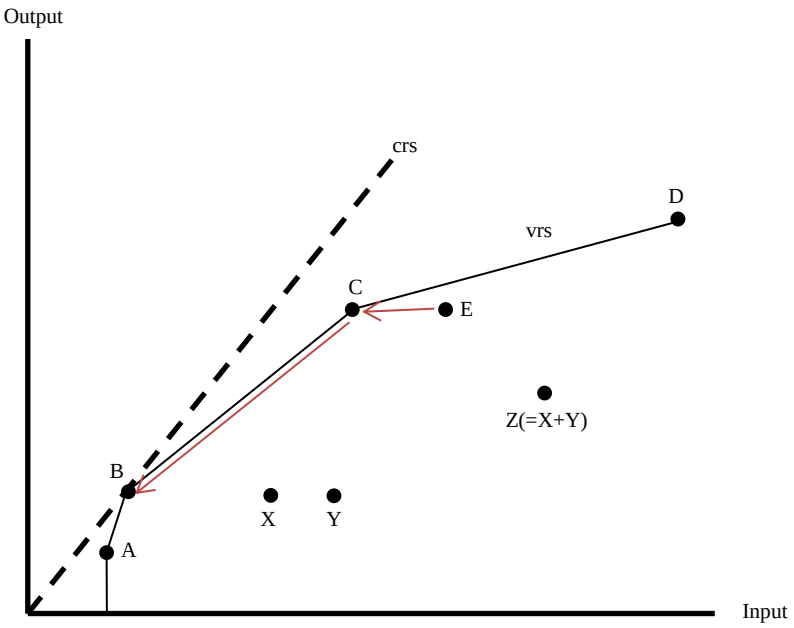
In chapter 2, we used Data Envelopment Analysis (DEA) to estimate the efficiency of housing corporations because, in our opinion, this method is most appropriate in this sector. We refer to chapter 2 (especially section 2.5) for an elaborate discussion on DEA. However, Simar and Wilson (2013) argue that using DEA-scores for making inferences is difficult and prone to incorrect estimations. This means that one should be cautious when for example using DEA-scores as variables in regression analyses. Therefore, in studying the relation between scale, mergers and efficiency, we will not solely rely on DEA as we did in chapter 2, but use a parametric approach (i.e., Stochastic Frontier Analysis) as well. Conceptually, the two methods are rather similar however. We will first develop a framework for DEA and afterwards present the SFA-approach.

3.3.3 Mergers and efficiency in a non-parametric setting

As noted in chapter 2, with DEA we may choose between a crs- and a vrs-specification.[5] The crs-specification assumes that the relationship between input and output is linear (i.e., doubling the inputs leads to a doubling of the outputs). Figure 3.2 repeats Figure 2.2 from chapter 2 and shows the difference between crs and vrs for the one-input, one-output case. Suppose that the technology in the sector has variable returns to scale (i.e., the vrs-line resembles the true production possibility frontier). We may now distinguish between three definitions of efficiency. A dmu located on the vrs-frontier is *pure technically efficient*, meaning that given the current scale of operations, it cannot improve its efficiency. This holds for dmu's A, B, C and D in Figure 3.2. However, B is the only dmu that is located on the crs-frontier. This means that given the current technological possibilities, no dmu is more productive than B. Therefore, the distance to the crs-frontier reflects *total (technical) inefficiency.* Thus, although dmu's A, C and D cannot improve efficiency given their scale, they could improve by moving along the vrs-frontier towards point B. That is, these three dmu's (in contrast to dmu B) do not have a maximum scale efficiency. Total technical efficiency (TE^{crs}) is thus the product of pure technical efficiency (TE^{vrs}) and scale efficiency (SE). Thus: $TE^{crs} = TE^{vrs} * SE$. More specifically, we note that dmu A is operating under economies of scale as it could benefit from increasing its scale whereas dmu's C and D are operating under diseconomies of scale.

[5] Other possibilities are non-increasing and non-decreasing returns to scale (see Coelli, 1996).

Figure 3.2. DEA with 1 input and 1 output, crs- versus vrs-specification.



An inefficiently operating dmu, such as E, therefore has two possibilities for improvement. Firstly, it can retain the current scale of operations, but work more efficiently (moving from E to C). Secondly, it may improve productivity even further by decreasing its scale to point B (for example by spinning off activities). A third possibility – profiting from a shift of the entire best practice frontier (technological progress) – is not considered in this example as this is exogenous to corporations.

3.3.4 Malmquist indices

Total factor productivity change (M^{tfpch}) can be written as the product of M^{techch}, a change in technology (i.e., the total shift of the frontier over time), M^{pech}, the change in pure technical efficiency (the extent to which a dmu approaches the vrs-frontier) and M^{sech}, the change in scale efficiency (Coelli, 1996). Thus:

$$M^{tfpch} = M^{techch} * M^{pech} * M^{sech} \tag{3.1}$$

In the example of Figure 3.2, a movement from E to C resembles pure technical efficiency change and a movement from C to B indicates an increase in scale efficiency. Further decompositions of the Malmquist index are possible (Simar and Wilson, 1998b).

3.3.5 Bootstraps

Simar and Wilson (1998a; 1999) note that efficiency scores estimated by means of DEA may be biased because they are derived using finite data samples. The true production possibility frontier is not observed; changing the data would change the results. Statistical estimation needs replication of the data-generating process. Therefore, wherever possible, we use the bootstrap procedure of Simar and Wilson (1999), replicating the data generating process in order to correct for potential biases and obtain confidence intervals. However, because bootstrapped DEA cannot be combined with controlling for exogenous variables, we cannot use it throughout the entire chapter. Without delving into the details, the process of bootstrapping Malmquist indices consists of five stages (see also Arjomandi et al., 2011 or Gitto and Mancuso, 2012):

1. Estimate the 'simple' Malmquist indices following the ordinary procedure (see Coelli, 1996).
2. Construct a pseudo-dataset, based on a kernel density estimation making use of the reflection method of Silverman (1986).
3. Calculate the Malmquist indices, using the pseudo-dataset obtained in step (2) as the reference set.
4. Repeat steps 2 and 3 B times. This gives a vector of bootstrap estimates.
5. From the vector in step (4), calculate the unbiased estimates of the Malmquist indices and the confidence intervals, based upon the preferred level of confidence.

3.3.6 Mergers and efficiency in a parametric setting

As noted in section 3.3.2, using DEA-scores as variables in a regression analysis may lead to incorrect estimations (Simar and Wilson, 2013). Therefore, we supplement the DEA by a parametric approach (SFA). SFA also allows us to decompose total factor productivity into pure technical efficiency change, technological change and a scale effect. We do this by means of the method introduced by Orea (2002).[6] First we use an SFA to estimate a translog cost function,[7] and to calculate efficiency scores. Next, we use the parameter estimates together with the efficiency scores to calculate total factor productivity changes and their decompositions.

[6] For an application to a cost function, see e.g. Abdul-Majid et al. (2011).
[7] One may also estimate production functions or distance functions if these are more suitable.

We estimate the following translog cost-function:

$$\ln(C) = \alpha_0 + \sum_{m=1}^{M} \beta_m \ln(Y_m) + \sum_{k=1}^{K} \delta_k \ln(Z_k) + \frac{1}{2}\sum_{m=1}^{M}\sum_{m=1}^{M} \beta_{mm} \ln(Y_m)\ln(Y_m) + \frac{1}{2}\sum_{k=1}^{K}\sum_{k=1}^{K} \delta_{kk} \ln(Z_k)\ln(Z_k) + \sum_{m=1}^{M}\sum_{k=1}^{K} \vartheta_{mk} \ln(Y_m)\ln(Z_k) + \varphi_t t + \frac{1}{2}\varphi_{tt} t^2 + \sum_{m=1}^{M} \psi_m \ln(Y_m)\, t + v + u \quad (3.2)$$

Where:

$C = costs$
$Y_m = output\ (m = 1, \dots, M)$
$Z_k = exogenous\ factor\ (k = 1, \dots, K)$
$v = random\ error\ term\ (normal\ distribution)$
$u = inefficiency\ term\ (half\ normal\ or\ truncated\ normal\ distribution)$
$t = time$

Note that we do not include input prices because these are not available. We do correct our cost measures for inflation in order to make them comparable over the years.[8] This is more appropriate than explicitly including price indices in the model, since these indices would suffer from multicollinearity with t.

The estimated parameters and efficiency scores can be used to calculate the change in total factor productivity and its decomposition into (1) the change in pure technical efficiency, (2) technological change and (3) a scale effect. In general, we have:

$$Tfp\ change = pure\ technical\ efficiency\ change + technological\ change + scale\ effect \quad (3.3)$$

This is calculated as follows:

[8] To be precise, we correct wages and salaries by means of a general wage index. Maintenance costs are corrected by means of a housing development price index (which takes into account the change in the price of materials and the change in wages for persons employed in housing construction). Other current expenditures are corrected by means of the general consumer price index. All other costs (only relevant if we use total expenditures instead of operational costs) are corrected by means of the housing development index.

$$\ln\left(\frac{TFP_{it+1}}{TFP_{it}}\right) = \ln\left(\frac{TE_{it+1}}{TE_{it}}\right) - \frac{1}{2}\left[\frac{\partial \ln(C_{it+1})}{\partial t} + \frac{\partial \ln(C_{it})}{\partial t}\right] + \frac{1}{2}\sum_{m=1}^{M}\left[(SF_{it+1}\varepsilon_{mit+1} + SF_{it}\varepsilon_{mit})(Y_{mit+1} - Y_{mit})\right] \quad (3.4a)$$

Where:

$$\varepsilon_{mit} = \frac{\partial \ln(C_{it})}{\partial \ln(Y_{mit})} \quad (3.4b)$$

$$SF_{it} = \left(\sum_{m=1}^{M} 1 - \varepsilon_{mit}\right) / \sum_{m=1}^{M} \varepsilon_{mit} \quad (3.4c)$$

3.4 Model specification

3.4.1 Data Envelopment Analysis

As noted in chapter 2, several model specifications are possible, depending on both theoretical and practical considerations. To investigate the (long-term) effects of mergers, we have to rely on a simple model that can be estimated for multiple years, because for more elaborate models, data availability is insufficient. Therefore, we adopt a model that is closely related to model 1a from chapter 2.

We relate current expenditures to the total number of new housing allotments, the number of continued contracts and the increase in quality of the dwellings. New allotments have been split up into four separate outputs: (1) persons below 65, housed adequately, (2) persons below 65, housed inadequately, (3) persons above 65, housed adequately, (4) persons above 65, housed inadequately. Adequate housing in this context means providing a dwelling that has a rent in accordance with the income of the tenant. The number of continued contracts is split up into households in (1) dwellings suitable for the elderly and handicapped and (2) all other dwellings.

The quality of dwellings is given by the number of WWS-points (see also section 2.6.2). Because one of the models we estimate is a crs-model, a relative output measure like average WWS-points (used in the models in chapter 2) would be inappropriate (Podinovski, 2004).

Therefore, we have to adapt model 1a from chapter 2 slightly.[9] We use the increase in average WWS-points, multiplied by the weighted number of dwellings in the current year as output. Thus:

$$Output = (Average\ WWS\ points\ end\ of\ year - average\ WWS\ points\ beginning\ of\ year) * 0.5(dwellings\ beginning\ of\ year + dwellings\ end\ of\ year)$$

Operational expenditures are taken as input. Operational expenditures consist of (1) wages and salaries, (2) maintenance costs and (3) other operational expenditures.[10] For completeness, we also consider a specification with total expenditures as input, which is given by operational expenditures plus depreciation, other value mutations of (im)material fixed assets and ground rent. Further, the number of dwellings at the start of the year is included as a nondiscretionary input. Finally, average age of the housing stock, soil quality of the region where the corporation is active and address density are included as exogenous variables. A simple regression indicates that corporations with an older housing stock, a less firm soil and a lower address density are disadvantaged (details not shown).[11] The specification is presented in Table 3.1.

Table 3.1. Model specification DEA.

	Model 1	**Model 2**
Input	Operational expenditures	Total expenditures
Output	Adequate housing (age<65) Inadequate housing (age<65) Adequate housing (age>65) Inadequate housing (age>65) Continued contracts (ordinary dwellings) Continued contracts (special dwellings) Change in housing quality (change in WWS-points)	See model 1
Fixed input	Number of dwellings at the beginning of the year	See model 1
Exogenous variables	Average age of dwellings Soil quality Address density	See model 1

[9] In principle, an optimal solution would be to conduct a hybrid model (using a vrs-specification for WWS-points and a crs-specification for all other outputs). However, such an approach is – to the best of our knowledge – not yet implemented in DEA-software.

[10] Operational costs have however been adjusted (so as to increase comparability) in the same way as in chapter 2 (see section 2.6.3).

[11] Note that in chapter 2, we did not include address density as exogenous variable. This is because this variable does not always show a significant impact on efficiency.

3.4.2 Stochastic Frontier Analysis

The model used for the Stochastic Frontier Analysis is slightly other than the one for the Data Envelopment Analysis. We use only 3 outputs in order to avoid multicollinearity. The specification is given in Table 3.2.

Table 3.2. Model specification SFA.

	Variable name	Model 1	Model 2
Cost variable	C	Operational expenditures	Total expenditures
Output	Y_1	New housing	See model 1
	Y_2	Continued contracts	
	Y_3	Housing quality (WWS-points)	
Exogenous variables	Z_1	Average age of dwellings	See model 1
	Z_2	Soil quality	
	Z_3	Address density	

3.5 Results

3.5.1 Efficiency scores and (dis)economies of scale (DEA)

The DEA-results are given in Table 3.3. For model 1, the average total (crs) efficiency score is 0.74. Pure technical efficiency (vrs) is 0.86 and half of the corporations is located on the vrs-frontier. Average scale efficiency (i.e., crs efficiency/vrs efficiency) is 0.85. This implies that the savings potential by increasing pure technical efficiency is roughly equal to the potential efficiency gains by changing scale. According to model 2, (scale) efficiency is somewhat lower.

Table 3.3. Static DEA results (all years).

	Period	Average efficiency	St. dev.	% with maximum score	Minimum efficiency
Model 1					
Total efficiency	2002-2012	0.74	0.20	25%	0.24
Pure technical efficiency	2002-2012	0.86	0.17	50%	0.26
Scale efficiency	2002-2012	0.85	0.16	25%	0.36
Model 2					
Total efficiency	2002-2012	0.69	0.23	25%	0.21
Pure technical efficiency	2002-2012	0.84	0.19	50%	0.24
Scale efficiency	2002-2012	0.81	0.19	20%	0.24

N runs from 461 in 2002 to 319 in 2012.

Table 3.4a presents scale (dis)economies in 2010 for the standard (non-bootstrapped) DEA model. The results of both models are quite similar. In 2010, 6 percent of the corporations operated under economies of scale, while 70 percent experienced diseconomies of scale. The bulk of the corporations should therefore be able to improve scale efficiency by reducing their

size. Scale efficiency is highest for corporations with 501-1,000 dwellings. For corporations with more than 2,500 dwellings, strong diseconomies of scale appear. Note that in 2012, corporations possessed about 6,300 dwellings on average (see Figure 3.1). Therefore, it appears that many corporations have grown too big. Note that, because DEA defines scale by means of all outputs and inputs, not by number of dwellings, it is possible that both economies and diseconomies of scale occur within the group of corporations with 1,001-2,500 dwellings (and in other groups). Also, not all corporations with more than 2,500 dwellings operate under diseconomies of scale. In other words: one cannot simply identify an optimal number of dwellings.

Table 3.4a. Scale (dis)economies in 2010 (non-bootstrapped).

Number of dwellings	Number of corporations	Average scale efficiency	% corporations with economies of scale	% corporations with scale neutrality	% corporations with diseconomies of scale
Model 1					
< 500	32	0.96	34%	59%	6%
501 – 1,000	33	0.99	30%	48%	21%
1,001 – 2,500	84	0.95	7%	37%	56%
2,501 – 5,000	68	0.88	0%	16%	84%
5,001 – 10,000	73	0.81	0%	10%	90%
>10,000	71	0.69	0%	6%	94%
All corporations	361	0.83	6%	24%	70%
Model 2					
< 500	32	0.95	31%	56%	13%
501 – 1,000	33	0.99	27%	52%	21%
1,001 – 2,500	84	0.92	1%	32%	67%
2,501 – 5,000	68	0.86	0%	19%	81%
5,001 – 10,000	73	0.77	0%	11%	89%
>10,000	71	0.63	0%	7%	93%
All corporations	361	0.83	6%	24%	70%

In 2010, the total number of corporations was 401. Due to data omissions, this dataset comprises 361 corporations.

(Dis)economies of scale need not always be significant. To test this, Table 3.4b repeats Table 3.4a for a bootstrapped DEA model. In this way, we can investigate whether or not scale (dis)economies are significant. Note however that the model has changed, since (as noted in section 3.3.4) a bootstrap specification does not allow the model to control for exogenous characteristics directly (i.e., the efficiency scores cannot be corrected for differences in exogenous factors). One cannot make use of both advantages (bootstrapping and controlling for exogenous factors) simultaneously.[12] Also, we only present results for model 1 to conserve space and time.

[12] Whether or not a bootstrapped model should be used is ambiguous: if the exogenous circumstances are very important to the efficiency scores, a non-bootstrapped model might be preferred. If the exogenous circumstances are not so important, a bootstrapped model might be better.

The bottom row of Table 3.4b reveals that about one third of all corporations experienced significant diseconomies of scale (compared with 70 percent given in Table 3.4a).

As noted, ideally, the model would also include measures of, for example, customer satisfaction as output (see also section 2.6.2). Unfortunately however, data on this issue are available for a subgroup of 149 corporations only. Moreover, the methodology of measurement has changed between 2011 and 2012. A simple cross-section regression for 2012 however reveals that large corporations have significantly lower scores on (most components of) customer satisfaction. Including the average score on customer satisfaction as an output, using data for 2012, does not change results much (details not shown). Therefore, we have no reason to believe that including customer satisfaction would alter conclusions about scale efficiency. Also, as noted, corporations have the task of improving livability. We exclude measures of livability however, because these are available for a few years only.

Table 3.4b. Scale (dis)economies in 2010 (bootstrapped).

Number of dwellings	Number of corporations	Average scale efficiency	% corporations with significant economies of scale	% corporations with no significant (dis)economies of scale	% corporations with significant diseconomies of scale
Model 1					
< 500	32	0.99	13%	88%	0%
501 – 1,000	33	0.97	0%	100%	0%
1,001 – 2,500	84	0.93	2%	87%	11%
2,501 – 5,000	68	0.91	0%	84%	16%
5,001 – 10,000	73	0.87	3%	49%	48%
>10,000	71	0.74	1%	15%	83%
All corporations	361	0.89	2%	66%	32%

In 2010, the total number of corporations was 401. Due to data omissions, this dataset comprises 361 corporations.

3.5.2 Malmquist indices (DEA)

To investigate efficiency changes over time, bootstrapped Malmquist indices are presented in Table 3.5. An index above (below) one indicates an increase (decrease) in efficiency. The index of total factor productivity change (tfpch) is decomposed into pure efficiency change (pech), technological change (techch) and scale efficiency change (sech), as described by equation (3.1).

Table 3.5 indicates that in most years, the change in pure technical efficiency is higher for merged corporations than for unmerged corporations. This gives an indication that the shake-up hypothesis may hold. On the other hand, each year, merged corporations have a lower scale effect meaning that merged corporations often operate under diseconomies of scale.

Finally, it seems that from 2009 onwards, a trend of increasing total factor productivity has set in.

Note however that these scores don't provide evidence about the significance of the effects. Therefore, section 3.5.3 provides a further inspection. Note also that the year-to-year variation in Malmquist indices is rather high. As noted in section 2.7, such high indices should be interpreted with caution. This is why we will also conduct a parametric approach to test the robustness of these numbers (see section 3.5.5).

Table 3.5. Average Malmquist indices (bootstrapped).

	Model 1				Model 2			
Period	**Pure technical efficiency change**	**Techno-logical change**	**Scale Effect**	**Total factor productivity change**	**Pure technical efficiency change**	**Techno-logical change**	**Scale Effect**	**Total factor productivity change**
Merged corporations								
2002/2003	1.31	0.82	0.78	0.84	1.17	0.68	0.81	0.60
2003/2004	1.23	0.95	0.89	0.89	1.10	1.21	0.84	1.12
2004/2005	1.09	0.98	0.86	0.85	0.89	1.15	1.11	1.00
2005/2006	1.23	1.05	1.11	1.13	1.29	1.00	0.88	1.13
2006/2007	1.21	0.93	1.03	0.91	1.59	0.94	1.07	1.35
2007/2008	1.13	1.11	0.90	1.00	1.22	1.17	1.03	1.09
2008/2009	0.91	1.11	0.93	0.94	0.97	1.10	0.79	0.95
2009/2010	1.29	0.92	0.95	1.03	1.20	1.03	0.86	0.96
2010/2011	1.18	1.32	0.93	1.42				
2011/2012	1.41	0.76	0.95	1.00				
Unmerged corporations								
2002/2003	1.21	0.86	1.02	1.03	1.15	0.69	1.02	0.76
2003/2004	1.13	0.99	1.15	1.08	1.15	1.22	1.09	1.40
2004/2005	1.08	0.98	0.89	0.97	1.00	1.15	1.02	1.06
2005/2006	1.12	1.02	1.22	1.05	1.21	0.94	0.98	1.05
2006/2007	1.15	0.94	1.26	1.02	1.21	0.93	1.14	1.06
2007/2008	1.01	1.02	1.05	0.99	1.00	1.16	1.25	1.06
2008/2009	0.94	1.10	0.97	1.01	1.03	1.05	0.84	1.05
2009/2010	1.32	0.88	1.04	1.11	1.33	1.07	1.14	1.34
2010/2011	0.97	1.27	0.99	1.19				
2011/2012	1.46	0.77	1.05	1.11				

3.5.3 Relation between scale, mergers and efficiency: baseline DEA-results

The previous section gives some evidence in favour of the shake-up hypothesis. To test this more thoroughly, we estimate a regression with the Malmquist components as dependent variables. To be more precise, we develop dependent variables that increase with the relevant Malmquist index. Therefore, we define efficiency in year *t* as the efficiency in year *t-1* multiplied by the relevant (bootstrapped) Malmquist index between *t-1* and *t*. For example, if efficiency for a certain dmu is 0.5 in the first year and the Malmquist index of total factor

productivity (M^{tfpch}) between that year and the next equals 1.5, our measure of total efficiency (Eff_t^{tfp}) in the second year equals 0.5*1.5=0.75. We express efficiency in natural logarithms so that each year, the variable changes with (the logarithm of) the Malmquist index. The dependent variables, respectively total efficiency, pure technical efficiency and scale efficiency thus read:

$$\ln\left(Eff_t^{tfp}\right) = \ln\left(Eff_{t-1}^{tfp} * M_{t-1,t}^{tfpch}\right) = \ln\left(Eff_{t-1}^{tfp}\right) + \ln(M_{t-1,t}^{tfp}) \quad (3.5a)$$

$$\ln\left(Eff_t^{pe}\right) = \ln\left(Eff_{t-1}^{pe} * M_{t-1,t}^{pech}\right) = \ln\left(Eff_{t-1}^{pe}\right) + \ln\left(M_{t-1,t}^{pech}\right) \quad (3.5b)$$

$$\ln(Eff_t^{se}) = \ln\left(Eff_{t-1}^{se} * M_{t-1,t}^{sech}\right) = \ln(Eff_{t-1}^{se}) + \ln\left(M_{t-1,t}^{sech}\right) \quad (3.5c)$$

Table 3.6 presents the results for model 1.[13] The first column gives the effects of a change in the number of dwellings and of merger activity on total efficiency change (see equation 3.5a). The second column gives the effect on pure technical efficiency change (equation 3.5b). We do not include a column with the effects of mergers on scale efficiency, as this would not be very informative. Indeed, if two corporations that already operate under diseconomies of scale merge, diseconomies will increase by definition (and scale efficiency would decrease). Note, however, that the regression of mergers on total efficiency also includes a component of scale efficiency. This column is included in order to show the net effect of mergers on total factor productivity.

According to regression 2 (Table 3.6), the relationship between the number of dwellings and pure technical efficiency is an inverted u-curve. The maximum of this curve is located at around 46,000 dwellings, a size that is reached by only one percent of the corporations.[14] This means that, in most cases, increasing scale seems to have positive impact on pure technical efficiency. This provides support for the shake-up hypothesis.

[13] Note that we have an unbalanced panel because of the mergers. We handle this by taking the corporation classification of the first year (2001) as a starting point. If two corporations (A and B) merge to one corporation (AB) between 2001 and 2002, we thus still have two separate observations in 2002 (that is, corporation AB now returns twice in the dataset). So, in effect, we estimate both the efficiency effects of A growing towards AB and of B growing towards AB. Note that in this case, we would have 'identical twins' in our dataset from 2003 onwards (as AB pops up two times each year). Therefore, we exclude one of these 'identical twins' from our regression from 2003 onwards.

[14] Note that this number should not be interpreted as the optimal number of dwellings, because regression (2) in Table 3.6 only deals with pure technical efficiency. So, regression (2) concludes that (unless corporations are very large), an increase in scale has a positive effect on pure technical efficiency. However, regression (1) indicates that increasing scale has no effect on total efficiency.

Table 3.6. Regressions of efficiency measures on scale and mergers.

	(1) Total efficiency	(2) Pure technical efficiency	(3) Total efficiency	(4) Pure technical efficiency
Dwellings (*1000)	-0.0011	0.0163***		
	(-0.2774)	(4.0823)		
Dwellings organic year t (*1000)			0.1070***	0.1053***
			(3.8003)	(4.1804)
Dwellings organic year t-1 (*1000)			-0.1355***	-0.0744***
			(-5.5745)	(-3.3633)
Dwellings merger (*1000)			-0.0016	0.0131***
			(-0.4280)	(3.0089)
Dwellings^2 (*1000)	-0.00002	-0.0002***	-0.000009	-0.0001**
	(-0.5366)	(-3.5964)	(-0.2207)	(-2.3719)
Merger year t	-0.0632**	-0.0168	-0.0435	-0.0007
	(-2.2278)	(-0.6255)	(-1.5583)	(-0.0255)
Merger year t-1	-0.0143	0.0394	-0.0169	0.0399
	(-0.4764)	(1.5363)	(-0.5959)	(1.5522)
Merger year t-2	-0.0288	-0.0217	-0.0233	-0.0190
	(-0.9874)	(-0.7227)	(-0.7944)	(-0.6233)
Merger year t-3…T	0.0198	0.0253	0.0201	0.0299
	(0.6154)	(0.8855)	(0.5798)	(0.9794)
Average age of housing stock[a]	-0.0144***	-0.0118***	-0.0142***	-0.0124***
	(-3.7019)	(-3.3888)	(-3.5663)	(-3.2326)
Soil quality[a]	-0.2464	0.0646	-0.1155	0.1225
	(-1.2849)	(0.3556)	(-0.5872)	(0.6055)
Address density[a]	0.0764***	0.0508**	0.0825***	0.0620**
	(3.0396)	(2.0590)	(3.4495)	(2.3751)
Constant	-0.2338	-0.6964***	-0.2139	-0.7225***
	(-1.0766)	(-3.1872)	(-0.9967)	(-2.9178)
N	4,389	4,389	3,912	3,912
R-squared	0.1684	0.1286	0.1936	0.1305

Panel analysis 2002-2012. Fixed effects and year effects included.
Robust t-statistics (based on clustered standard errors) between brackets.
*** p<0.01, ** p<0.05, * p<0.

[a] As a bootstrap specification does not allow the model to control for exogenous characteristics, the efficiency scores cannot be corrected for differences in exogenous factors a priori. Therefore, these factors have to be included as control variables in the regression equation.

The aforementioned results indicate that for corporations operating under economies of scale, increasing scale would improve both scale efficiency and pure technical efficiency. For corporations with diseconomies of scale however, there are two opposite effects. Increasing scale would decrease scale efficiency, and improve pure technical efficiency. Whether or not increasing scale is advantageous thus depends on the initial situation. According to regression 1 of Table 3.6, there is no significant effect of increasing scale on total efficiency. Thus, both effects appear to cancel each other out on average.[15]

[15] Note however that this finding might in fact resemble the case of a 'summation merger'. Consider Figure 3.2 again. Suppose that two corporations, X and Y, merge into a new organization, Z, which is simply the sum of the original organizations (i.e., $Output_Z = Output_X + Output_Y; Input_Z = Input_X + Input_Y$). Obviously, total productivity doesn't change in this case (society is equally well off), but scale efficiency has decreased (corporation Z is larger than the optimal scale at B) and pure technical efficiency has increased (Z is closer to the

Note that corporations can alter their scale in two ways: through organic growth (building, buying) and by merging. To disentangle these two components, regressions 3 and 4 include both a variable measuring the scale level that has been reached through organic growth *(dwellings organic)* and a variable measuring the number of dwellings obtained by merging *(dwellings merger)*.[16]

Organic growth appears to have a positive impact on pure technical efficiency in the same year (regression 4). This impact is moderated by a negative lagged effect however. This is probably a result of how we use the data. If a corporation builds dwellings at the end of year *t*, we perceive it as a scale increase in year *t*. Total expenditures in year *t* will probably increase only moderately, since in the first months of the year nothing happened. The net effect of organic growth on pure technical efficiency is still positive and significant however (0.1053-0.0744=0.0309 (or 3 percent if the number of dwellings increases by 1,000)). The effect of growth by merger is smaller (0.0131 or 1.3 percent) but also significant.[17] This is consistent with the hypothesis of Hansen et al. (2014) and the findings of Lupton and Kent-Smith (2012), that (especially) merging may be beneficial because it leads to a reconsideration of existing practices, improving pure technical efficiency.[18] According to regression (4), this does not only hold for merging but for organic growth as well. This is surprising, since there would not be a reason to expect a reconsideration of practices when organic growth occurs.

Note that the effects are economically small: a scale increase of 1,000 dwellings leads to an increase in pure technical efficiency of about 1.3 to 3 percent (minus the very small effect of the quadratic term). Such scale increases only occur with mergers. Organic growth deals with much smaller numbers (Crooijmans, 2015).

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vrs-frontier than X and Y). Therefore, in theory, it could be that two corporations 'merge on paper' (i.e., they merge from a legal point of view, but do not integrate any of their operations, so that, materially, nothing will change). If this were to be the case, our empirical result might reflect window-dressing. However, we presume that this is very unlikely because there seems to be no point in merging on paper only.

[16] These variables are constructed as follows. In the first year of measurement (2002), *dwellings organic* simply equals the total number of dwellings of each corporation and *dwellings merger* is zero. *Dwellings organic* increases or decreases throughout the years if the corporation alters its housing stock by building, demolishing, buying or selling. *Dwellings merger* increases by the extent of a merger, if a merger occurs. By definition, the sum of the two variables equals the total housing stock of the corporation.

[17] Because the lagged variable of *dwellings merger* is not significant, we dropped this variable from the regression.

[18] One could question why the scale increase of the merger is significant rather than the merger dummy. This is probably due to multicollinearity however. Indeed, when removing *dwellings merger* from regression 4, the *merger dummy* in year *t* becomes significant. One could also argue that a big merger (i.e., a merger leading to a large scale increase) may have a stronger impact that a small merger.

Again, the effect of merging on total efficiency (regression 3) is not significantly different from zero. This seems to be in line with the findings of Van den Berge et al. (2013) and Crooijmans (2015) who did not find any effect of merging on aggregate costs and efficiency measures. This is not surprising, considering our earlier result that many corporations operate under diseconomies of scale. The effect of organic growth on total efficiency (0.1070-0.1355= -0.0285) is negative, but insignificant, indicating that the decrease in scale efficiency cancels out the increase in pure technical efficiency.

In short, growth – whether organic or by merger – seems to improve pure technical efficiency. However, it appears that – at least for the period studied in this chapter – increasing scale did not succeed in raising total productivity, because for many corporations, it reduced scale efficiency.

3.5.4 Robustness check within DEA

The results from Table 3.6 may be biased because the decision to merge is obviously not a random (or purely exogenous) process. It may depend upon many factors, one of which might be pre-merger efficiency. Similarly, organic growth may also be driven by initial efficiency. As a result, our control group includes corporations that may be incomparable because they did not merge.

The selection effect of merging can be mitigated by dropping the corporations that did not merge in our research period from the regressions. The control group then consists of corporations that merged, just like the treatment group, but in a different year. Table 3.7 gives the results, which turn out to be very similar to the main results in Table 3.6. Therefore, it appears that our results are not driven by a selection effect.

Concerning organic scale increases, the reverse causation problem may be dealt with by means of instrumental variables (IV) regression. We instrument the number and the squared number of dwellings by (1) the (first and second order) lagged number of dwellings, (2) the (first and second order) lagged number of dwellings, squared and (3) the number of dwellings that the subnational government is planning to facilitate in the region where the corporation is active. The latter variable is based on *De Nieuwe Kaart van Nederland*, a dataset comprising all housing projects that subnational governments are planning to implement. We presume that corporations operating in regions with such plans have a stronger incentive for increasing

scale than others. Also, we assume this variable is exogenous as it reflects decisions of subnational governments, not corporations.

Table 3.7. Regressions of efficiency measures on scale and mergers (merged corporations only).

	(1) Total efficiency	(2) Pure technical efficiency	(3) Total efficiency	(4) Pure technical efficiency
Dwellings (*1000)	-0.0015	0.0165***		
	(-0.3562)	(4.1043)		
Dwellings organic year t (*1000)			0.0976***	0.0879***
			(3.6131)	(3.9680)
Dwellings organic year t-1 (*1000)			-0.1206***	-0.0515***
			(-5.3609)	(-2.6110)
Dwellings merger (*1000)			-0.0022	0.0137***
			(-0.5638)	(3.0642)
Dwellings^2 (*1000)	-0.00002	-0.0002***	0.000001	-0.0001**
	(-0.4004)	(-3.6045)	(0.0257)	(-2.3651)
Merger year t	-0.0717**	-0.0190	-0.0533*	-0.0071
	(-2.5490)	(-0.6996)	(-1.9528)	(-0.2622)
Merger year t-1	-0.0189	0.0383	-0.0213	0.0386
	(-0.6467)	(1.5376)	(-0.7675)	(1.5299)
Merger year t-2	-0.0339	-0.0180	-0.0269	-0.0158
	(-1.0980)	(-0.5688)	(-0.8592)	(-0.4849)
Merger year t-3…T	0.0120	0.0389	0.0181	0.0434
	(0.3251)	(1.2053)	(0.4595)	(1.2843)
Average age of housing stock[a]	-0.0120***	-0.0095**	-0.0101**	-0.0084
	(-2.7012)	(-2.1836)	(-2.0770)	(-1.5504)
Soil quality[a]	-0.3752	-0.2177	-0.1859	-0.1529
	(-1.2725)	(-0.7758)	(-0.6305)	(-0.5166)
Address density[a]	0.0780***	0.0483*	0.0791***	0.0547*
	(2.8246)	(1.7182)	(2.9332)	(1.7969)
Constant	-0.2030	-0.5138	-0.3303	-0.6460*
	(-0.6223)	(-1.5142)	(-1.1019)	(-1.7465)
N	1,956	1,956	1,701	1,701
R-squared	0.1783	0.1476	0.2187	0.1408

Panel analysis 2002-2012. Fixed effects and year effects included.
Robust t-statistics (based on clustered standard errors) between brackets.
*** p<0.01, ** p<0.05, * p<0.1

[a] As a bootstrap specification does not allow the model to control for exogenous characteristics, the efficiency scores cannot be corrected for differences in exogenous factors a priori. Therefore, these factors have to be included as control variables in the regression equation.

Table 3.8 gives the results of the IV-regression. The Kleibergen-Paap statistic indicates that our instruments are strong. According to regression (4), growth by merger still increases pure technical efficiency, but organic growth loses significance. This implies that the net effect of organic growth on total efficiency is negative (regression (3)). These findings are more in line with the idea brought forward by Bogetoft and Wang (2005) and Hansen (2014). Increasing scale is only beneficial if it is attained by means of a merger, because in this case existing practices might be reconsidered. Increasing scale via organic grows reduces scale efficiency in many instances without bringing any positive effects. The net effect of a merger on total

efficiency remains insignificant. This analysis thus implies that a merger has a negative and a positive effect, which indicates the presence of a paradox.

Table 3.8. Regressions of efficiency measures on scale and mergers (IV-regression).

	(1) Total efficiency	(2) Pure technical efficiency	(3) Total efficiency	(4) Pure technical efficiency
Dwellings (*1000)	-0.0132*	0.0146*		
	(-1.6642)	(1.7725)		
Dwellings organic (*1000)			-0.0993***	-0.0196
			(-2.6371)	(-0.5792)
Dwellings merger (*1000)			-0.0080	0.0168**
			(-0.9126)	(2.1417)
Dwellings^2 (*1000)	0.0001	-0.0001	0.00003	-0.0001**
	(1.3753)	(-1.6356)	(0.3577)	(-2.1093)
Merger year t	-0.0035	-0.0345	-0.0245	-0.0435
	(-0.0790)	(-0.7491)	(-0.5109)	(-0.9856)
Merger year t-1	-0.0027	0.0063	-0.0070	0.0041
	(-0.0640)	(0.1769)	(-0.1525)	(0.1172)
Merger year t-2	-0.0083	-0.0374	-0.0117	-0.0393
	(-0.1964)	(-0.9256)	(-0.2735)	(-0.9980)
Merger year t-3…T	0.0262	0.0021	0.0091	-0.0052
	(0.5342)	(0.0486)	(0.1809)	(-0.1203)
Average age of housing stock[a]	-0.0115***	-0.0112***	-0.0118***	-0.0113***
	(-3.2139)	(-3.0341)	(-3.2416)	(-3.0507)
Soil quality[a]	0.0588	0.2199	0.1122	0.2406
	(0.2610)	(0.9735)	(0.4953)	(1.0665)
Address density[a]	0.0928***	0.0508	0.0946***	0.0512
	(2.7602)	(1.5162)	(2.5904)	(1.5332)
N	3,135	3,135	3,135	3,135
R-squared	0.1929	0.1330	0.1724	0.1262
Kleibergen-Paap rk Wald F statistic	28.69	28.69	28.70	28.70

Panel analysis 2002-2012. Fixed effects and year effects included.
Robust z-statistics (based on clustered standard errors) between brackets.
Instrumented variables: *Dwellings, Dwellings^2*
Instruments: *First and second order lag of dwellings, first and second order lag of dwellings^2, housing planned by subnational governments*
*** p<0.01, ** p<0.05, * p<0.1
[a] As a bootstrap specification does not allow the model to control for exogenous characteristics, the efficiency scores cannot be corrected for differences in exogenous factors a priori. Therefore, these factors have to be included as control variables in the regression equation.

3.5.5 Results with a parametric approach

As noted, for our parametric approach we estimate the cost function as given in equation (3.3). Note that we have standardized the data to the mean beforehand (i.e., for each variable C, Y or Z we divide each observation by its mean in 2012). Standardization has the advantage that the estimated parameters can be interpreted as elasticities at the sample mean (Ollinger et al., 2000). Also, standardization reduces the problem of multicollinearity between linear, squared and cross terms (Tovar et al., 2007).

Table 3.9 provides the results.[19] For completeness, we estimate both a pooled OLS-model and the random-effects model developed by Battese en Coelli (1992). A Breusch-Pagan test indicates that a random effects model is superior, so we use this outcome for further calculations.[20] Because most interaction terms prove to be insignificant, one may argue that a Cobb-Douglas cost function may be sufficient. However, a test that all square and interaction terms are equal to zero is rejected (at the 1 percent level).

Table 3.9. Cost function estimates (translog cost function).

Dependent:	(1) Pooled Operational expenditures	(2) Random effects (bc92) Operational expenditures	(3) Pooled Total expenditures	(4) Random effects (bc92) Total expenditures
Y_1	0.0839***	0.1176***	0.0031	0.0375
	(4.5122)	(3.9548)	(0.1186)	(1.0981)
Y_2	0.9850***	0.9596***	1.0871***	1.0413***
	(49.0904)	(29.4856)	(39.1046)	(27.7625)
Y_3	0.4418***	0.4012**	0.5881***	0.6850***
	(3.6070)	(2.3142)	(3.4427)	(3.2912)
Z_1	0.4047***	0.4365***	0.4130***	0.3839***
	(12.7427)	(8.6970)	(9.1146)	(6.9332)
Z_2	-0.0023	-0.0137	-0.0180	-0.0209
	(-0.1818)	(-0.7535)	(-0.9793)	(-0.8656)
Z_3	0.0470	0.0966	-0.2291***	-0.1848*
	(0.7999)	(1.1731)	(-2.6492)	(-1.8479)
$Y_1 * Y_1$	0.0045	0.0108	0.0031	0.0083
	(1.0023)	(1.3510)	(0.4677)	(1.1009)
$Y_2 * Y_2$	0.0309***	0.0425***	0.0249**	0.0210
	(4.0825)	(3.5749)	(2.3717)	(1.4615)
$Y_3 * Y_3$	-0.1305	-0.0576	0.2176	0.4759
	(-0.4491)	(-0.1706)	(0.5406)	(0.9514)
$Y_1 * Y_2$	-0.0191***	-0.0254***	-0.0115**	-0.0128*
	(-4.9810)	(-3.7178)	(-2.1416)	(-1.8108)
$Y_1 * Y_3$	-0.0536	0.0479	-0.2401***	-0.1147
	(-1.2637)	(0.6409)	(-3.9945)	(-1.3207)
$Y_2 * Y_3$	0.1205**	0.0153	0.4019***	0.2714***
	(2.4998)	(0.1863)	(5.8858)	(2.6963)
$Z_1 * Z_1$	0.1985***	0.2232***	0.2125***	0.2158***
	(6.4821)	(4.8887)	(5.0457)	(3.0840)
$Z_2 * Z_2$	0.0102	0.0160	-0.0014	-0.0081
	(0.7421)	(0.5322)	(-0.0757)	(-0.3150)
$Z_3 * Z_3$	0.8642*	0.2358	1.8292***	1.6735**
	(1.9379)	(0.3592)	(2.9220)	(2.4288)

[19] In some cases, Y_1 (new allotments) is zero so that estimating the translog cost function would be problematic (because one cannot take the logarithm of 0). In this case, we replace zeros by the minimum of the nonzero values and include a dummy to correct for the measurement error (see: Battese, 1996). This occurs in about two percent of the cases.

[20] Note that we have decided not to use a fixed effects model, even though a Hausman test indicates that this would be superior to a random effects model. We do this, because a fixed effects model does not take the variance between subjects into account. So as far as efficiency is constant over time, this is captured by the fixed effects. This might be inappropriate, because for corporations the within-subject variance is larger than the between-subject variance (especially for scale).

Dependent:	(1) Pooled Operational expenditures	(2) Random effects (bc92) Operational expenditures	(3) Pooled Total expenditures	(4) Random effects (bc92) Total expenditures
$Z_1 * Z_2$	0.0203	0.0334	0.0647**	0.0521
	(0.9383)	(0.7020)	(2.1583)	(1.2125)
$Z_1 * Z_3$	-1.0773***	-1.2380***	-1.0877***	-1.0830***
	(-7.1741)	(-4.2929)	(-5.2285)	(-4.7880)
$Z_2 * Z_3$	0.1532***	0.1404	0.0399	0.0602
	(3.0402)	(1.5398)	(0.5612)	(0.6791)
$Z_1 * Y_1$	-0.0069	0.0176	-0.0043	0.0087
	(-0.4328)	(0.6659)	(-0.1892)	(0.1648)
$Z_1 * Y_2$	0.0328*	0.0114	0.0529**	0.0354
	(1.8052)	(0.3935)	(2.0513)	(0.6000)
$Z_1 * Y_3$	-0.1782	0.0633	-0.0736	0.0538
	(-1.6323)	(0.3704)	(-0.4794)	(0.2637)
$Z_2 * Y_1$	0.0148**	0.0202*	-0.0032	0.0073
	(2.0407)	(1.9444)	(-0.3342)	(0.5298)
$Z_2 * Y_2$	-0.0130	-0.0218*	0.0047	-0.0060
	(-1.4946)	(-1.6486)	(0.4121)	(-0.3714)
$Z_2 * Y_3$	0.1257**	0.1025	-0.0490	-0.1067
	(2.5139)	(1.1688)	(-0.6880)	(-1.0989)
$Z_3 * Y_1$	0.0076	-0.0819	-0.1178*	-0.1042
	(0.1481)	(-1.2199)	(-1.6597)	(-1.1829)
$Z_3 * Y_2$	-0.0345	0.0768	0.1926**	0.1801*
	(-0.5862)	(0.9933)	(2.3426)	(1.7389)
$Z_3 * Y_3$	0.2297	0.5972	-0.4031	0.0898
	(0.8176)	(1.5504)	(-0.9813)	(0.1822)
t	0.0535***	0.0607***	0.0823***	0.0896***
	(10.4827)	(8.0025)	(9.9378)	(9.4606)
$t * t$	-0.0073***	-0.0072***	-0.0126***	-0.0145***
	(-11.1454)	(-8.4641)	(-10.1458)	(-10.6488)
$Y_1 * t$	-0.0052***	-0.0053***	-0.0010	-0.0030
	(-3.3947)	(-2.6800)	(-0.4401)	(-1.0484)
$Y_2 * t$	0.0005	-0.0000	-0.0011	0.0005
	(0.2621)	(-0.0021)	(-0.4365)	(0.1668)
$Y_3 * t$	-0.0172*	-0.0226	0.0143	-0.0031
	(-1.6972)	(-1.4070)	(0.9116)	(-0.1396)
$Dummy\ Y_1 = 0$	0.1519***	0.1861	0.0195	-0.0296
	(2.6710)	(1.5162)	(0.2321)	(-0.3462)
Constant	-0.2742***	-0.5096***	-0.4261***	-0.3398***
	(-10.0943)	(-8.3279)	(-11.5141)	(-2.7963)
Observations	5,594	5,594	4,832	4,832
Years	2001-2012	2001-2012	2001-2010	2001-2010
Distribution of efficiency term	Half-normal	Truncated normal	Half-normal	Truncated normal

z-statistics in parentheses (in regressions 2 and 4 based on clustered standard errors)
*** p<0.01, ** p<0.05, * p<0.1

The resulting efficiency scores from the SFA are given in Table 3.10. It appears that the efficiency scores are quite vulnerable to the model chosen. Throughout the years, the efficiency scores are relatively similar however.

Table 3.10. Efficiency scores SFA.

		Model 1				Model 2			
Year	**N**	**Mean**	**Std. Dev**	**Min**	**Max**	**Mean**	**Std. Dev**	**Min**	**Max**
2001	525	0.69	0.08	0.38	0.97	0.84	0.04	0.73	0.95
2002	546	0.70	0.08	0.39	0.97	0.84	0.04	0.72	0.95
2003	531	0.70	0.08	0.40	0.97	0.84	0.04	0.71	0.95
2004	508	0.71	0.08	0.40	0.97	0.83	0.04	0.71	0.95
2005	494	0.71	0.08	0.41	0.97	0.83	0.04	0.71	0.94
2006	490	0.72	0.08	0.42	0.97	0.83	0.04	0.70	0.94
2007	453	0.72	0.07	0.54	0.96	0.83	0.04	0.71	0.94
2008	445	0.73	0.07	0.55	0.96	0.83	0.04	0.70	0.94
2009	426	0.73	0.07	0.55	0.97	0.82	0.04	0.70	0.94
2010	414	0.74	0.07	0.56	0.97	0.82	0.05	0.69	0.94
2011	388	0.75	0.07	0.57	0.97				
2012	374	0.75	0.07	0.58	0.97				

Finally, Table 3.11 gives the decomposition of total factor productivity change, by means of the methods presented in section 3.3.7.[21] Several issues pop up. First of all, it appears that efficiency change is close to zero in most cases. This holds both for corporations that merged and for those that did not merge. That is, these outcomes fail to affirm the shake-up hypotheses that efficiency change is higher for institutions that merge. This conflicts with the DEA-results.

Secondly, the scale effect turns out to be negative for corporations that have merged, affirming the notion that merging leads to (increased) diseconomies of scale. For corporations that did not merge, there was hardly any effect since their scale changed only marginally. So according to these results, mergers proved to be unfavourable and we do not find a scale paradox. Note however, that in the final two years (2010/2011 and 2011/2012) the scale effect was very moderate, even for corporations that merged. So it seems that the scale issue may become less important over time. Moreover, technological change is negative in most years, but turns positive in the final few years. This may be a consequence of the increased public attention that the subject of efficiency has received in recent years as a result of the incidents that have harassed the sector (see section 1.2).[22] Figure 3.3 shows the relationship between time and costs for model 1 for the average corporation. The figure confirms our notion that in the most recent years of our research period, costs started decreasing (and thus productivity started increasing).

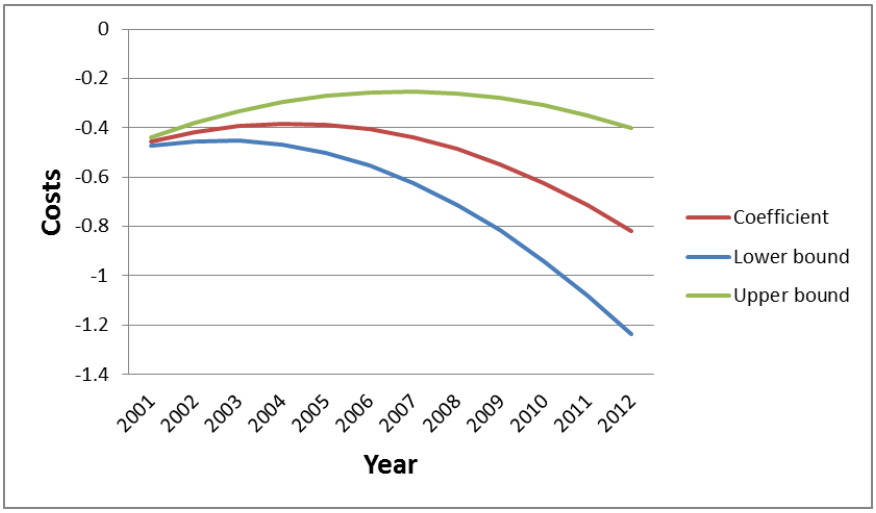
[21] Note that to calculate the scale effect (equation 3.4), we only consider the effect of a change in Y_1 (new allotments) and Y_2 (continued contracts) since a change in Y_3 (WWS-points) does not reflect a change in scale. Accordingly, we have calculated the scale elasticities for corporations with average WWS-points in order to make corporations comparable.

[22] Note that if all corporations would increase their efficiency in a similar way (i.e., each corporation decreases costs by five percent) this will be measured as technological change, even though strictly seen, this increase in productivity is not the result of (exogenous) technological progress.

Table 3.11. TFP-decompositions under SFA.

Period	Model 1				Model 2			
	Pure technical efficiency change	Techno-logical change	Scale Effect	Total factor productivity change	Pure technical efficiency change	Techno-logical change	Scale Effect	Total factor productivity change
Merged corporations								
2001/2002	0.01	-0.05	-0.06	-0.11	0.00	-0.07	-0.06	-0.13
2002/2003	0.01	-0.05	-0.06	-0.09	0.00	-0.05	-0.06	-0.12
2003/2004	0.01	-0.04	-0.07	-0.10	0.00	-0.04	-0.07	-0.11
2004/2005	0.01	-0.03	-0.05	-0.07	0.00	-0.03	-0.06	-0.09
2005/2006	0.01	-0.02	-0.05	-0.06	0.00	-0.01	-0.06	-0.07
2006/2007	0.01	-0.02	-0.04	-0.05	0.00	0.00	-0.05	-0.05
2007/2008	0.01	-0.01	-0.04	-0.04	0.00	0.02	-0.06	-0.04
2008/2009	0.01	0.00	-0.03	-0.02	0.00	0.03	-0.05	-0.02
2009/2010	0.01	0.01	-0.03	-0.01	0.00	0.05	-0.05	-0.01
2010/2011	0.01	0.01	-0.02	0.00				
2011/2012	0.01	0.02	-0.01	0.01				
Unmerged corporations								
2001/2002	0.01	-0.06	0.00	-0.05	0.00	-0.07	0.00	-0.07
2002/2003	0.01	-0.05	0.00	-0.04	0.00	-0.06	0.00	-0.06
2003/2004	0.01	-0.04	0.00	-0.04	0.00	-0.04	0.00	-0.05
2004/2005	0.01	-0.04	0.00	-0.03	0.00	-0.03	0.00	-0.03
2005/2006	0.01	-0.03	0.00	-0.02	0.00	-0.01	0.00	-0.02
2006/2007	0.01	-0.02	0.00	-0.01	0.00	0.00	0.00	0.00
2007/2008	0.01	-0.01	0.00	-0.01	0.00	0.02	0.00	0.01
2008/2009	0.01	-0.01	0.00	0.00	0.00	0.03	0.00	0.03
2009/2010	0.01	0.00	0.00	0.01	0.00	0.04	0.00	0.04
2010/2011	0.01	0.01	0.00	0.01				
2011/2012	0.01	0.02	0.00	0.02				

Figure 3.3. Cost change over time, based upon translog cost function, model 1.



To conclude, the SFA confirms the notion that many corporations operate under diseconomies of scale so that merging would be undesirable. However, in contrast to the DEA, the SFA does not find evidence in favour of a shake-up hypothesis implying that there is no positive

effect of merging on pure technical efficiency. This means that support for the shake-up hypothesis is not robust.

We argue however that even if there would be a shake-up effect, this should not be used as a justification to merge. Indeed, high levels of pure technical efficiency should be attainable without increasing scale as well. That is, no scale increase should be needed to optimize current processes. Ideally, decisions about changing the scale should be based upon the presence of (dis)economies of scale.

3.6 Conclusion

This chapter investigates the effect of scale (and mergers) on efficiency of Dutch housing corporations. We do this by decomposing total factor productivity change into (1) pure technical efficiency change, (2) technological change and (3) scale efficiency change, and accordingly study the influence of merging on these factors. Such a decomposition is possible both with a Data Envelopment Analysis (DEA) and a Stochastic Frontier Analysis (SFA), so we conduct both to test robustness.

The DEA-results suggest that most corporations operate under diseconomies of scale. This means that for these corporations, scale efficiency can be improved by decreasing scale. At the same time, however, the results indicate that a scale increase through merging leads to higher pure technical efficiency. This provides evidence in support of the shake-up hypotheses: a merger may be beneficial because it forces organizations to reassess their practices and gives an opportunity to learn from each other.

However, since DEA is sensitive to data outliers and does not take into account white noise, the Malmquist indices of productivity change show peaks and dips that may seem unreasonably high. Furthermore, it has been argued that inferences based upon DEA scores should be interpreted with caution. Therefore, we also conduct an SFA by estimating a (translog) cost function and calculating the change in total factor productivity and its components. Such an analysis confirms the notion of diseconomies of scale, since most corporations that merge show a negative scale effect. However, with this approach, we fail to find support for the shake-up hypothesis, implying that there is no positive effect of merging on pure technical efficiency. This means that support for the shake-up hypothesis is not robust.

Furthermore, we argue that even if there would be a shake-up effect, this should not be used as a justification to merge. Indeed, high levels of pure technical efficiency should be attainable without increasing scale as well. That is, no scale increase should be needed to optimize current processes. Ideally, decisions about changing the scale should be based upon the presence of (dis)economies of scale.

Chapter 4

Interest Spreads and Bailout Clauses[1]

[1] This chapter is based upon Veenstra and Van Ommeren (forthcoming).

4.1 Introduction

The operations of housing corporations are highly capital intensive; therefore, they need large sums of external funding. In contrast to private parties, housing corporations have the advantage that the majority of their loans is explicitly guaranteed by a bailout clause. This form of guarantee is designed to lead to significantly lower interest rates for corporations as their creditors would face no risk of non-repayment. As a result, the bailout clause should allow corporations to devote more resources to social housing services.

In many countries, bailouts are explicitly ruled out by legislation. This is to prevent 'moral hazard'; the danger that borrowers could become less rigorous in controlling their finances with the knowledge that they would be assisted should problems arise (Rodden, 2006). Borrowers thus face a 'soft budget constraint' (Kornai et al., 2003), which is seen to encourage them to behave irresponsibly. Thus in the literature, the dominant view is that an explicit no-bailout clause must be formulated in order to emphatically state to institutions that they will not be rescued (Allers, 2015). In practice, however, it is difficult to credibly enforce such a clause. Actual bankruptcy of subnational governments or (semi-)public institutions could entail high welfare and political costs (Goodspeed, 2002; Plekhanov and Singh, 2007). Indeed, there are numerous examples of bailouts actually occurring despite the existence of a no-bailout clause (Rodden, 2006; Heppke-Falk and Wolff, 2008).

Despite these arguments, in the Dutch public sector, explicit bailout clauses exist for e.g., municipalities, housing corporations and the health care sector. In the case of municipalities, Allers (2015) notes that the bailout clause has not led to excessive malpractice. Indeed, only a few municipalities demand government assistance and anecdotal evidence suggests that municipalities only do this when there is no other option (CPB, 2015).[2] Therefore, Allers (2015) argues, there is sufficient reason to challenge the traditional view that bailouts must be ruled out. It may even be the case that the benefits of a bailout clause (reduced interest payments) outweigh the costs (defaults on loans and/or increased inefficiencies). In this case, a bailout scheme would in fact be preferable. This chapter attempts to measure the effect of a bailout clause on interest rates by focusing on loans made to housing corporations.

[2] According to Allers (2015), from 1998 until 2013, only nine different municipalities have been provided financial support by the central government. In 2014 only two (out of a total of 403) municipalities received support.

By comparing a set of guaranteed and unguaranteed corporation loans, we first investigate whether the bailout clause for housing corporations is succeeding in lowering interest rates. Secondly, we study whether differences in interest rates can be explained by housing corporation characteristics such as indebtedness; under a credible bailout scheme all housing corporations should pay the same interest rate on similar loans, regardless of their financial position. Thirdly, we investigate whether corporations pay a positive commercial margin on their loans, by testing whether the interest rates of guaranteed corporation loans exceed the risk-free reference rate. If this is the case, there may be scope for reducing interest payments by bargaining more sharply. On the other hand, it could also be the case that housing corporations have to pay a premium for extra costs that the creditor cannot recover in times of default. We therefore finally test whether these non-recoverable costs are relevant. This is done by comparing corporation loans with municipality loans because non-recoverable costs are likely to be more relevant for the former than for the latter.

Whereas previous studies often focus on cases where bailouts are explicitly ruled out (for an overview, see Van Hecke et al., 2012), this chapter focuses on an explicit bailout clause. We exploit a unique micro-level dataset of loans made to housing corporations that distinguishes both guaranteed and unguaranteed loans. This enables us to investigate whether structural differences exist between the two groups of loans. Secondly, we consider bank loans, instead of public bond issues. This implies that interest rates can also include a component of slack, as they depend on the bargaining outcome of two parties.

The rest of this chapter is organized as follows. Section 4.2 describes the institutional background of housing corporations, paying special attention to the bailout arrangements. Section 4.3 briefly describes the theory on interest rate determination and provides the hypotheses we will be testing. In section 4.4 we present the research setup and the data, whereas section 4.5 presents the main results. The robustness of our findings is tested in a sensitivity analysis which is given in section 4.6. Section 4.7 concludes.

4.2 Institutional background

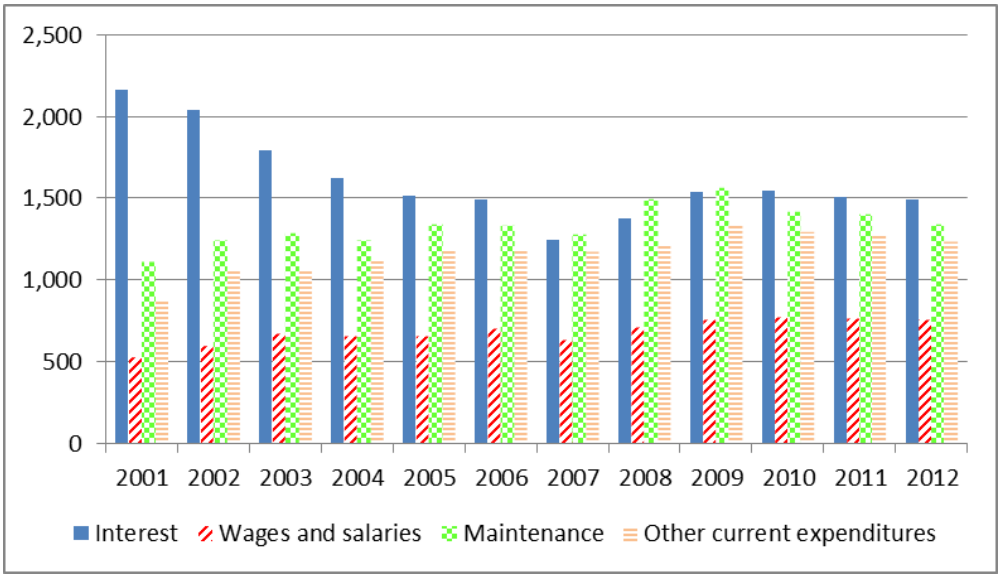
4.2.1 General

As noted in chapter 2 (section 2.2.2), the ties between the government and housing corporations have been loosened over the past decades, both operationally and financially. Indeed,

corporations no longer receive subsidies for their activities. The major advantage that housing corporations still maintain in comparison to purely private parties is a set of guarantees should they face financial problems.[3] This safety net communicates to creditors that providing capital to corporations is risk-free. As a result, interest payments should be minimized. Furthermore, the bailout clause should make sure that financing costs remain equable for all types of housing corporations.

As noted in chapter 2 (section 2.2.2), in 2012, 381 Dutch corporations possessed around 2.2 million dwellings in total. Although the total number of corporations gradually declined as a result of mergers, their total housing stock remained fairly constant over the years (see section 3.2.1). Needless to say, the operations of corporations are highly capital intensive. In 2012, the total value of debt in the sector amounted to more than 90 billion euros.[4] Not surprisingly, a large share of the corporations' costs is made up by interest payments, totalling about 3.4 billion euros in 2012 (see Figure 4.1). However, Figure 4.1 shows a trend of decreasing interest costs, mainly as a result of declining investments.

Figure 4.1. Average costs of housing corporations per dwelling. All numbers in 2012 euros.



Capital costs (depreciation) not shown as these are not available for all years.

[3] Recall that we argued in chapter 2 (footnote 5) that the positive effect of the balancing and grossing Act on the corporation's financial position still implies a clear advantage over private parties. That is, the lump-sum conversion of the balancing and grossing Act led to a substantial improvement in the financial position of the corporations. It is up to the corporations themselves to manage these extra resources in a responsible way.

[4] According to WSW (2012), the total level of guaranteed (long-term) debt was 87.4 billion euros. According to data from the CFV, short-term debt (which is unguaranteed by definition) was more than 5 billion euros. We do not know the value of long-term unguaranteed debt, but we do know that BNG Bank only rarely makes such loans, so that probably, this number is relatively small.

Housing corporations receive the bulk of their external funding from BNG Bank. As the largest bank in the Netherlands specializing in loans to subnational governments and other parties active in the (semi-)public sector, the market share of BNG Bank was approximately 50 percent for housing corporations in 2012.[5] Corporations can also fund themselves through NWB Bank, the second largest public sector bank or, alternatively, through a commercial bank.

4.2.2 The guarantee fund for the social housing sector

A credible no-bailout clause serves to make creditors aware of the risks of a loan (i.e., the probability of default). This means a premium is charged based on the borrower's risk profile. As borrowers prefer a low interest rate, they have an incentive to closely manage their financial positioning. In the Dutch case, where bailouts are explicitly permitted, this 'market discipline', is absent or at least distorted (Lemmen, 1999; Schuknecht et al., 2009).

However, a form of 'rule discipline' does exist in the Netherlands, in the form of legislation and policies that constrain institutions' borrowing capacity in practice (Lemmen, 1999; Schuknecht et al., 2009). Indeed, the Guarantee Fund Social Housing (*Waarborgfonds Sociale Woningbouw*, WSW) assesses each corporation's financial position in order to determine whether or not it may borrow under the guarantee of the bailout clause.

These WSW guarantees are thus not unconditional. When the WSW monitors the (financial) position of each housing corporation to determine creditworthiness (WSW, 2009), the assessment scheme they utilise is based upon (1) the financial position, (2) the organization of the housing corporation as a whole and (3) the market position of their dwellings. If the WSW considers creditworthiness insufficient and if there are no visible signs of improving, the WSW may refuse the granting of guarantees.

Dutch housing corporations can access two main types of loans; guaranteed and unguaranteed. Only capital used for investing in the service of general economic interest (*Diensten van Algemeen Economisch Belang*, DAEB) can be borrowed under the guarantee of the bailout clause. Such services include core social housing activities, such as building dwellings for people on a low-income. In contrast, loans financing, for example, commercial activities are not guaranteed.[6] It is also of note that short-term loans are, by definition, not guaranteed.

[5] Source: interview with the specialist for the social housing sector of BNG Bank.
[6] The list of activities that fall under the guarantee scheme has changed slightly over the years. For example, since 2000, loans for building 'socially desirable assets' such as neighbourhood centers can be guaranteed.

The guarantee scheme consists of three levels[7] (see Figure 4.2). First of all, if the resources of a housing corporation are insufficient to resolve their own problems, 'reorganization subsidies' may be provided. During our research period (2001-2013), this task was conducted by the financial supervisor, the Central Public Housing Fund (*Centraal Fonds Volkshuisvesting*, CFV). However, since July 1, 2015, the CFV is replaced by the Authority housing corporations (*Autoriteit woningcorporaties*, Aw)[8] and decisions concerning reorganization subsidies are being made by the WSW since then. These subsidies are paid for by implementing a 'one-off tax' on other housing corporations. In order to obtain such a subsidy, corporations face intensive supervision and must present a reorganization plan.

At the second level, creditors can appeal to the guarantee funds of the WSW if amortization and interest payments are not being paid, despite the provision of reorganization subsidies. The WSW has a financial reserve that can be called on, and if this reserve drops below a certain threshold, the WSW can increase its resources by enforcing an '*obligo*' contribution from all housing corporations.[9] This contribution is calculated on the basis of the amount of debt of the guaranteed loans of each corporation.

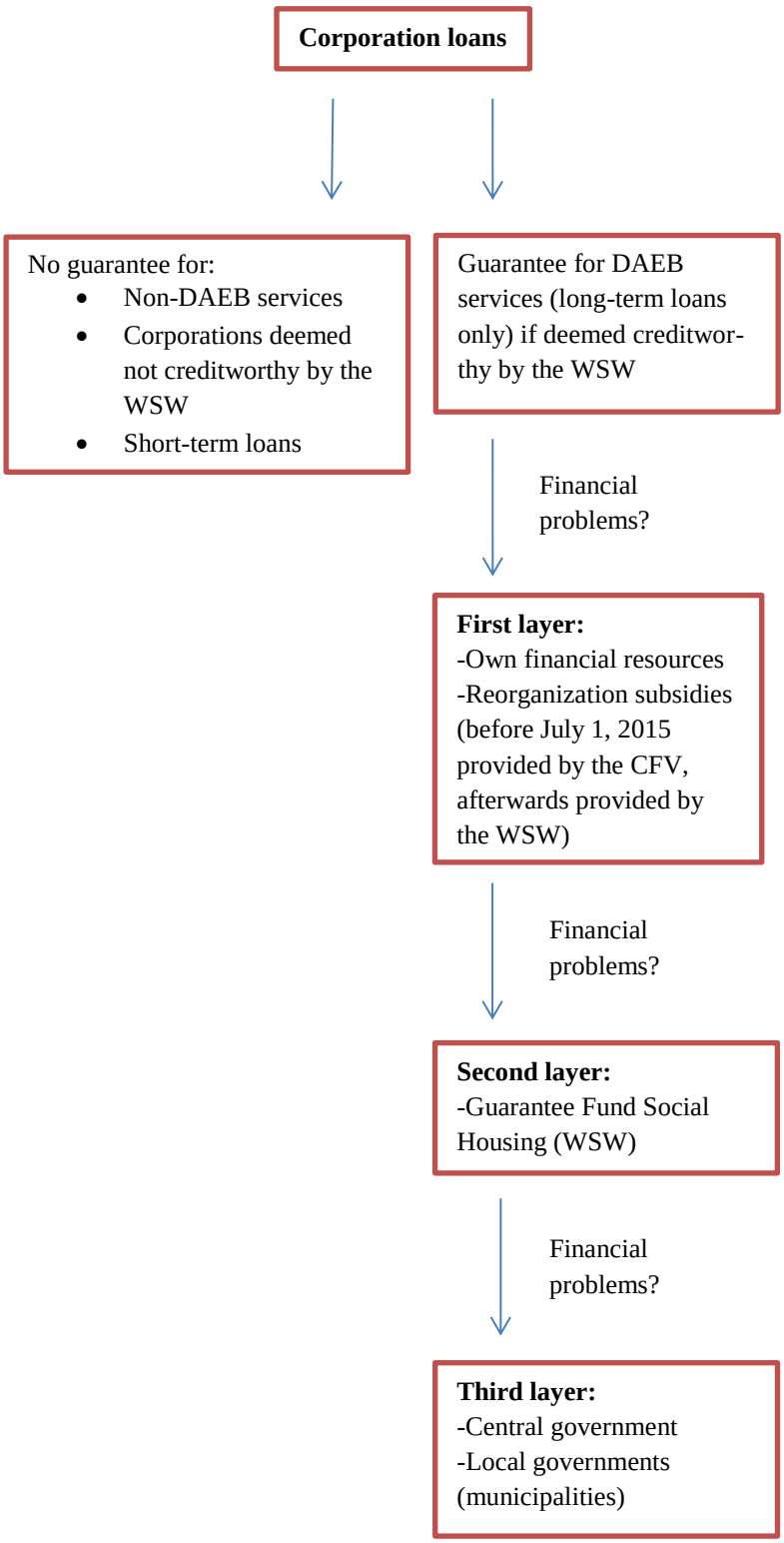
In practice, until now, only the first level has been called upon, even though a few (large) housing corporations have come under severe financial stress in recent times (for an overview, see De Jong, 2013). It is the creditor's responsibility to decide whether to contact the WSW, but to-date the second level has not ever been utilised, which also means there is no anecdotal evidence about when it will be engaged.

In essence, these first two levels of the guarantee scheme are based on the concept of housing corporations providing indirect support amongst each other. There is a further third level if the first two were insufficient; if this is the case, the government will step in to provide interest-free loans to the WSW. The burden of debt thus entailed is then equally divided between central and local governments (municipalities). Accounting for the local government share, 50 percent is provided by the municipalities where the corporation holds possession, and 50 percent is provided by all Dutch municipalities.

[7] See http://www.wsw.nl for more information.
[8] See also section 2.2.2.
[9] At the end of 2011, the financial reserves of the WSW equaled 477 million euros, the (potential) sum of 'obligo' contributions was 3.2 billion euros, so that to the total guarantee capital of the second layer was approximately 3.7 billion euros. Source: WSW.

The guarantee system thus implies that guaranteed loans should be interpreted by the creditors as risk-free, because in the end, the government acts as a lender of last resort. Therefore, in principle, a creditor will have hardly any incentive to monitor individual corporations.

Figure 4.2. Guarantee structure of Dutch housing corporation loans.



According to De Jong (2013), one of the main causes of the incidents that have harassed the social housing sector, was the heavy reliance on the collective guarantee scheme. De Jong (2013) states that, because of the complexity of the guarantee scheme, no single party has stakes high enough to keep track of the riskiness of housing corporations. The corporations themselves feel protected by their soft budget constraints, seeing no need to control their debt closely. Creditors are also aware of the bailout scheme, and so they devote little or no time to monitoring the housing corporation's riskiness. In addition, the parties involved in creating the safety net (CFV/Aw, WSW, central and local governments) may sit on the fence as well, expecting the other parties to do the monitoring.[10] De Jong (2013) concludes that these factors can lead to excessive risk for the sector as a whole.

Dutch Parliament (2014) therefore argues that the current bailout system should be reconsidered. It is argued that it would be better not to guarantee loans fully, so that corporations always bear part of the risk when borrowing money. In the end, according to the inquiry commission, it should even be possible for corporations to go bankrupt so that moral hazard is reduced. However, such a modification would probably imply that interest costs will increase. Moreover, even though recently a few (large) corporations got into severe financial distress, as noted, up until now only the first level of the guarantee scheme has been accessed. Therefore, so far, the bailout clause does not seem to have caused any severe problems. From December 31, 1990 until 2012, just twenty corporations received reorganization subsidies to a total of 1.3 billion euros (CFV, 2013c). Therefore, it is not impossible that the benefits of the bailout clause outweigh the costs.

4.3 Theory and hypotheses

4.3.1 Interest rate setting

Suppose a party (e.g., a housing corporation) borrows money from a bank. If the bank is certain that the borrower will fulfil the interest payments, and the capital market is perfectly competitive, the bank will demand the risk-free interest rate on the loan it provides. The risk-free interest rate is assumed to be equal to the interest rate at which the national government, or to be more precise, the government that has control over the money supply (Lemmen,

[10] As noted, the CFV has been replaced by the Aw since July 1, 2015. Although the Aw has a task of financial supervision, it does not have a formal role in the execution of the bailout.

1999) borrows money, and it is influenced by general economic factors that determine the demand for, and supply of capital.

Suppose now, that the creditor faces a positive probability $P(X_j)$ that borrower j will default on its debt, where X_j is a vector of variables affecting this probability. The expected return on this investment is:

$$R_{i,j}^{exp} = \left(1 - P(X_j)\right) R_{i,j} + \tau_{i,j} P(X_j) R_{i,j} - P(X_j) c \qquad (4.1)$$
$$i = 1,2,\dots,N_j, j = 1,2,\dots,J$$

where $R_{i,j}$ is the rate of return[11] agreed upon by the creditor and debtor j $(j = 1,2,3,\dots,J)$ on loan i $(i = 1,2,3,\dots,N_j)$. We thus have J borrowing parties (i.e., corporations) with N_j loans.

Further, $\tau_{i,j}$ is the proportion of the return that the creditor recovers in case of default, following Heppke-Falk and Wolff (2008). We can extend Heppke-Falk and Wolff's (2008) model by including a variable c that denotes the extra costs that would not be recovered in case of default, such as legal costs that the bank would have to make. These costs may also comprise delays in payment (Schulz and Wolff, 2009).[12]

If the bank is risk-neutral, it will make the loan if the expected return on this investment minimally equals the risk-free return rate, R^f, that is:

$$R_{i,j}^{exp} \geq R^f \qquad (4.2)$$

Substituting (4.1) into (4.2) and solving for $R_{i,j}$ yields:

$$R_{i,j} \geq \frac{R^f + P(X_j) c}{1 - (1 - \tau_{i,j}) P(X_j)} \qquad (4.3a)$$

The term on the right hand side of equation (4.3a) thus represents the return that the creditor minimally requires in order to make the loan. That is:

$$R_{i,j}^{min} = \frac{R^f + P(X_j) c}{1 - (1 - \tau_{i,j}) P(X_j)} \qquad (4.3b)$$

[11] To be more precise $R_{i,j} = 1 + r_{i,j}$ where $r_{i,j}$ is the interest rate of the loan.

[12] To be more complete, the total extra costs may be both fixed (legal costs) and/or dependent on the loan sum (payment delays). Total extra costs would then be $C = c * loan\ sum + \bar{C}$. To get the return on the initial investment, this term should be divided by the loan sum ($C/loan\ sum = c + \bar{C}/loan\ sum$). For simplicity, section 4.3.1 assumes that fixed costs ($\bar{C}$) are not relevant so that only c appears in equation (4.1). Still, in the empirical part, the loan sum is included in the regressions.

If there is a non-zero probability that the borrower will default on its debt ($P(X_j) > 0$), the creditor would require an interest rate exceeding the risk-free interest rate as $R_{i,j}^{min} - R^f > 0$ in this case. This means that a positive interest spread would result (i.e., the difference between the actual and risk-free interest rate is positive). The higher the probability of default, the larger the interest spread. $\tau_{i,j}$ is also relevant: the higher the proportion of the return that the creditor recovers in case of default, the smaller the interest spread. Finally, if the extra non-recoverable costs (c) increase, the return demanded will also increase.

Two benchmark scenarios emerge from equation (4.3b) resembling the housing corporations' situation. If there is an explicit and credible no-bailout clause ($\tau_{i,j} = 0$), the minimally required return obtains its maximum value of:

$$R_{i,j}^{min} = \frac{R^f + P(X_j)c}{1 - P(X_j)} \tag{4.4a}$$

On the other hand, if there is an explicit bailout agreement that guarantees the loan ($\tau_{i,j} = 1$), the creditor only requires a premium above the risk-free rate in order to account for the non-recoverable costs, that is:

$$R_{i,j}^{min} = R^f + P(X_j)c \tag{4.4b}$$

If the non-recoverable costs are negligible, c approaches 0 and the minimally required interest rate would (approximately) equal the risk-free rate. Therefore, while for most countries an extra premium would be demanded for subnational governments or public organizations (Küttel and Kugler, 2002), in the Dutch case, this premium is expected to be small or negligible.

Finally, note that if we assume perfect competition, the actual return rate agreed upon ($R_{i,j}$) equals the required rate of return ($R_{i,j}^{min}$), because if the bank would demand a higher rate, the corporation would probably borrow from another bank. However, if the creditor has market power, it may obtain an extra premium (i.e., commercial margin), which will depend on e.g., bargaining skills of both parties and the availability of alternative financing options (denoted as Q_j). For example, if a corporation is willing to pay $R_{i,j}^{max} (\geq R_{i,j}^{min})$, the rate of return agreed upon becomes:

$$R_{i,j} = R_{i,j}^{min} + \sigma(Q_j)[R_{i,j}^{max} - R_{i,j}^{min}] \tag{4.5}$$

As Dutch corporations do not normally issue bonds, but rather participate in private arrangements with a lending party, such a premium may indeed arise.[13]

In short, a positive interest spread may occur because: (1) the loan is not guaranteed and there is a positive probability of default; (2) non-recoverable costs are relevant; or (3) the creditor succeeds in attaining a commercial margin.

4.3.2 Hypotheses

The aforementioned framework leads to a set of testable hypotheses. As noted, our dataset allows us to distinguish between both guaranteed and unguaranteed (mostly short-term) corporation loans. This offers us the unique opportunity to see what a bailout clause does to interest spreads.

Hypothesis 1 tests whether there is a significant difference in interest spread between guaranteed and unguaranteed loans and thus whether the formal bailout scheme is actually taken into account by BNG Bank. If we were to reject this hypothesis, it may imply that creditors believe that the formal distinction between guaranteed and unguaranteed loans within the bailout structure is not credible so that in effect all loans will be guaranteed to the same degree. According to Van der Schaar (2006), it is generally believed that the interest advantage of the bailout scheme is around 0.5 percentage points (or 50 basis points). Based on a survey among corporations, Finance Ideas (2011) notes that several corporations expect to have an interest rate advantage of 1 to 1.5 percentage point. Finally, Hendriks (2013) gives a figure of 0.5 to 1 percentage point, whereas WSW (2014) mentions a difference of 1.1 percentage point. It is a unclear however how these figures are calculated. Indeed, firm empirical evidence is lacking.

Hypothesis 1:

Unguaranteed loans have higher interest spreads than guaranteed loans.

For unguaranteed loans, corporation characteristics (X_j) are presumed to be relevant determinants of the interest spread (equation (4.4a)). For guaranteed loans, according to equation (4.4b), these characteristics are only relevant if extra non-recoverable costs (c) matter. If these costs are very small, the interest spread may even be insensitive to the risk profile of the

[13] The volumes needed for bond issues require corporations to bundle their demand. Several initiatives have unrolled, but did not lead corporations to structurally engage in bond issues (source: BNG Bank).

corporations. Hypothesis 2 tests whether the relationship between corporation characteristics and the interest spreads is different for guaranteed and unguaranteed loans.

> *Hypothesis 2:*
> *For unguaranteed loans, the corporation characteristics such as the financial position – indicating riskiness – influence the interest spread. For guaranteed loans, this relationship is weaker or even absent. We therefore expect a structural break between the two types of loans.*

Van Hecke et al. (2012) provide an extensive overview of the literature on (the determinants of) interest spreads as far as local governments are concerned. The bulk of that literature concludes that higher debt leads to higher interest rates: see for example Booth et al. (2007); Landon and Smith (2007); Heppke-Falk and Wolff (2008). Some of the literature holds that local government budget balance is also important (Booth et al., 2007; Schuknecht et al., 2009).

Most studies focus on countries where no (explicit) bailout clause exists. Heppke-Falk and Wolff (2008) however, focus on the German case in which a bailout of a region (*Land*) might well occur. The probability of a bailout could actually be predicted by utilizing a variable that the German law courts use in their assessments of bailouts. It appears that indeed the expectation of bailout payments lowers the interest rate. This suggests that investors do, in effect, take into account the possibility of a potential bailout.

Nevertheless, Heppke-Falk and Wolff (2008) find that as fiscal variables do have a significant influence on interest spreads, investors do not see regional governments as completely risk-free. This finding is not replicated by Schulz and Wolff (2009), however, who find that the effect of the debt level is only weakly significant.

Feld et al. (2013) focus on the case of Swiss cantons where there was a structural break in investors' expectations of potential bailout. In July 2003, the Swiss Federal Court officially decided that the canton of Valais was not obliged to bail out the municipality of Leukerbad after it came into financial trouble. Previous to this decision, Swiss law had indicated that although cantons did not have bailout obligations, they could still deviate from this ruling. This possibility apparently led to a widespread belief among investors that municipalities would be bailed out, if and when necessary. Feld et al. (2013) find indeed that since the 2003

judgment, cantons, being relieved from any expected bailout obligations, have seen a decline in bond yields by 25 basis points.

The Swiss case shows certain similarities with the case of Dutch housing corporations, because both utilise two different bailout schemes. However, whereas in the Swiss case, a distinction is made between a non-credible and a credible no-bailout clause, the Dutch case features an explicit bailout clause and an explicit no-bailout clause. Also, in the Swiss case, there was a cut-off between the two schemes in 2003, whereas in the case of Dutch corporations, both schemes coexist throughout the years.

In addition to financial characteristics, the scale of the organization could be influential as well. In case there is no explicit bailout clause, Heppke-Falk and Wolff (2008) note that larger organizations may have lower interest rates as they may be 'too big to fail' meaning that for these organizations, the no-bailout clause would not be credible. Also, the authors note that larger institutions may have a lower risk profile as they are more diversified. Under an explicit bailout scheme, these arguments could lose relevance however, since there is no difference in riskiness among small and large corporations. Finally, one may state that large institutions have more financial expertise and so they would have more knowledge on what can be considered to be a 'fair' interest rate and therefore bargain more effectively.

Indeed, because we are dealing with bank loans, the interest rate depends on the outcome of a bargaining process. In this case, even for guaranteed loans, the interest rate does not necessarily equal the risk-free reference rate. It is often noted that housing corporations fail to maximize their company value because there are no stockowners demanding adequate returns (Conijn, 2011). This weak requirement does not force corporations to put effort in minimizing interest payments. Especially for 'rich' corporations, the incentive may be weak. Therefore, we may expect to find a component of slack in the interest rates of corporation loans. In principle, we would expect interest rates on guaranteed corporation loans to equal their reference rates, as both are risk-free. If this is not the case, this may indicate the existence of slack. Hypothesis 3 provides an empirical test for this.

Hypothesis 3:

For guaranteed loans, the interest rates of corporations equal – on average – their reference rates, because both can be considered to be risk-free.

The interest rate on a guaranteed corporation loan may also exceed the risk-free reference rate if there are non-recoverable costs (*c*) (see equation 4.4b). That is, even though the loan is guaranteed, it is not completely risk-free because the creditor might have to incur costs in order to recover its loan. According to BNG Bank, it does not worry about non-recoverable costs when providing loans to corporations.[14] To empirically investigate whether or not these costs are negligible, we compare the interest rates of corporation loans with those of municipality loans. As for municipalities the bailout works 'automatically', the creditor is not involved in the process of recovering a loan in case of a default. Therefore, it does not need to worry about non-recoverable costs. For corporations on the other hand, the bailout clause secures individual loans, rather than their entire financial position. In this case, the creditor ís involved in the process of the execution of the clause. Therefore, it is likely that *c* is smaller for municipalities than for corporations. This notion is captured by hypothesis 4.

> *Hypothesis 4:*
> *The interest rate on guaranteed corporation loans equals the interest rate on municipality loans.*

The null of hypothesis 4 is that *c* is negligible both for corporations and municipalities. This implies that both corporation and municipality loans should be considered to be completely risk-free, and therefore, there is no reason that interest rates would be different, except for differences in loan characteristics (such as e.g., maturity, loan sum).

4.4 Research setup and data

4.4.1 Research setup

The aforementioned framework suggests that the interest spread depends on two sets of variables: (1) a bailout indicator ($\tau_{i,j}$) and (2) corporation specific characteristics (X_j). To test hypotheses 1 and 2, we therefore estimate the following regression model:

$$r_{i,j,t}^{spread} = \alpha + \beta\tau_{i,j,t} + \gamma X_{j,t} + \delta L_{i,j,t} + \theta_t + \mu_j + \varepsilon_{i,j,t} \quad (4.6a)$$

where $r_{i,j,t}^{spread}$ is the interest spread between a corporation loan and its risk-free reference rate. Thus:

[14] Source: interview with the specialist for the social housing sector of BNG Bank.

$$r_{i,j,t}^{spread} = r_{i,j,t}^{c} - r_{i,j,t}^{ref} \quad (4.6b)$$

For each observation, a reference rate is used that has the same: (1) amortization scheme; (2) contracting date; and (3) maturity. This way, we control for factors influencing the general interest rates in the economy, such as (expected) inflation, as well as structural differences in interest as a result of differences in amortization or maturity. Opting for a spread frees us from the problem of explicitly controlling for these factors (Küttel and Kügler, 2002). Especially macro-economic factors that fluctuate over time are difficult to control for; simply including year dummies would be insufficient as they don't take into account day-to-day fluctuations of interest rate determinants. Note that we construct an interest spread in absolute, rather than relative terms. This is done because BNG Bank maintains that credit assessments lead to an additional spread in percentage points for risky loans, regardless of whether the risk-free interest rates in the economy are high or low.[15] In our sensitivity analysis (see section 4.6), we consider the effect of using a relative spread.

Further, $\tau_{i,j,t}$ is a bailout indicator, taking the value of 1 if the loan is guaranteed and 0 if not, $X_{j,t}$ is a column-vector with corporation specific characteristics, $L_{i,j,t}$ denotes a column-vector with loan characteristics (such as the maturity and the loan sum), θ_t is a year dummy, μ_j is a corporation specific (fixed) effect and $\varepsilon_{i,j,t}$ is the error term. i is the loan subscript $(i = 1,2,3,\dots,N_j)$, j the corporation subscript $(j = 1,2,3,\dots,J)$ and t the time subscript.

Note that we deal with clustered data, i.e., the data on individual loans is regressed on a variable that is measured at a higher (housing corporation) level (Moulton, 1990). We thus have J clusters with N_j observations. This could be a reason to cluster the standard errors at the level of housing corporations. However, because the clusters are unbalanced, this may lead to a downward bias in cluster robust standard errors (Rogers, 1993; Nichols and Schaffer, 2007). We use clustered standard errors in our main results and non-clustered errors in the sensitivity analysis (section 4.6).

4.4.2 Data

We have obtained micro-data on several financial products that BNG Bank provided to housing corporations between 2001 and 2013. We focus on four categories of products with a fixed interest rate and an amortization scheme in line with available reference interest rates:

[15] Source: interview with the chair of the credit committee of BNG Bank.

1. Short-term loans (maturity less than 2 years), where payment of principal and interest are due at maturity.
2. Long-term loans where the principal is to be paid back at maturity (fixed or bullet).
3. Long-term loans where amortization and interest is paid in equal instalments (annuity).
4. Long-term loans where the principal is paid back in equal instalments (linear).

These loan categories encompass 52 percent of all housing corporation financial transactions with BNG Bank over our research period and 87 percent of the total loan sum. Accurate reference rates are not currently available for other loan types. Corporation specific variables are available for 2001-2012 (yearly data), obtained through *CorpoData*; the database of the CFV (see section 2.6.1).

4.4.3 Guaranteed versus unguaranteed loans

Our dataset comprises both short-term and long-term loans. Nearly all long-term loans of corporations are safeguarded by an explicit bailout clause. That is, these loans are used in order to conduct DAEB-services and the concerning corporations have been considered sufficiently creditworthy by the WSW. Short-term loans on the other hand are unguaranteed by definition. As a result, the creditor has a stronger incentive to monitor the borrowing party. Because all loans are borrowed at the same bank (BNG Bank), the variation in interest rates has to be explained by variation between corporations.

Figure 4.3 shows the number of different loan categories in the dataset. We can see that the most important method of long-term financing is by means of bullet loans, and that the number of annuity loans has decreased rapidly from 2002 onwards. Figure 4.3 also presents short-term money data, but there are no entries previous to 2008 as BNG Bank's internal system only maintains entries for limited periods. For this category we see that the number of short-term loans has had a sharp decrease, from 2009 onwards. This can be traced back to when BNG Bank decided to reduce day-to-day money lending (loans with a maturity of 1-3 days) because the fixed costs of issuing contracts were not being compensated for by the (smaller) profit margins.[16]

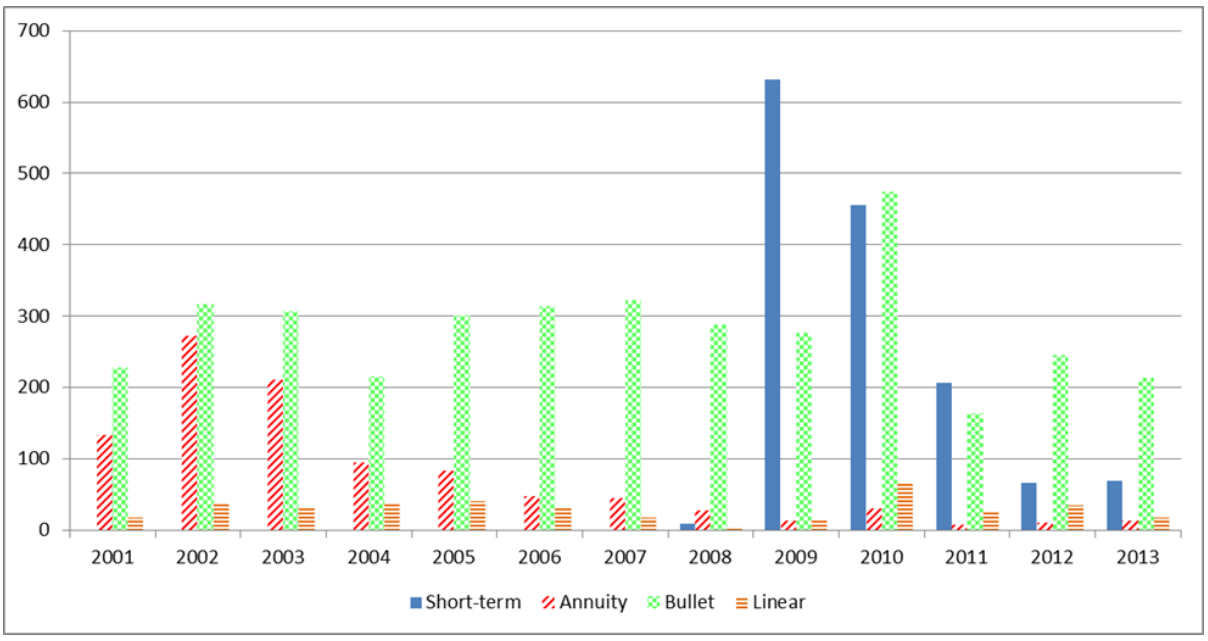
[16] Only if the loan sum is very high and BNG Bank has a very high liquidity, day-to-day money is still lent.

4.4.4 Reference interest rates

Interest rates on housing corporation loans do not solely depend on a corporation's characteristics, but also on specific characteristics of the loan (e.g., the contracting and starting day of the loan, the amortization pattern, the maturity and the loan sum), as well as general market conditions. In order to control for this, we have linked every housing corporation loan to a reference interest rate given by BNG Bank. To understand these reference rates, it is important to know more about BNG Bank's financing process.

In order to grant long-term loans, BNG Bank needs to borrow on the international capital markets. The proceeds of these bonds issues, paying a fixed interest rate, are immediately swapped for Euribor (European inter-bank offered rates) to mitigate risk. On the other hand, short-term funding is obtained on the money market. Whilst short-term lending rates are based on Euribor rates, long-term lending rates are based on Swap rates for long-term transactions.

Figure 4.3. Number of corporation loans made by BNG Bank per product category from 2001-2013.



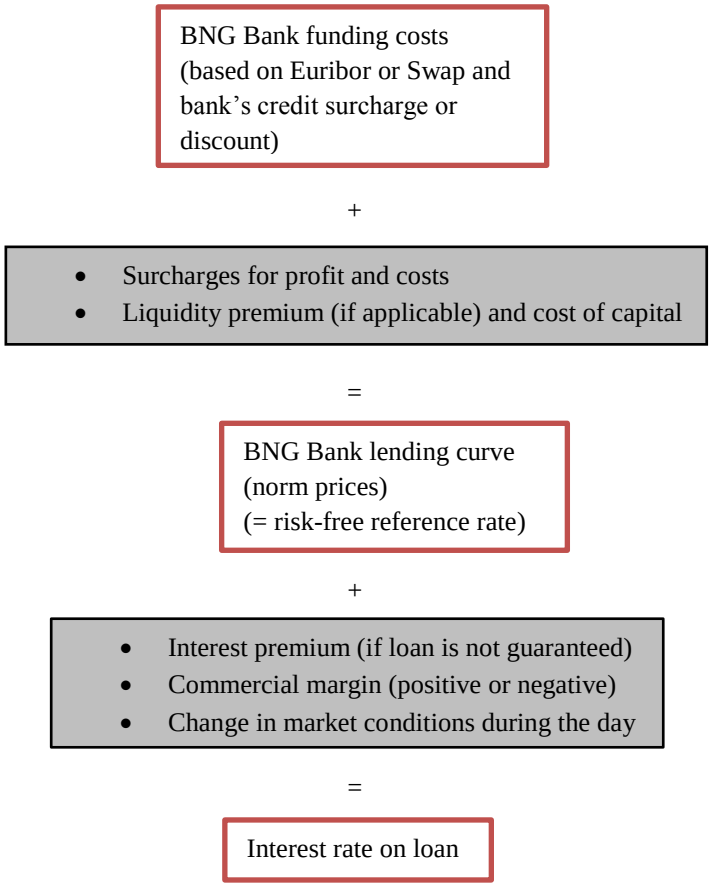
Before the start of every business day, the bank builds a 'pricing yield curve' by first connecting the funding interest rates of different maturities, and then adding surcharges for profit and costs (which may depend on loan sum and maturity), a liquidity premium (if applicable),[17]

[17] A liquidity premium was introduced during the financial crisis of 2008, when international credit market liquidity was low.

and a surcharge for cost of capital (‘usage of balance sheet’) – the surcharges for costs may differ between loans that are guaranteed and those that are not.

The lending yields represent ‘norm prices’ for risk-free lending. We use these norm prices as our reference rates. As noted, the actual interest rate on a loan may differ from these norm prices if a loan is not guaranteed. Also, a commercial margin, as a result of bargaining, can be realized. This commercial margin may be either positive or negative for each separate loan, but has to be at least 0 on average since otherwise BNG Bank would not get its required return. Besides this commercial margin, the interest rate may also differ from its reference rate because of changes in interest rates during the day (i.e., the reference rate is the norm price at the start of the day, thus if a loan is made at the end of the day, market conditions may have changed). Figure 4.4 summarizes the build-up of the interest rates.

Figure 4.4. Build-up of interest rates.



For short-term borrowing, the bank’s risk-free lending rates are closely related to the official Euribor rates. For example, during the period 1999-2014 the average difference between the one-month Euribor and the BNG Bank one-month risk-free lending rate was just 1 basis point.

This makes the Euribor rate an appropriate reference rate for risk-free short-term borrowing. The Euribor rate is publicly available for all maturities during the relevant research period.

For each of the three long-term loan types (i.e., bullet, annuity, linear), BNG reference rates are available on a daily basis but not for all maturities. More specifically, we have reference rates for bullet loans with 5 and 10 year maturity, for annuity loans with 10, 15, 20 and 25 year maturity and for linear loans with 5, 10, 15, 20 and 25 year maturity. For other maturities, we would have to rely on (linear) inter- and extrapolation to obtain references. Because the true yield curve of BNG Bank will probably not be linear, this would introduce white noise in the data. Therefore, we do not include interpolated observations in our main analysis. The effect of including these observations on the results is presented in our sensitivity analysis (section 4.6).

Note that reference rates cannot precisely control for all loan characteristics, especially (1) the difference between the contracting and starting date of a loan and (2) the loan sum. Therefore these characteristics are included in the regression ($L_{i,j,t}$). For completeness, we also include the maturity of the loan.

Finally, reference rates are all based on relatively small loans (with loan sums up to 2.5 million euros). Because banking costs of a loan agreement are fixed to a large extent, a higher premium is demanded for small loans to cover costs. Therefore, the reference rates are relatively high and may therefore be considered to be upper estimates.[18]

4.4.5 Independent variables

The independent variables ($\tau_{i,j,t}, X_{i,j,t}$ and $L_{i,j,t}$) may require more clarification as they are very specific to the sector in some instances.

- Variables at corporation level:
    - *Company value* is the net present value of future revenues and costs, divided by the number of dwellings.[19]
    - *Long-term debt* is the most straightforward measure of indebtedness of the corporation. We express this in terms of dwellings to account for scale effects.[20]

[18] BNG Bank does this to create a margin of safety in case interest rates would increase during the day.
[19] These future revenues and costs are estimated by the corporations themselves, but have been made comparable by the CFV by means of a unification procedure (CFV, 2012).

- *Equity* is a refined measure of equity per dwelling which takes into account future prospects of the corporation (CFV, 2012).[21] This measure is therefore not a perfect mirror image of *long-term debt.*[22] Equity is an important psychological number for corporations as the CFV/Aw uses this to judge the performance of the corporations.
- *Expected equity in t+5* gives the level of equity (per dwelling) that the corporation expects to have in 5 years from the current year. Prospects are important indicators of the riskiness of corporations.
- *Net cash flow* gives the net cash flows resulting from operational activities, divided by the number of dwellings.
- The number of *dwellings* is an indicator of the scale level.

- Variables at individual loan level:
  - *Rating BNG* measures the rating score that BNG Bank assigns to the riskiness of the loan. For unguaranteed loans, BNG Bank itself monitors not only the riskiness of the borrowing corporation, but also that of the specific project being financed.[23] This variable may therefore provide additional information on top of corporation characteristics. Note that this variable is only relevant for unguaranteed loans.
  - *Maturity* is the number of years in which the loan is due.
  - *Loan sum* is the amount of money borrowed (principle).
  - *Delay* indicates the difference (in days) between the contracting and starting day of the loan arrangement. This is relevant if a loan has a 'forward start', i.e., the loan is made on a certain date, but the money transfer takes place at a later date. According to BNG Bank, as the interest rate of immediately borrowing is higher than the return on a deposit for the delay period, this loss of interest is covered by an additional spread on the borrowing rate.[24]
  - *Guaranteed* is a dummy variable that equals 0 if the loan is unguaranteed and 1 if the loan is guaranteed.

[20] We thus focus on long-term debt only as short-term debt was not available for all years. For most corporations, short-term debt comprises no more than 5 percent of total debt however.
[21] Company value is an important building block of equity, but the two are certainly not equal. For example, provisions have been added to obtain equity, and immaterial fixed assets have been subtracted.
[22] Another reason for this is that we miss short-term debt in this picture. This data is not available for all years however (see footnote 20).
[23] Source: interview with the specialist for the social housing sector of BNG Bank.
[24] Source: interview with the manager of the client desk of BNG Bank.

Table 4.1 gives descriptive statistics concerning the interest spreads and the independent variables. The units of observation are individual loans.

Table 4.1. Descriptive statistics.

	N (excl. inter- and extra-polation)	N (incl. inter- and extra-polation)	Mean	St. dev.	Min	Max
Interest spread (all loans)	2,796	5,587	0.22	0.30	-1.61	3.94
Interest spread (guaranteed loans)	1,505	4,296	0.07	0.19	-1.61	1.55
Interest spread (unguaranteed loans)	1,291	1,291	0.45	0.30	-0.29	3.94
Company value per dwelling (in 1,000 euros)	2,796	5,587	42.16	13.39	5.85	144.49
Long-term debt per dwelling (in 1,000 euros)	2,796	5,587	32.58	17.45	5.21	179.42
Equity per dwelling (at time *t*) (in 1,000 euros)	2,796	5,587	10.76	6.46	-54.14	88.88
Expected equity per dwelling (at time *t+5*) (in 1,000 euros)	2,796	5,587	11.04	6.35	-15.57	72.05
Net cash flow per dwelling (in 1,000 euros)	2,796	5,587	0.91	0.99	-4.62	18.19
Dwellings	2,796	5,587	16,525	17,657	91	81,376
Loan sum (in 1,000 euros)	2,796	5,587	9,434	13,174	39	150,000
Rating BNG (only relevant for unguaranteed loans)[a]	1,264	1,264	8	2	0	19
Delay (days)	2,796	5,587	137	220	0	2,378
Maturity (years)	2,796	5,587	13	11	0	50
Guaranteed (dummy)	2,796	5,587	0.80	0.40	0	1

[a] On scale of 0 to 19.

4.4.6 Linking corporation data with loan data

Housing corporation specific variables are given on a yearly basis – that is to say they reveal the situation of the corporation at the end of a year, while data on housing corporation loans gives information on the date of the loans. The question of how to combine yearly and daily data is somewhat arbitrary.

According to BNG Bank, several sources are used to obtain the most recent (therefore necessary) information about the housing corporation.[25] For our main results, we therefore assume that the bank has the most up-to-date information. To check for robustness, we have repeated our analysis under the assumption that it takes a year to obtain this data, which would be the case should the bank rely solely on annual reports (see the sensitivity analysis; section 4.6). Thus, we describe two scenarios:

[25] Source: interview with the specialist for the social housing sector of BNG Bank.

- In the **standard scenario**, we link all loans in the first half of year *t* to corporation characteristics in year *t-1*. Loans in the second half of year *t* are linked to year *t* itself.
- In the **lagged scenario**, we link all loans in the first half of year *t* to corporation characteristics in year *t-2*. Loans in the second half of year *t* are linked to year *t-1*.

4.5 Results

4.5.1 Determinants of interest spreads

Table 4.2 presents the estimation results of equation (4.6). Regression (1) shows the results for all loans, regressions (2)-(5) give the results per loan type, and regression (6) combines bullet loans and short-term loans.

Regression (1) shows that interest spreads are higher for unguaranteed loans than for guaranteed loans. The coefficient on *guaranteed* is negative and significant which confirms hypothesis 1. The coefficient is -0.8046, which means that the bailout system reduces the interest spread by around 80 basis points.

Note that in regression (1), we have not included dummy variables for the type of amortization. This is because the variable *'short-term loan'* suffers from multicollinearity with the variable '*guaranteed'*. Indeed, as noted, most unguaranteed loans are short-term loans. Therefore, we cannot completely isolate the effect of unguaranteed loans. It could be argued that the difference in spreads between guaranteed and unguaranteed loans is (partly) due to the difference in loan type.

When including loan type dummies in regression (1), we find no significant difference in interest spread between different long-term loan types (i.e., the coefficients of dummies for bullet, annuity and linear loans are insignificant; details not shown). Thus the loan type does not seem to be of major influence. There is no reason to believe that a higher spread would be required for short-term loans just because they have a short maturity.

Additionally, note there are also three unguaranteed bullet loans (eleven when including inter- and extrapolation; see the sensitivity analysis in section 4.6). Although the number is very small, this does allow us to isolate the effect of the bailout clause. Regression (2) (dealing with bullet loans only) indicates that the interest spread is about 86 basis points higher for unguaranteed loans. This effect cannot be due to differences in loan type, because regression (2) only considers bullet loans.

Table 4.2. Regression results of interest spreads.

	(1)[a] All loans	(2) Bullet loans	(3) Annuity loans	(4) Linear loans	(5) Short-term loans	(6) Bullet & Short-term loans
Corporation characteristics						
Company value	-0.0001	0.0022	-0.0013	-0.0006	-0.0435***	-0.0017
	(-0.0700)	(1.4551)	(-0.8939)	(-0.2540)	(-5.0081)	(-0.5018)
Long-term debt	0.0007	-0.0018	-0.0019	-0.0011	0.0164***	0.0032
	(0.3626)	(-1.0327)	(-0.5761)	(-0.4707)	(3.0109)	(0.9345)
Equity	0.0041	0.0004	0.0033	-0.0008	0.0479***	0.0100*
	(1.2065)	(0.1188)	(0.8777)	(-0.0989)	(6.3575)	(1.9452)
Expected equity *t+5*	-0.0024	0.0023	0.0019	0.0044	-0.0364***	-0.0054
	(-1.0444)	(1.2375)	(1.2773)	(0.7459)	(-2.9191)	(-1.6303)
Net cash flow	-0.0094	0.0014	0.0004	-0.0016	0.0542	0.0113
	(-1.1405)	(0.1704)	(0.0390)	(-0.0974)	(0.5186)	(1.0260)
Dwellings	-0.0019	-0.0006	-0.0003	0.0161	0.0276***	-0.0016
	(-0.8372)	(-0.2705)	(-0.2272)	(0.4460)	(4.3210)	(-0.5022)
Loan characteristics						
Rating BNG					0.1711**	-0.0217
					(2.3229)	(-0.6881)
Loan sum	0.0053	0.0112*	-0.0017	0.0015	0.0074	0.0033
	(1.5835)	(1.9202)	(-1.2524)	(0.1701)	(1.5362)	(0.9331)
Square root of loan sum	-0.0584**	-0.0833**	0.0026	-0.0171	-0.0623	-0.0350
	(-2.3613)	(-2.4846)	(0.1846)	(-0.5531)	(-1.5896)	(-1.3018)
Delay	0.0002	0.0001	0.0006**	0.0001	0.0092	0.0004*
	(0.8699)	(0.4565)	(2.4147)	(0.4701)	(0.8726)	(1.7639)
Square root of delay	0.0149**	0.0175***	0.0042	0.0173***	-0.0587*	0.0085
	(2.5353)	(2.8885)	(0.7240)	(3.5244)	(-2.0238)	(1.2102)
Maturity	0.0010	-0.0000	0.0217***	0.0021	0.6461	0.0128
	(0.1303)	(-0.0030)	(3.9577)	(0.1844)	(0.9717)	(0.9098)
Square root of maturity	-0.0100	-0.0162	-0.2020***	-0.0452	-0.4803***	-0.1196
	(-0.1509)	(-0.1781)	(-3.7920)	(-0.5385)	(-4.2627)	(-0.9818)
Guaranteed	-0.8046***	-0.8586***				-0.7451**
	(-4.4476)	(-8.9052)				(-2.0625)
Constant	0.7151**	0.8058**	0.1412	-0.0752	-0.0045	0.6990*
	(2.0814)	(2.0914)	(0.5050)	(-0.4404)	(-0.0162)	(1.7064)
Observations	2,796	810	486	209	1,264	2,074
R-squared	0.6607	0.7638	0.8821	0.8928	0.6838	0.7072

Robust t-statistics (based upon clustered standard errors) in parentheses.
*** p<0.01, ** p<0.05, * p<0.1
Year and corporation dummies included.
[a] Dummy variables denoting the type of loan are omitted because of multicollinearity with *Guaranteed*.
The number of observations in regression (1) does not equal the sum of regressions (2)-(5), because *Rating BNG* is not available for all unguaranteed loans.

One may also argue that bullet loans and short-term loans are essentially the same (as for both loan types the principal is paid back at maturity). The only difference is in fact the difference in maturity. Regression (6) shows the regression results for bullet and short-term loans together. The bailout clause remains significant, but the coefficient is reduced to -0.7451.[26]

[26] Alternatively, one may argue that the effect of the bailout could be estimated by means of regression discontinuity design (Thistlethwaite and Campbell, 1960; Lee and Lemieux, 2010) on the basis of bullet and short-term loans. The idea behind this is that the relationship between maturity and interest spread may show a

These results lead us to conclude that *guaranteed* has a significant impact on the interest spread. This means that the bailout clause succeeds in lowering interest rates. It also implies that the no-bailout clause for unguaranteed loans is credible. That is, BNG Bank does not seem to expect a bailout for unguaranteed loans.To give a rough indication of the impact of the bailout clause, note that the total level of guaranteed corporation debt was 87.4 billion euros in 2012 (source: WSW, 2012). According to regression (1), corporations would have to pay an additional interest of 0.80 percent over this debt, if it would not be guaranteed. This implies that the estimated benefits of the bailout would be 700 million euros (87.4 billion*0.8%) per year in reduced interest payments. If we were to use the more conservative estimate of regression (6), the benefit of the bailout becomes 650 million euros per year (87.4 billion*0.75%).

The direct costs of the bailout clause could be shown in the total loan sum on which housing corporations defaulted. Although we do not have this information directly, we do know the amount of reorganization subsidies provided to corporations in order to restore their financial position. As noted in section 4.2.2, from December 31, 1990, until 2012, the CFV provided 1.3 billion euros in reorganization subsidies (CFV, 2013c). Corrected for inflation, this equals 1.5 billion euros (in 2012 euros). Note that there may also be secondary costs involved if, for example, the bailout clause led to operational inefficiency. It is not possible to measure this, however, as there are no housing corporations in The Netherlands not operating under the bailout clause. But we do know that these costs would have to be substantial in order to outweigh the benefits of the bailout scheme. Indeed, if we compare the estimate of yearly benefits (700 million euros) with the direct costs of about 70 million euros (1.5 billion euros/22 years), the indirect costs of the bailout clause would have to amount to more than 600 million euros per year for the bailout clause to be considered undesirable.[27]

According to regressions (2)-(4), housing corporation characteristics appear to have no influence on the interest spreads for guaranteed loans. This is in line with hypothesis 2. One

discontinuity at a maturity of 2 years (because beyond this threshold, we deal with guaranteed loans). That is, with a maturity of 2 years or longer, we expect a 'jump' in interest spreads. This method indeed reveals a discontinuity at a maturity of 2 years (results not shown). However, because bullet and short-term loans have different reference rates (bullet loans are based on Swap rates and short-term loans are based on Euribor rates), it might not be appropriate to treat the two loan types as the same. Therefore, we do not delve into this method further.

[27] Note that while the bailout clause also leads to monitoring costs (for the CFV/Aw and the WSW), at the same time it relieves BNG Bank from supervisory activities. Although it is uncertain who would have the lower monitoring costs, we presume that the difference between the two is not large enough to affect the desirability of the bailout clause.

might note that due to multicollinearity among regressors, regressions (1)-(4) may suffer from overestimated standard errors. Removing variables would not alter our conclusions however (results not shown).

Regression 5 shows that in contrast to guaranteed loans, housing corporation characteristics are highly relevant for short-term (and thus unguaranteed) loans: higher company value, lower long-term debt and higher expected equity all lead to a reduction of interest spreads. This is also in line with hypothesis 2. The main exception, however, is the significant positive effect of equity on the interest spread. This appears to be counterintuitive, as higher equity implies a more favourable financial position (CFV, 2012), this should decrease rather than increase interest rates. It could be the case however, that corporations with high levels of equity may not put much effort into lowering interest costs as they do not have much difficulty with their repayment obligations (i.e., high equity can lead to less sharp bargaining). However, it could be argued that if this were relevant, the effect of equity should also be relevant for guaranteed loans, and we see that this is not the case. In addition, the coefficient on *equity* becomes insignificant in regression (5) once all other corporation characteristics are excluded (results not shown).

Further, the coefficient on net cash flow is also insignificant in regression (5). This might partly be explained by the fact that we use the cash flow in the current year only. Unfortunately, we do not have adequate data on forecasts of cash flows, which would be an important parameter indicating the ease with which debt could be repaid (WSW, 2009). Another confirmation of hypothesis 2 is the fact that the risk rating BNG Bank allocates to each unguaranteed loan positively influences the interest spread.[28] Surprisingly, *Rating BNG* becomes negative (but insignificant) in regression (6).

Finally, it appears that the scale of the housing corporation (i.e., the number of dwellings) is only relevant for short-term (unguaranteed) loans. If the number of dwellings increases, the interest spread increases as well. This is rather surprising as we would have expected a negative relationship between scale and interest spreads (see section 4.3.2). It could be that for larger housing corporations, the stakes are higher, so that monitoring is conducted more strictly.

[28] Of course, this is very logical, since the BNG itself creates this variable. Indeed, it would be very surprising if there would be no effect. Still, the variable is included since it provides information on the specific risk of the loan itself in addition to the riskiness of the corporation. When removing the variable, conclusions do not alter.

The coefficients of corporation characteristics in regressions of unguaranteed loans differ from those of guaranteed loans. A Chow test reveals that the effects of the relevant variables are larger for unguaranteed loans than for guaranteed loans (significant at 1 percent level, details not shown).

In conclusion, unguaranteed loans show a significantly higher spread than guaranteed loans. The difference is around 80 basis points. The explicit bailout clause appears to do its job; it succeeds in lowering interest rates. Also, for guaranteed corporation loans, the financial position does not influence the interest spreads significantly, whereas for unguaranteed loans the financial position of the corporation is highly relevant. A remarkable exception to these findings is the positive impact of the corporation's equity.

4.5.2 Comparison with reference rates

Figure 4.5 compares interest rates on corporation loans with their reference rates by means of a scatter plot. If an observation lies on the dashed 45-degree line, the two rates are exactly equal. In the left panel of the figure, dealing with guaranteed loans, we might expect all observations to be located on this line, since – as mentioned – corporation loans are free of credit risk as they fall under the bailout clause and the reference rates are based on risk-free rates as well.[29] The figure shows however that the bulk of observations lies northwest of this line, indicating that in most cases, corporations borrow relatively expensively. This finding may indicate that either (1) corporations pay a positive commercial margin, or (2) BNG Bank expects corporations' default to be costly, despite the existence of the bailout clause (this may happen if extra non-recoverable costs (c) are relevant).

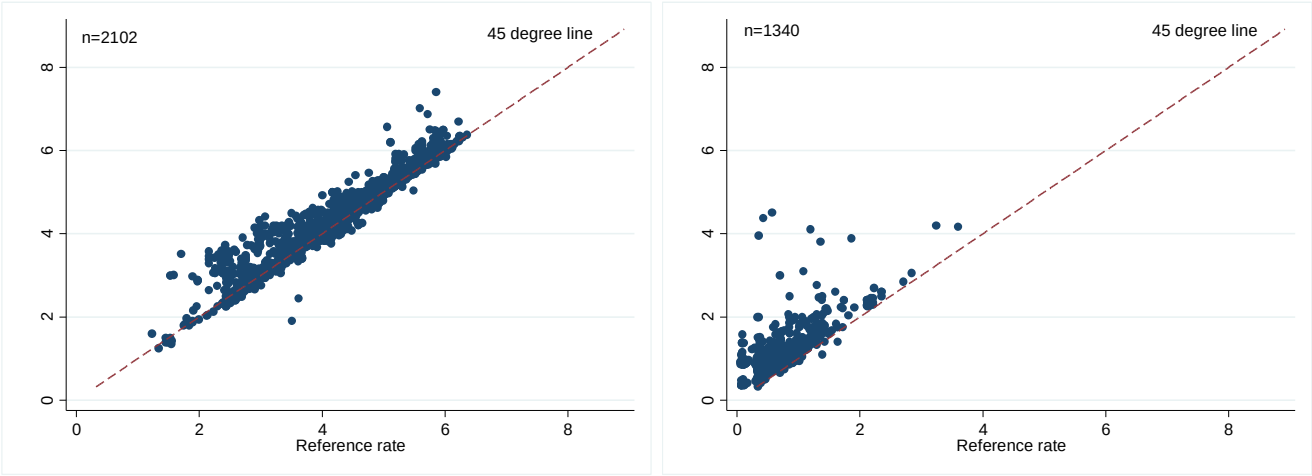
In the right panel of Figure 4.5, interest rates of unguaranteed (risky) corporation loans are plotted against risk-free reference rates (Euribor). This figure shows a positive spread for nearly all loans, compliant with expectations.

Figure 4.5 (left panel) suggests that hypothesis 3 should be rejected as the bulk of observations shows a positive interest spread. In fact, on average, guaranteed corporation loans have an interest rate seven basis points (or 1.6 percent) higher than their reference rate. For unguaranteed loans, the average spread is 44 basis points (or 150 percent), which – again – is in line with hypothesis 1. That is, the spread is higher for unguaranteed loans than for

[29] As noted, if anything we would expect reference rates to be overestimated rather than underestimated because they are based on small loan sums (see section 4.4.4).

guaranteed loans. The question is whether or not the interest spread of seven basis points for guaranteed loans is significant. The next section delves into this.

Figure 4.5. Corporation interest rates versus reference rates (inter- and extrapolation excluded).



4.5.3 Slack and savings potential

We thus saw that interest rates on guaranteed corporation loans exceed their reference interest rates most of the time (Figure 4.5, left panel). As noted, based on simple averages, the difference between the two (i.e., the average deviation from the 45-degree line in Figure 4.5) is 7 basis points or 1.6 percent. Table 4.3 shows these simple averages per loan type. It appears that annuity loans show the largest spread.

Table 4.3. Average interest rates of corporations versus reference rates (guaranteed loans).

	Bullet	Linear	Annuity	All
Average interest rate	4.30	4.34	5.03	4.61
Average reference rate	4.25	4.29	4.93	4.54
Average absolute spread in basis points (interest rate-reference rate)	5.01	5.61	10.04	7.20
Average relative spread (((interest rate-reference rate)/reference rate)*100%)	1.32%	1.27%	2.10%	1.64%

Such a simple average might be distorted however because the reference rates are not perfect, since they do not control for all loan characteristics (especially *delay* and *loan sum*). To control for this, consider equation (4.6) again and note that for guaranteed loans $\gamma = 0$ and $\tau_{i,j} = 1$ so that:

$$r_{i,j,t}^{spread} = \alpha + \beta + \delta L_{i,j,t} + \theta_t + \varepsilon_{i,j,t} \tag{4.7a}$$

where we have removed the fixed effects from the regression.[30] That is, the interest spread should be nonzero only if we cannot perfectly control for loan characteristics. However, according to section 4.3.1, a positive interest spread might occur if either non-recoverable costs are relevant (equation 4.4b) or because there is imperfect competition and therefore scope for bargaining (equation 4.5). These factors cannot be measured directly, and will therefore end up in the error term if they are relevant. If this is the case, a traditional error term (with a normal distribution) may not be appropriate. The method of Stochastic Frontier Analysis (SFA, Aigner et al., 1977; Meeusen and Van den Broeck, 1977) allows us to split up the error term (ε) into a one-sided 'inefficiency component'[31] with a half-normal distribution[32] (u) and a white noise error term (v) with a normal distribution. That is:

$$\varepsilon_{i,j,t} = v_{i,j,t} + u_{i,j,t} \tag{4.7b}$$

SFA allows to test the hypothesis $H_0: \sigma_u^2 = 0$. This hypothesis tests whether or not the variance of the inefficiency component is significantly different from zero, that is, it tests whether the interest rates exceed the reference rates significantly. If we fail to reject this hypothesis, equation (4.7) reduces to an OLS and the error term consists only of the white noise term. We reject H_0 however (at the 1 percent level) meaning that the inefficiency term should not be rejected. The average of the 'inefficiency term' is 0.1044, which means that interest rates on guaranteed corporation loans exceed their reference rates by 10.44 basis points on average, while controlling for loan characteristics. This is somewhat higher than the crude average we found in Table 4.3. Therefore, hypothesis 3 should be rejected.

Thus, we see that corporation interest rates are significantly higher than the rates that BNG Bank expects to realize on similar risk-free loans. This finding may have two main causes (see equations 4.4b and 4.5):

1) Guaranteed loans may not be fully risk-free, because of the extra costs involved in a bailout. So, if a corporation runs into financial distress with its payment obligations, BNG Bank might incur costs that cannot be recovered (i.e., *c* is not negligible in equation (4.4b)). However, if this is the case, we would expect the financial position of the

[30] If we would not remove the fixed effects, part of the slack probably turns up in this term. An alternative to measure inefficiency would therefore be to investigate whether or not the corporation dummy variables are significantly different from zero. This indeed turns out to be the case for most dummy variables.
[31] Note that the term 'inefficiency component' may be misleading in this case, because (as we explain in this section), the difference between the interest rate and its reference rate is not necessarily the consequence of inefficiency.
[32] Other distributions of the inefficiency component may be chosen.

corporation to be relevant in the determination of the interest rates of guaranteed loans as $X_{j,t}$ turns up in equation 4.4b if $c > 0$. We saw that this is not the case (Table 4.2).

2) Corporations pay a positive commercial margin on their loans (see Figure 4.4). This may happen for two main reasons:
    a. It could be the that there exists inefficiency or slack in corporation loans (i.e., corporations should be able to reduce their interest payments by bargaining sharper).
    b. A positive commercial margin can also be the result of market power of BNG Bank. If BNG Bank has market power, it may raise interest rates above marginal costs (i.e., interest rates above reference rates) so that it can obtain a commercial margin. In principle however, although BNG Bank is by far the largest public sector bank, corporations are free to borrow elsewhere. The most prominent alternative to BNG Bank is NWB Bank, which is the second largest public sector bank. Also, corporations may choose to finance themselves via commercial banks. NWB Bank seems to be a reasonable option as it has the same credit rating as BNG Bank and should therefore have similar borrowing costs.[33] Therefore, the argument for market power does not seem very strong. Still, it may be the case that BNG Bank borrows relatively cheap for some reason therefore having an advantage over other banks. If this is the case, BNG Bank can exploit this advantage and obtain a commercial margin. Thus, although in principle corporations have multiple options for borrowing, there might exist some market power. Therefore, this possibility cannot be ruled out completely.

The next section develops an additional test to investigate whether or not BNG Bank demands a premium for non-recoverable costs for risk-free loans (i.e., whether or not *c* is negligible in equation (4.4b)). We do this by comparing corporation loans with municipality loans.

4.5.4 Corporation loans versus municipality loans

Just as for housing corporations, the bulk of municipality loans are provided by BNG Bank. Because municipalities are guaranteed financially by the central government, all of their loans are credit risk-free.

[33] Both BNG Bank and NWB Bank are rated Aaa by Moody's and AA+ by Standard & Poor's. Source: BNG Bank, NWB Bank.

The main difference between corporations and municipalities is that the guarantee fund of corporations guarantees individual loans, whereas for municipalities, their entire financial position is guaranteed by a general bailout scheme. If a corporation runs into trouble with its payment obligations, the parties involved (the corporation itself, BNG Bank, CFV/Aw, WSW) will have to negotiate to solve the problems. This may lead to extra costs for BNG Bank. For municipalities, the rescue operation is straightforward as the central government will simply step in by providing a supportive grant to the municipality.[34] BNG Bank is not involved in this process. This implies that c would be higher for corporations than for municipalities, potentially leading corporations to pay higher interest rates. In order to investigate this we compare risk-free corporation loans with municipality loans. The regression equation reads:

$$r_{i,j,t}^{spread} = \delta L_{i,j,t} + \varphi Corporation\ dummy_{i,j,t} + \theta_t + \varepsilon_{i,j,t} \tag{4.8}$$

where r^{spread} is defined as in equation (4.6b), with the only difference that we do not only consider corporation loans (r^c) but municipality loans (r^m) as well. $L_{i,j,t}$ is a vector of loan characteristics (*loan sum, delay, maturity and loan type*). *Corporation dummy* is a dummy variable taking on a value of 1 if we deal with a corporation loan and 0 if we have a municipality loan. We have data on 4,207 individual loans to municipalities (5,514 when including loans with inter- and extrapolated reference rates), also obtained from the database of BNG Bank. Results are given in Table 4.4.

Table 4.4 finds no evidence of a systematic difference between corporation and municipality loans. The coefficient of the corporation dummy is close to zero and insignificant in all regressions. This finding provides additional evidence that the potential non-recoverable costs (c) are considered to be negligible by BNG Bank. We thus fail to reject hypothesis 4. This suggests that the guarantee scheme for housing corporations (securing individual loans) seems to succeed in matching the general bailout scheme of municipalities (which cannot default because their entire financial position is secured). Both clauses prove to be equally credible.

Therefore, it appears likely that corporations could reduce their interest payments slightly by bargaining more sharply or putting more effort in searching for banks with better offers. However, the possibility that BNG Bank has a competitive advantage because of low funding

[34] Municipalities do have to fulfil certain requirements in order to obtain the grant however. For example, tax rates should be sufficiently high (Allers, 2015).

costs cannot be ruled out completely. In this case, cheaper alternatives would not be available. More research is needed to solve this issue.

Table 4.4. Regression results of interest spreads: comparison of corporations and municipalities.

	(1) All guaranteed loans	(2) Bullet loans	(3) Annuity loans	(4) Linear loans
Loan sum	0.0024***	0.0006	0.0011	0.0046***
	(3.8391)	(0.6489)	(0.7852)	(3.7710)
Square root of loan sum	-0.0294***	-0.0178**	-0.0179**	-0.0413***
	(-7.2336)	(-2.2976)	(-2.1468)	(-5.9454)
Delay	0.0005***	0.0003***	0.0005***	0.0006***
	(12.8571)	(2.7911)	(4.8022)	(13.8480)
Square root of delay	0.0061***	0.0111***	0.0054*	0.0051***
	(5.8778)	(4.3531)	(1.7986)	(4.7785)
Maturity	0.0102***	0.0050	0.0222***	0.0102***
	(5.1718)	(0.8361)	(7.1476)	(2.9466)
Square root of maturity	-0.0881***	-0.0461	-0.2036***	-0.0895***
	(-5.5482)	(-1.1429)	(-6.7066)	(-3.1680)
Linear loan	-0.0137**			
	(-2.3052)			
Bullet loan	-0.0247***			
	(-3.5471)			
Corporation dummy	-0.0040	-0.0024	-0.0093	-0.0056
	(-0.6778)	(-0.2479)	(-0.7735)	(-0.5322)
Constant	0.1054***	0.2363*	0.3727***	0.1791***
	(3.0647)	(1.9239)	(4.8777)	(3.1721)
Observations	6,324	1,454	1,136	3,734
R-squared	0.6706	0.5723	0.6619	0.7189

Robust t-statistics in parentheses.
*** p<0.01, ** p<0.05, * p<0.1
Year dummies included.

4.6 Sensitivity analysis

We test the robustness of our results from hypotheses 1 and 2 in five ways. First of all, we define an interest spread in relative (rather than absolute) terms. Secondly, we include all loans with interpolated and extrapolated reference rates. Thirdly, we show the results for non-clustered (but robust) standard errors. Fourthly, we use the lagged scenario (instead of the standard scenario) and finally, we rerun the analysis including interaction terms that allow us to distinguish between a pre-crisis and post-crisis effect.

For our main results, we use an interest spread in absolute terms (see equation 4.6b). Allers and Van Ommeren (2016) argue that a relative interest spread might be preferred over an absolute spread in order to control more precisely for (1) changes in interest rates over time

and (2) differences in interest rates between loan types. Therefore, we re-estimate equation 4.6, but redefine equation 4.6b into:

$$r_{i,j,t}^{spread} = \frac{r_{i,j,t}^{c} - r_{i,j,t}^{ref}}{r_{i,j,t}^{ref}} \tag{4.9}$$

Results are presented in Table 4.5. We now find that the coefficient on *guaranteed* differs significantly between regression (1) and (2). This is because regression (1) includes unguaranteed (short-term) loans with relatively low interest rates while regression (2) includes loans with relatively high interest rates. This contrasts with our main results in which the coefficients were similar. This is in line with the explanation of BNG Bank itself (see section 4.4.1). Therefore, it seems that BNG Bank increases its required interest rate by a certain amount of basis points for unguaranteed loans, regardless of the risk-free interest rate. This makes the absolute spread more appropriate in our specific case. Further, housing corporation characteristics remain relevant only for unguaranteed loans in Table 4.5.

As noted, reference rates are not available for all maturities (section 4.4.4). Loans with maturities for which no reference rate exists are obtained by linear inter- and extrapolation. For example, the reference rate of a bullet loan with a maturity of 8 years, is found by interpolating the reference rates for a 5-year loan and a 10-year loan. For a 3-year bullet loan, we interpolate for the 12-month Euribor rate and the 5-year rate. For bullet loans with a maturity longer than 10 years, we use the reference rate for a 10-year loan. Inter- and extrapolation is needed for about half the loans.

Because the true yield curve of BNG Bank does not need to be linear, inter- and extrapolation may introduce white noise in the data. Therefore, the main results (Table 4.2) show the results without interpolated reference rates. The disadvantage is however that the number of observations decreases when excluding inter- and extrapolated reference rates.

Table 4.5. Regression results of interest spreads (relative interest spread).

	(1)[a] All loans	(2) Bullet loans	(3) Annuity loans	(4) Linear loans	(5) Short-term loans	(6) Bullet & Short-term loans
Corporation characteristics						
Company value	0.0024	0.0007	-0.0005	-0.0002	-0.2483***	-0.0038
	(0.3276)	(1.5765)	(-1.1621)	(-0.2217)	(-8.9762)	(-0.2427)
Long-term debt	0.0050	-0.0008	-0.0005	-0.0004	0.0759***	0.0245*
	(0.8303)	(-1.3829)	(-0.5599)	(-0.5758)	(9.8735)	(1.8111)
Equity	0.0049	-0.0001	0.0003	0.0000	0.2447***	0.0325
	(0.3537)	(-0.0647)	(0.2837)	(0.0061)	(8.0542)	(1.4589)
Expected equity *t+5*	0.0079	0.0009	0.0004	0.0011	-0.0811***	-0.0053
	(0.6820)	(1.5846)	(1.3046)	(0.8324)	(-4.6087)	(-0.2781)
Net cash flow	-0.0196	0.0004	0.0014	0.0022	0.5086*	-0.0001
	(-0.6638)	(0.1879)	(0.5383)	(0.4943)	(1.7304)	(-0.0031)
Dwellings	0.0004	-0.0005	0.0000	0.0063	0.2178***	0.0137
	(0.0422)	(-0.6567)	(0.0256)	(0.6893)	(7.6466)	(0.8345)
Loan characteristics						
Rating BNG					0.7391***	-0.1431
					(3.6401)	(-1.4399)
Loan sum	0.0048	0.0038**	-0.0005	0.0008	0.0127*	-0.0015
	(0.5643)	(2.0662)	(-1.4370)	(0.3217)	(1.8040)	(-0.1819)
Square root of loan sum	-0.0897	-0.0274***	0.0018	-0.0066	-0.1025	-0.0138
	(-1.1245)	(-2.5990)	(0.5012)	(-0.7283)	(-1.4921)	(-0.1776)
Delay	-0.0002	0.0000	0.0001*	0.0000	0.0204	0.0007
	(-0.4189)	(0.3410)	(1.8814)	(0.1269)	(0.3422)	(0.8021)
Square root of delay	0.0124	0.0050***	0.0009	0.0045***	-0.0836	-0.0129
	(0.7333)	(2.6510)	(0.5072)	(4.0649)	(-0.6723)	(-0.4394)
Maturity	0.0214	0.0005	0.0054***	0.0019	-3.6782	0.0841**
	(1.1665)	(0.1258)	(4.0232)	(0.6801)	(-1.0560)	(2.2145)
Square root of maturity	-0.1539	-0.0094	-0.0518***	-0.0241	-0.5437	-0.6852**
	(-0.9700)	(-0.3042)	(-3.9713)	(-1.1702)	(-0.6658)	(-2.0436)
Guaranteed	-1.6909***	-0.2463***				-2.0690*
	(-3.7821)	(-7.0318)				(-1.8883)
Constant	0.7864	0.2801**	0.1090	0.0042	0.2565	0.8071
	(0.5240)	(2.2732)	(1.3017)	(0.0883)	(0.2696)	(0.3988)
Observations	2,796	810	486	209	1,264	2,074
R-squared	0.6364	0.7362	0.8731	0.8949	0.8468	0.6622

Robust t-statistics (based upon clustered standard errors) in parentheses.
*** p<0.01, ** p<0.05, * p<0.1
Year and corporation dummies included.
[a] Dummy variables denoting the type of loan are omitted because of multicollinearity with *Guaranteed*.
The number of observations in regression (1) does not equal the sum of regressions (2)-(5), because *Rating BNG* is not available for all unguaranteed loans.

When including inter- and extrapolated observations, the total number of observations increases from 2,796 (Table 4.2) to 5,587 (Table 4.6). Table 4.6 still indicates that guaranteed loans have a lower interest spread; the magnitude of the effect is increased somewhat (from -0.8046 in Table 4.2 to -1.1365 in Table 4.6). Using this coefficient, the benefit of the bailout in 2012 would be around 1 billion euros (87.4 billion*1.14%). Also, for bullet loans, which now include eleven unguaranteed loans, the coefficient on *guaranteed* remains significant (see regression 2). The same holds when combining short-term and bullet loans (regression 6).

Thus we can confirm the finding that unguaranteed loans show a higher interest spread than guaranteed loans. Additionally, the results still indicate that housing corporation characteristics are only relevant for unguaranteed loans.

Table 4.6. Regression results of interest spreads (interpolation and extrapolation included).

	(1)[a] All loans	(2) Bullet loans	(3) Annuity loans	(4) Linear loans	(5) Short-term loans	(6) Bullet & Short-term loans
Corporation characteristics						
Company value	-0.0005	-0.0009	0.0008	-0.0025*	-0.0435***	-0.0008
	(-0.4128)	(-0.5501)	(0.2858)	(-1.7353)	(-5.0081)	(-0.5473)
Long-term debt	0.0001	0.0004	-0.0043*	0.0023**	0.0164***	0.0010
	(0.1355)	(0.2713)	(-1.8587)	(2.0434)	(3.0109)	(0.5156)
Equity	0.0035	0.0012	-0.0072	0.0083	0.0479***	0.0047
	(1.4945)	(0.3594)	(-1.0461)	(1.2045)	(6.3575)	(1.4046)
Expected equity *t+5*	0.0012	0.0031	0.0024	-0.0017	-0.0364***	-0.0010
	(0.6984)	(1.1280)	(0.9506)	(-0.4323)	(-2.9191)	(-0.3450)
Net cash flow	-0.0051	0.0030	0.0018	0.0031	0.0542	0.0058
	(-0.7596)	(0.3985)	(0.1148)	(0.2466)	(0.5186)	(0.7291)
Dwellings	-0.0026	-0.0007	-0.0010	0.0165	0.0276***	-0.0050
	(-1.0606)	(-0.1559)	(-0.4050)	(0.6071)	(4.3210)	(-1.3166)
Loan characteristics						
Rating BNG					0.1711**	0.0123
					(2.3229)	(0.5246)
Loan sum	0.0027	-0.0037	-0.0019	0.0003	0.0074	0.0034
	(1.4189)	(-1.0685)	(-0.8972)	(0.0627)	(1.5362)	(1.5650)
Square root of loan sum	-0.0323**	0.0003	0.0095	-0.0041	-0.0623	-0.0406**
	(-2.3022)	(0.0104)	(0.5150)	(-0.1796)	(-1.5896)	(-2.3008)
Delay	-0.0001	-0.0002	0.0005*	-0.0002***	0.0092	-0.0002
	(-1.2373)	(-1.4578)	(1.8857)	(-2.7989)	(0.8726)	(-1.4722)
Square root of delay	0.0162***	0.0167***	-0.0004	0.0215***	-0.0587*	0.0171***
	(4.5198)	(4.3276)	(-0.0462)	(6.9796)	(-2.0238)	(4.0504)
Maturity	-0.0239***	-0.0340***	0.0337***	0.0224***	0.6461	-0.0288***
	(-5.3323)	(-6.4930)	(3.3601)	(2.6438)	(0.9717)	(-5.0515)
Square root of maturity	0.2194***	0.3098***	-0.3079***	-0.1845**	-0.4803***	0.2661***
	(5.8175)	(6.9846)	(-3.0732)	(-2.4305)	(-4.2627)	(5.6711)
Guaranteed	-1.1365***	-0.9286***				-1.0740***
	(-10.1873)	(-6.9810)				(-4.6442)
Constant	0.7291***	0.2476	0.9410*	-0.3595	-0.0045	0.4044
	(11.0458)	(1.3586)	(1.9082)	(-1.0333)	(-0.0162)	(1.4626)
Observations	5,587	3,039	898	359	1,264	4,303
R-squared	0.4820	0.4809	0.6613	0.8618	0.6838	0.5273

Robust t-statistics (based upon clustered standard errors) in parentheses.
*** p<0.01, ** p<0.05, * p<0.1
Year and corporation dummies included.
[a] Dummy variables denoting the type of loan are omitted because of multicollinearity with *Guaranteed*.
The number of observations in regression (1) does not equal the sum of regressions (2)-(5), because *Rating BNG* is not available for all unguaranteed loans.

Table 4.7 gives the results when standard-errors are not clustered (yet still robust for heteroskedasticity). These results are similar to the main results in Table 4.2.

Table 4.7. Regression results of interest spreads (no clustering of standard errors).

	(1)[a] All loans	(2) Bullet loans	(3) Annuity loans	(4) Linear loans	(5) Short-term loans	(6) Bullet & Short-term loans
Corporation characteristics						
Company value	-0.0001	0.0022*	-0.0013	-0.0006	-0.0435***	-0.0017
	(-0.1385)	(1.6576)	(-0.8972)	(-0.2678)	(-7.7668)	(-0.8384)
Long-term debt	0.0007	-0.0018	-0.0019	-0.0011	0.0164***	0.0032*
	(0.9604)	(-1.2646)	(-0.7668)	(-0.5166)	(4.0066)	(1.8329)
Equity	0.0041	0.0004	0.0033	-0.0008	0.0479***	0.0100***
	(1.5088)	(0.1715)	(1.0394)	(-0.1075)	(7.0175)	(2.7975)
Expected equity *t+5*	-0.0024	0.0023	0.0019	0.0044	-0.0364***	-0.0054**
	(-1.6022)	(1.4664)	(1.4377)	(0.8220)	(-4.9119)	(-2.4786)
Net cash flow	-0.0094	0.0014	0.0004	-0.0016	0.0542	0.0113
	(-1.1974)	(0.1962)	(0.0487)	(-0.1044)	(0.9082)	(1.3868)
Dwellings	-0.0019*	-0.0006	-0.0003	0.0161	0.0276***	-0.0016
	(-1.7929)	(-0.3556)	(-0.2534)	(0.5725)	(4.2958)	(-0.7834)
Loan characteristics						
Rating BNG					0.1711***	-0.0217
					(4.4860)	(-1.3284)
Loan sum	0.0053***	0.0112**	-0.0017	0.0015	0.0074**	0.0033
	(2.9298)	(2.2919)	(-1.3645)	(0.2216)	(2.3285)	(1.5866)
Square root of loan sum	-0.0584***	-0.0833***	0.0026	-0.0171	-0.0623**	-0.0350**
	(-3.8157)	(-2.9461)	(0.2180)	(-0.6687)	(-2.2340)	(-2.0453)
Delay	0.0002	0.0001	0.0006***	0.0001	0.0092	0.0004**
	(1.2259)	(0.7948)	(3.6027)	(0.3597)	(0.8029)	(2.3354)
Square root of delay	0.0149***	0.0175***	0.0042	0.0173***	-0.0587**	0.0085
	(3.3693)	(4.5359)	(1.0512)	(2.9533)	(-1.9937)	(1.6258)
Maturity	0.0010	-0.0000	0.0217***	0.0021	0.6461	0.0128
	(0.1576)	(-0.0040)	(4.7506)	(0.2461)	(1.2667)	(1.4983)
Square root of maturity	-0.0100	-0.0162	-0.2020***	-0.0452	-0.4803***	-0.1196*
	(-0.1852)	(-0.2367)	(-4.6212)	(-0.5751)	(-4.5938)	(-1.7121)
Guaranteed	-0.8046***	-0.8586***				-0.7451***
	(-6.3568)	(-9.9069)				(-3.9433)
Constant	0.7151**	0.8058***	0.1412	-0.0752	-0.0045	0.6990**
	(2.5708)	(2.8988)	(0.6075)	(-0.2819)	(-0.0323)	(2.2887)
Observations	2,796	810	486	209	1,264	2,074
R-squared	0.6607	0.7638	0.8821	0.8928	0.6838	0.7072

Robust t-statistics in parentheses.
*** p<0.01, ** p<0.05, * p<0.1
Year and corporation dummies included.
[a] Dummy variables denoting the type of loan are omitted because of multicollinearity with *Guaranteed*.
The number of observations in regression (1) does not equal the sum of regressions (2)-(5), because *Rating BNG* is not available for all unguaranteed loans.

The results in Table 4.8 indicate the effect of using lagged corporation variables instead of standard variables (section 4.4.6). For guaranteed loans (regressions 2-4), results are similar to Table 4.2. However, regression (5) shows that for unguaranteed loans, most housing corporation characteristics lose significance. It appears likely therefore that BNG Bank is aware of a corporation's circumstances before its financial data become publicly available in its annual report.

Table 4.8. Regression results of interest spreads (lagged corporation variables).

	(1)[a] All loans	(2) Bullet loans	(3) Annuity loans	(4) Linear loans	(5) Short-term loans	(6) Bullet & Short-term loans
Corporation characteristics						
Company value	0.0038*	0.0028	0.0009	-0.0039	-0.0116	0.0028
	(1.7851)	(1.4343)	(0.5309)	(-0.2154)	(-0.7294)	(0.8971)
Long-term debt	-0.0018	-0.0017	-0.0055	0.0030	-0.0113*	-0.0039**
	(-1.0619)	(-1.2921)	(-1.4264)	(0.3694)	(-1.7193)	(-2.0691)
Equity	-0.0059	0.0004	-0.0109	-0.0006	-0.0184	-0.0080
	(-1.1375)	(0.1602)	(-1.6455)	(-0.0426)	(-0.8010)	(-1.1478)
Expected equity *t+5*	-0.0035	-0.0010	0.0014	-0.0035	0.0047	0.0013
	(-0.9319)	(-0.4688)	(0.3743)	(-0.3211)	(0.2922)	(0.2265)
Net cash flow	0.0053	0.0147***	0.0010	-0.0479	-0.2622*	0.0091
	(0.5882)	(3.5146)	(0.0612)	(-0.9527)	(-1.7185)	(0.9713)
Dwellings	0.0004	-0.0008	0.0001	-0.1985	0.0314	-0.0008
	(0.1645)	(-0.4981)	(0.1153)	(-0.8637)	(1.5664)	(-0.2393)
Loan characteristics						
Rating BNG					0.2864***	-0.0465*
					(3.0803)	(-1.9146)
Loan sum	0.0050	0.0038**	-0.0018	0.0028	0.0064	0.0029
	(1.4383)	(2.3435)	(-0.9136)	(0.2812)	(1.1282)	(0.7822)
Square root of loan sum	-0.0530**	-0.0423**	0.0029	-0.0147	-0.0560	-0.0302
	(-2.0096)	(-2.5745)	(0.1319)	(-0.4297)	(-1.2702)	(-1.0435)
Delay	0.0001	0.0001	0.0008**	0.0001	0.0144**	0.0004*
	(0.3524)	(0.3669)	(2.1549)	(0.4578)	(2.1248)	(1.6889)
Square root of delay	0.0188***	0.0196***	-0.0018	0.0136*	-0.0602**	0.0108
	(2.8261)	(3.8156)	(-0.2038)	(1.7303)	(-2.2100)	(1.5371)
Maturity	0.0061	0.0116	0.0241***	0.0017	0.6684	0.0163
	(0.7953)	(1.4019)	(3.0102)	(0.0861)	(1.0942)	(1.3612)
Square root of maturity	-0.0489	-0.0965	-0.2325***	-0.0591	-0.4993***	-0.1392
	(-0.7424)	(-1.4419)	(-3.0929)	(-0.4313)	(-3.2604)	(-1.2876)
Guaranteed	-0.7663***	-0.7850***				-0.9246***
	(-4.2986)	(-7.4926)				(-2.8914)
Constant	1.6593***	0.9500***	0.4680**	14.3487	0.0830	2.7642***
	(3.2571)	(4.3432)	(2.3993)	(0.8753)	(0.1557)	(6.4668)
Observations	2,640	759	370	197	1,287	2,046
R-squared	0.6789	0.8378	0.8776	0.8597	0.6338	0.7179

Robust t-statistics (based upon clustered standard errors) in parentheses.
*** p<0.01, ** p<0.05, * p<0.1
Year and corporation dummies included.
[a] Dummy variables denoting the type of loan are omitted because of multicollinearity with *Guaranteed*.
The number of observations in regression (1) does not equal the sum of regressions (2)-(5), because *Rating BNG* is not available for all unguaranteed loans.

According to Zipfel and Zimmer (2013), there is reason to believe that the impact of debt levels on interest spreads reflects a structural break between the period before the global economic crisis began in 2008 and the period afterwards. They argue that since the economic crisis, suppliers of capital may well be more aware of the riskiness of, for example, subnational governments. Zipfel and Zimmer (2013) find that for German Länder, in the period prior to the collapse of Lehman on September 15, 2008, the relative economic output and the debt/GDP ratio had no significant impact on the interest spread, whereas in later years, they

did find a significant impact. Note that nearly all the short-term loans we study were made after September 15, 2008 whereas our dataset contains guaranteed loans for the pre-crisis period as well. It may be the case that since the crisis, corporation characteristics are also relevant for guaranteed loans.

Table 4.9a repeats the regressions while including interaction terms between the corporation characteristics and a crisis dummy variable.[35] This dummy variable equals one for all loans made from September 16, 2008 onwards and zero otherwise. The question whether corporation characteristics are significant after the crisis cannot be answered by examining only the coefficients on the interaction terms. Indeed, the marginal effect of for example company value on the interest spread if the crisis dummy equals one, is the sum of the direct effect (0.0006) and the interaction effect (-0.0057), which is -0.0051. In a similar fashion, the corresponding standard error has to be calculated accordingly (for an excellent discussion on interaction terms, see Brambor et al., 2006). Table 4.9b therefore presents the coefficients and corresponding t-values of the corporation characteristics, under the condition that the crisis dummy equals one. Clearly, no significant results appear so that we find no evidence of extra monitoring activities since the crisis.

In addition to this sensitivity analysis, we also test the robustness of the results on hypotheses 3 and 4. Concerning hypothesis 3, equation (4.7) is re-estimated, with inter- and extrapolation included. The average inefficiency of corporation loans now becomes 0.1444 (instead of 0.1044 found earlier). This again indicates that the inclusion of inter- and extrapolation may overestimate results.

Finally, we test the robustness of the results on hypothesis 4 by re-estimating equation (4.8) and including all inter- and extrapolated reference rates. Table 4.10 does exactly this (compare with Table 4.4) and shows that the corporation dummy remains insignificant so our finding that non-recoverable costs are not relevant is confirmed.

[35] Note that Table 4.9a does not show interaction terms for short-term loans, since the dataset comprises only one short-term loan from before September 16, 2008.

Table 4.9a. Regression results of interest spreads (including interaction with crisis dummy).

	(1) All loans	(2) Fixe loans	(3) Annuity loans	(4) Linear loans	(5) Short-term loans
Corporation characteristics					
Company value	0.0006	0.0042**	-0.0004	0.0011	-0.0435***
	(0.3599)	(2.1790)	(-0.2657)	(0.4552)	(-5.0081)
Long-term debt	-0.0003	-0.0053***	-0.0013	-0.0038	0.0164***
	(-0.2193)	(-2.7165)	(-0.4022)	(-1.4821)	(3.0109)
Equity	-0.0055	-0.0028	0.0048	0.0091	0.0479***
	(-1.1478)	(-0.4431)	(1.5681)	(0.5051)	(6.3575)
Expected equity *t+5*	0.0027	0.0021	0.0012	0.0124*	-0.0364***
	(1.2533)	(0.5669)	(0.7352)	(1.9457)	(-2.9191)
Net cash flow	-0.0085	0.0067	-0.0010	-0.0066	0.0542
	(-0.9985)	(1.1744)	(-0.1015)	(-0.2930)	(0.5186)
Dwellings	0.0022	-0.0022	-0.0003	-0.0138	0.0276***
	(0.9463)	(-0.6972)	(-0.2496)	(-0.4608)	(4.3210)
Company value*Crisis dummy	-0.0057*	-0.0060*	0.0122	-0.0169	
	(-1.7902)	(-1.7382)	(0.2632)	(-1.4867)	
Long-term debt*Crisis dummy	0.0039	0.0057*	0.0055	0.0109	
	(1.6214)	(1.7674)	(0.2265)	(1.3027)	
Equity*Crisis dummy	0.0137**	0.0079	-0.0222	-0.0142	
	(2.1891)	(1.2035)	(-0.9777)	(-0.8065)	
Expected equity *t+5**Crisis dummy	-0.0087*	-0.0008	-0.0263	-0.0157	
	(-1.6757)	(-0.2083)	(-0.3187)	(-1.6566)	
Net cash flow*Crisis dummy	0.0078	-0.0372	-0.1726	-0.0026	
	(0.1765)	(-0.9464)	(-0.5851)	(-0.0579)	
Dwellings*Crisis dummy	-0.0050**	0.0014	0.0032	-0.0066**	
	(-2.0330)	(0.6547)	(0.5480)	(-2.2581)	
Loan characteristics					
Rating BNG					0.1711**
					(2.3229)
Loan sum	0.0054	0.0102**	-0.0031	0.0018	0.0074
	(1.6438)	(2.1974)	(-0.6790)	(0.1970)	(1.5362)
Square root of loan sum	-0.0577**	-0.0798***	0.0096	-0.0194	-0.0623
	(-2.4113)	(-2.8629)	(0.4054)	(-0.5835)	(-1.5896)
Delay	0.0001	0.0001	0.0006**	0.0001	0.0092
	(0.5479)	(0.3886)	(2.4274)	(0.5935)	(0.8726)
Square root of delay	0.0166***	0.0181***	0.0038	0.0178***	-0.0587*
	(2.7099)	(2.9632)	(0.6561)	(3.5794)	(-2.0238)
Maturity	0.0023	-0.0023	0.0220***	0.0062	0.6461
	(0.3031)	(-0.1766)	(3.8849)	(0.4183)	(0.9717)
Square root of maturity	-0.0131	0.0044	-0.2029***	-0.0777	-0.4803***
	(-0.2061)	(0.0464)	(-3.7031)	(-0.7695)	(-4.2627)
Guaranteed	-0.8819***	-0.8386***			
	(-4.6376)	(-11.8346)			
Constant	1.4178***	0.7483	0.5668	1.8922	-0.0045
	(2.9880)	(1.4073)	(1.1577)	(0.9175)	(-0.0162)
Observations	2,796	810	486	209	1,264
R-squared	0.6695	0.7705	0.8872	0.9123	0.6838

Robust t-statistics (based upon clustered standard errors) in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Year and corporation dummies included.

[a] Dummy variables denoting the type of loan are omitted because of multicollinearity with *Guaranteed*.

The number of observations in Regression (1) does not equal the sum of Regressions (2)-(5), because *Rating BNG* is not available for all unguaranteed loans and because annuity loans are omitted.

Table 4.9b. Significance of interaction terms from Table 4.9a.

	(1) All loans	(2) Fixe loans	(3) Annuity loans	(4) Linear loans	(5) Short-term loans
Company value	-0.0051	-0.0018	0.0118	-0.0158	-0.0435***
	(-1.5030)	(-0.5523)	(0.2557)	(-1.2995)	(-5.0081)
Long-term debt	0.0036	0.0004	0.0042	0.0071	0.0164***
	(1.4847)	(0.1601)	(0.1726)	(0.9021)	(3.0109)
Equity	0.0082	0.0051	-0.0174	-0.0051	0.0479***
	(1.5097)	(1.7114)	(-0.7374)	(-0.7377)	(6.3575)
Expected equity *t+5*	-0.0060	0.0013	-0.0251	-0.0033	-0.0364***
	(-1.4533)	(0.6880)	(-0.3034)	(-0.4963)	(-2.9191)
Net cash flow	-0.0007	-0.0305	-0.1736	-0.0092	0.0542
	(-0.0167)	(-0.7747)	(-0.5817)	(-0.2014)	(0.5186)
Dwellings	-0.0028	-0.0008	0.0029	-0.0204	0.0276***
	(-1.5388)	(-0.4423)	(0.4808)	(-0.6604)	(4.3210)

Robust t-statistics (based upon clustered standard errors) in parentheses.
*** p<0.01, ** p<0.05, * p<0.1
This table denotes the coefficients and associated t-statistics of the corporation characteristics under the condition that the crisis dummy equals 1.
The results in this table are based upon the regressions in Table 4.9a.

Table 4.10. Regression results of interest spreads: comparison of corporations and municipalities (interpolation and extrapolation included).

	(1) All guaranteed loans	(2) Bullet loans	(3) Annuity loans	(4) Linear loans
Loan sum	0.0011	-0.0027*	-0.0014	0.0050***
	(1.2697)	(-1.8988)	(-0.6880)	(3.7723)
Square root of loan sum	-0.0217***	0.0017	-0.0005	-0.0445***
	(-3.8236)	(0.1763)	(-0.0355)	(-6.0919)
Delay	0.0002***	-0.0001	0.0004***	0.0005***
	(5.2873)	(-0.9852)	(3.5161)	(11.0144)
Square root of delay	0.0090***	0.0139***	0.0072**	0.0058***
	(7.2822)	(6.8339)	(2.0146)	(5.0096)
Maturity	-0.0068***	-0.0173***	0.0203***	0.0155***
	(-3.4728)	(-6.2658)	(4.3102)	(5.6368)
Square root of maturity	0.0677***	0.1663***	-0.1642***	-0.1341***
	(4.3623)	(7.8221)	(-3.4258)	(-5.8659)
Linear loan	-0.0759***			
	(-8.2588)			
Bullet loan	0.0092			
	(0.9489)			
Corporation dummy	-0.0054	-0.0115	-0.0122	-0.0082
	(-0.6769)	(-0.9264)	(-0.5440)	(-0.6698)
Constant	-0.0166	-0.2775***	0.3017**	0.1959***
	(-0.4958)	(-5.1031)	(2.2960)	(3.6656)
Observations	11,062	4,746	1,992	4,324
R-squared	0.2968	0.2654	0.2214	0.6467

Robust t-statistics in parentheses.
*** p<0.01, ** p<0.05, * p<0.1
Year dummies included.

In short therefore, the robustness checks do not lead to very different conclusions. First of all, the bailout clause still reduces interest rates, although the effect is somewhat higher when including inter- and extrapolated loans. Secondly, the finding that the relation between corporation characteristics and the interest spread is only relevant for unguaranteed loans appears to be robust. Thirdly, we find that the interest spreads are significantly higher than 0 for guaranteed loans. Including inter- and extrapolation increases the commercial margin slightly however. Finally, we find no significant difference between spreads of corporation loans and municipality loans, suggesting that extra costs in case of default are not relevant to the creditor.

4.7 Conclusion

The Dutch (semi-)public sector is characterized by its unique bailout clauses. Though short-term loans to housing corporations are not guaranteed, most of the long-term capital that these corporations borrow in order to perform their public tasks is explicitly guaranteed. The guarantee scheme for corporations consists of three levels: the first two relying on mutual solidarity, and the third on governmental support. In spite of theoretical expectations, only rarely has the guarantee scheme been put to use. Just recently, incidents involving the housing corporation sector have brought back the plea to rein in this scheme of mutual solidarity.

In this chapter we have compared interest spreads (i.e., the difference between the actual interest rate and a risk-free reference rate) of guaranteed and unguaranteed housing corporation loans provided by BNG Bank, the market leader in this sector. While controlling for other relevant factors we have found evidence that the guarantee scheme has an effect on interest rates, as unguaranteed loans have higher interest spreads than guaranteed loans. The interest spread for guaranteed loans is about 75 to 110 basis points lower than for unguaranteed loans. This yields yearly benefits to the social housing sector of around 650 million to 1 billion euros in reduced interest payments. Comparing this with the reorganization subsidies provided by the CFV to rescue housing corporations (1.5 billion euros in 22 years), it appears likely that the bailout clause has had a positive net benefit. This means that the bailout clause would only be undesirable if it led to very high indirect costs such as, for example, loss of efficiency.

The relevance of the bailout clause is again confirmed by our findings, showing that a housing corporation’s financial position (or riskiness) influences the interest spreads for unguaranteed

loans only. For guaranteed loans, interest spreads are insensitive to changes in the financial position of the corporation. This indicates that, in our research period, BNG Bank did not monitor corporations when providing guaranteed loans, but relied on the credibility of the bailout clause and the assessment of the supervisory authorities. For unguaranteed loans, however, BNG Bank did monitor the riskiness of the borrowing corporation as well as that of the project being financed.

Still, however, interest rates on guaranteed loans exceed the risk-free reference interest rates by about seven basis points on average. A Stochastic Frontier Analysis reveals that this difference is significant. In principle, this may have two causes: (1) BNG Bank doesn't view guaranteed corporation loans as completely risk-free because of potential non-recoverable costs when default occurs or (2) corporations pay a positive commercial margin on their loans. The first possibility is unlikely: if guaranteed corporation loans would entail risk, we would expect the financial position of the corporation to be a relevant determinant of the interest spread for these loans as well. We show that this is not the case.

Also, if non-recoverable costs were relevant, we would expect corporations to pay higher interest rates than municipalities as these costs would probably be higher for corporations than for municipalities. This is because if a housing corporation defaults, BNG Bank would be involved in the bailout process, whereas for municipalities, the bailout works automatically. However, as we can find no significant difference between the two, this implies that both bailout clauses are equally credible. That is to say, the guarantee scheme for housing corporations (securing individual loans) seems to succeed in matching the situation of municipalities (whose entire financial position is secured).

This leaves the second possibility (i.e., a positive commercial margin) to be most probable. A commercial margin could be due to bargaining skills. In this case, corporations might be able to reduce interest rates by bargaining more sharply or searching for cheaper alternatives. However, it could also be that cheaper alternatives are not available if BNG Bank has a competitive advantage compared to other banks. Although a competitive advantage does not appear to be very likely (because NWB Bank has the same credit ratings as BNG Bank), this possibility cannot be ruled out completely. More research needs to be done to solve this issue.

In short, the bailout clause of housing corporations succeeds in keeping interest rates low, but there might still be some room for lowering interest rates even further.

Chapter 5

Rent Setting Behaviour of Housing Corporations

5.1 Introduction

Previous chapters have emphasized that Dutch housing corporations have a high degree of autonomy. As noted, there are hardly any specific targets that have to be fulfilled. Legislation only provides general guidelines which can often be interpreted as one sees fit. The main exception to this, however, is the legislation concerning social rents.

As chapter 1 indicated, many governments argue that without intervention, the price of housing for low-income households would become unacceptably high. Several reasons may cause this market shortcoming. For example, imperfect competition may lead suppliers to exploit market power. Also, suppliers may pursue cherry-picking which means that the choice of the tenant is not only based on their bidding, but on the 'riskiness' of the tenant as well (Priemus, 2003). Finally, the process of matching tenants with houses involves search costs meaning there is no single equilibrium rent (Ménard, 2009). Moreover, it is often noted that the costs of moving house are higher for the tenant than for the corporation. These imperfections may lead to prices exceeding marginal costs, imposing problems of affordability.

Accordingly, multiple government intervention plans have been implemented, making the market situation even more complicated (Buiter et al., 2006) and not necessarily leading to a reduction in rents (Ménard, 2009). This chapter investigates how rents are determined in the Dutch social housing market.

Because the institutional and sociological setting differ from country to country, one has to take this into account when studying a country's housing market (Gilderbloom and Appelbaum, 1987). In the Netherlands, social rents are set by housing corporations, but heavily regulated by the central government in order to ensure affordability.[1] In fact, all social dwellings have been assigned maximum rent levels, based on their physical quality. Furthermore, the yearly rent increase that a corporation imposes is also capped. If a corporation wants to generate more revenues per dwelling, the only option is to increase the physical quality of the housing stock.

Within these legal boundaries, corporations may decide on different rent levels for several reasons. Some corporations may focus on keeping rents as low as possible while others may

[1] Besides these regulations, the government also intervenes by providing rent subsidies to low-income households (see also section 1.1.2). Therefore, there may be a gap between the gross rent set by the corporation and the net rent paid by households. Since this chapter takes the viewpoint of corporations, so whenever the word rent is used, this refers to gross rent.

demand a higher rent in order to generate revenues to invest in e.g., new dwellings or livability projects.

Note however that, as corporations have to be self-sufficient, rent levels in effect also have a lower bound, namely the level just high enough to cover minimum costs. This minimum rent level may differ between corporations and over time because of exogenous circumstances. Indeed, we saw in chapter 2 (section 2.6.3) that some corporations have to incur higher costs because of their circumstances.

Furthermore, corporations may face different market conditions. Because the housing market is a geographical market (Meen, 2001; Mueller and Loomis, 2008), corporations have to take into account regional circumstances that influence the demand for and supply of (social) housing. More specifically, we may expect a close interaction between neighbouring corporations. If one housing corporation lowers its rent, others may have to follow, to prevent tenants from moving out and profiting from the cheaper alternative. Also, tenants' organizations or supervisory boards may use the rent of neighbouring corporations as a benchmark to compare the own corporation with. This comparison may be used to press for lower rents. Spatial interaction among housing corporations may therefore occur for reasons that are very similar to the case of local governments, i.e., 'tax competition' (Wilson, 1986) and 'political yardstick competition' (Allers and Elhorst, 2005).

This chapter studies to what extent rents differ between corporations and attempts to investigate the driving forces behind rent increases, thereby focusing on two main issues. First of all, we investigate whether an increase in physical quality is accompanied by an equivalent increase in rents. Secondly, we try to find out whether corporations mimic their neighbours in their rent setting behaviour.

The rest of the chapter is set up as follows. Section 5.2 briefly describes the legislation on social rents in the Netherlands. A report of Woonbond (2010) on rent setting behaviour of corporations is discussed in section 5.3. Section 5.4 develops the hypotheses of this chapter. The data and the research setup are presented in section 5.5. Section 5.6 gives the main results of the empirical analysis whereas section 5.7 provides a sensitivity analysis. Section 5.8 concludes.

5.2 Rent regulation

As noted, there are only a few hard requirements that corporations have to fulfil so that they have considerable leeway in their operations (see chapter 2). However, central government involves actively with the rent levels in the social housing market. Indeed, each social dwelling has been assigned a maximum rent, based on its (physical) characteristics.[2] A social dwelling is a dwelling with a rent that is not higher than the maximum rent at which households may receive rent subsidy (i.e., the liberalization boundary or *liberalisatiegrens*). In 2015, this maximum rate was €710.68 per month.[3] Above this rent level, rents are not restricted to a maximum.

To determine the maximum rent level, corporation dwellings have been assigned 'quality points' on the basis of the so-called Housing valuation scheme (*Woningwaarderingsstelsel*, WWS; see also section 2.6.2). The central government determines the exact design of the WWS. The number of quality points depends largely on physical characteristics such as the size of the dwelling, sanitary facilities, kitchen equipment, etc.[4] The location is – to some extent – relevant as well (dwellings in cities receive more points than dwellings in rural areas).[5] Also, if a dwelling is built after 1976 it receives extra points (the younger the dwelling, the higher the number of extra points).

For single family units, the maximum rent level of a dwelling is related approximately linearly to the number of WWS-points.[6] In 2014, the maximum rental price per quality point varies from €4.82 per month (a dwelling with 40 points has a maximum rent of €192.76) and

[2] Note that the maximum feasible rent may – at least in theory – actually lie below the legal maximum if increasing the rent beyond a certain threshold leads the dwelling to remain vacant. In this case, a higher rent implies lower revenues. It is not likely however that this is a common case for corporations as most of them face substantial waiting lists of households trying to obtain a social dwelling (PBL, 2014). Furthermore, it is often noted that there is a wide gap between private rent and social rent, meaning that there is enough scope to increase social rents.

[3] See also: http://www.rijksoverheid.nl/onderwerpen/huurwoning/sociale-huurwoning-huren.

[4] More detailed information is available at http://www.rijksoverheid.nl/onderwerpen/huurwoning/puntensysteem-huurwoning/puntensysteem-zelfstandige-woning.

[5] Since October 1, 2015, the valuation scheme has been revised so that besides physical characteristics, the estimated value of the dwelling now also partly determines the maximum rent. The idea is that with this modification, differences in market circumstances are taken into account more precisely. For more information, see: http://www.rijksoverheid.nl/nieuws/2014/10/17/nieuwe-opzet-woningwaarderingsstelsel.html.

[6] Single family units have their own entrance, kitchen and toilet. If (one of) these facilities is/are shared by multiple households, the dwelling is not a single family unit (for example a flat).
See also: http://www.rijksoverheid.nl/onderwerpen/huurwoning/vraag-en-antwoord/wat-is-een-zelfstandige-woning-en-wat-is-een-onzelfstandige-woning.html.

€5.14 per month (a dwelling with 250 points has a maximum rent of €1,284.58). Thus, to be precise, the maximum price per quality point gradually increases.[7]

In practice, corporations demand rents far below the maximum level. In 2012, corporations demanded a rent level of 67 percent of the maximum rent. The corporation with the highest relative rents had a rent of 89 percent of the maximum. Although we do not have information on the level of individual dwellings, it appears that the maximum rent levels do not serve as real constraints for most corporations.

Besides the maximum *level* of rent, the rent *increase* is also legally constrained to a maximum. Central government distinguishes between two kinds of rent increases. First of all, every 12 months (on July the 1st), corporations may increase the rent of all dwellings by a certain maximum percentage.[8] This percentage is the same for all corporations. For the remainder of this chapter, we call this the maximum 'regular rent increase'. In most years, the maximum regular rent increase was a fixed percentage, but in a few years it depended on housing characteristics or incomes of tenants.[9]

Secondly, if a household leaves a dwelling, corporations are free to increase the rent by whatever percentage they prefer (provided that the rent does not exceed the maximum level). This is called 'rent harmonization'.

The only way to increase rents further is by improving the physical quality of the dwelling. In this way, the number of quality points increases and the corporation is allowed to implement an extra rent increase. Therefore, quality improvement may be a path to generate extra revenues. However, quality improvements can only be made with approval of the tenant. Also, guidelines of the central government emphasize that the rent increase has to be in line with the costs that the corporation makes to improve quality (Ministry of National and

[7] For apartments, the relationship between points and maximum rent is somewhat more complex. This chapter focuses on single family units.

[8] Note that before 2016, corporations could not differentiate between dwellings. That is, if a corporation decided to increase rents by *x%*, all dwellings (except those where a new tenant moved in) would have this rent increase. Since 2016, the legislation concerning rent increases is reformed. Now, the increase of the *total rent revenues* of a corporation is limited to a certain maximum percentage. This means that corporations may now differentiate between dwellings. Since this chapter focuses on earlier years, we will not take this into account however.

[9] To be more precise, in the period 2002-2004, the maximum regular rent increase depended on the difference between the maximum rent level and the actual rent level. In 2013 and 2014, the maximum regular rent increase is higher for households whose income is relatively high.
Source: Dutch central government (http://www.rijksoverheid.nl/onderwerpen/huurwoning/documenten-en-publicaties/Brochures/2014/07/08/ overzicht-huurverhogingspercentages-1980-2014.html).

Kingdom Affairs, 2011).[10] If corporations stick to these guidelines, they should not profit from quality increases.

5.3 Research of Woonbond

Woonbond (2010) conducted an extensive survey among all (401) corporations in 2010 with the aim to map the average rents of the corporations and to investigate the reasons for potential rent increases. *Woonbond* is the national representative organization looking after the interests of tenants and persons searching for a dwelling.

68 percent of the corporations participated in the survey. Woonbond (2010) concluded that substantial regional differences in rents were present. Also, it appeared that both corporations focusing on the elderly and those housing mostly young people demanded higher rents. Finally, (very) large corporations showed the highest rents on average.

Corporations mentioned several reasons for their regular rent increases. First of all, many corporations reported that changes in the financial position urged them to raise rents (i.e., exogenous shocks). The implementation of the 'corporate income tax' (*vennootschaps-belasting*) in 2006 and a 'specific tax' (*Vogelaarheffing*)[11] in 2008 were among the reasons most often mentioned.[12]

[10] There is one other exception. If a rent contract has been started after July 1st in a certain year, the corporation may pass through a rent increase on July 1st of the following year, even though the time between start of the contract and the rent increase is less than 12 months. Also, if the corporation implements a rent increase more than 12 months after the previous increase, (for example 15 months), it is allowed to implement the next rent increase within 12 months. For example, if the time between two dates of rent increases was 15 months, the corporation may increase rent again after 9 months.
For more information, see: http://www.rijksoverheid.nl/onderwerpen/huurwoning/vraag-en-antwoord/hoe-vaak-mag-mijn-verhuurder-de-huur-verhogen.html.

[11] This specific tax was implemented to raise funds for investments in problem districts. The minister of Housing, Districts and Integration appointed 40 Dutch districts with excessive problems in the context of livability and housing circumstances. Corporations with possession in these districts could appeal for a specific supportive grant. The grants were financed by a specific tax on all corporations that did not hold possession in these areas.

[12] In 2013, a probably even larger shock occurred with the introduction of the landlord-tax (*Verhuurderheffing*). This is a tax on the value of the dwellings of a corporation, with the aim to lower the national debt position (see also section 2.4).
(See for example: http://www.rijksoverheid.nl/onderwerpen/huurwoning/verhuurderheffing).
Many corporations have announced that they will react to this tax by increasing rents with the maximum rate.
(See for example: "Veel woningcorporaties verhogen huur maximaal" (2014) or
http://www.aedes.nl/content/artikelen/klant-en-wonen/huurbeleid/gedateerd/aedes--verhuurdersheffing-leidt-tot-huurverhoging.xml.
The year 2013 is not incorporated in this study however.

Secondly, many corporations mentioned that the rent was increased in order to bring rents in line with the quality of dwellings. Whether this argument is valid may be controversial. Indeed, one could question what the use is of bringing the rent in line with the quality by arguing that, ceteris paribus, the rent/quality ratio should always be as low as possible. This may indicate that increasing quality of dwellings is used by corporations to generate extra revenues. Others may argue that households living in a dwelling with a very low rent/quality ratio have no incentive to leave the dwelling, meaning that it will not become available for other households that may need it more. Therefore, bringing rents in line with quality could improve mobility in the housing market and have desirable distributional effects.

Other often mentioned reasons were the need to increase financial resources for future investments projects, and improving market processes (e.g., mobility).

Finally, a few corporations have reported the intention to keep rents constant or as low as possible, because they see affordability as their core task. No corporations mentioned that the rent was increased as a reaction to the rent increase of its neighbours. In short therefore, several reasons for setting the rent levels are mentioned, but according to anecdotal evidence, changes in cost levels and taxes are the main drivers.

Of course, reasons mentioned in surveys do not necessarily reflect the true reasons of rent increases. Therefore, below we will develop an empirical test to investigate the main determinants of rent increases.

5.4 Theory and hypotheses

This chapter focuses on two potentially important reasons for a rent increase. Firstly, rents may be increased after the quality of dwellings increases. Secondly, corporations may mimic the rent-setting behaviour of their neighbours meaning that spatial interaction may be present.

5.4.1 Rent and quality

According to Koolma (2008), corporations let their dwellings at rents below market prices as the net present value of rent revenues is lower than the potential revenues from selling the dwellings. Koolma (2008) notes that social rents are more closely related to the WWS-scheme which merely reflects physical quality, not market prices, as location is insufficiently accounted for.

This notion is confirmed by Drentje (2011). Based on a survey of nine housing corporations, Drentje (2011) concludes that for new allotments, corporations use the WWS-scheme as guideline in determining rent levels. This holds especially for dwellings below the 'liberalization threshold'. For dwellings above this threshold, corporations use rents that are more market-oriented, according to Drentje (2011).

As noted, the maximum rent is related approximately linearly to the physical quality of a dwelling (i.e., if WWS-points double, the maximum rent approximately doubles). If corporations would follow this scheme blindly, we would expect a linear relationship between *actual* rents and quality as well. However, there are two main reasons why this is not necessarily the case.

First, suppose that an increase in WWS-points with *x%* can be accomplished with a cost increase of less than *x%*. As noted, in such a case, corporations are expected to implement a rent increase that is in line with the extra costs (Ministry of National and Kingdom Affairs, 2011). That is, corporations should not profit from quality increases. Note however, that if a corporation improves the quality of its housing stock by buying or building new (high-quality) dwellings, it is free to generate extra revenues from it by demanding the maximum allowed rent.

Secondly, if the number of WWS-points does not adequately reflect the attractiveness of a dwelling, increasing rents may be unfeasible. Indeed, the 'demand for housing quality' does not have to be linear with respect to quality (i.e., a tenant may be willing to pay *x* euros for a house with 70 WWS-points but not necessarily *2x* euros for a house with 140 WWS-points). This may imply than an increase in quality cannot be followed by an equivalent increase in rents because the tenants are not willing to pay the higher rent. However, it is not likely that this is a real bottleneck for corporations, since most corporations seem to demand rents below market-value (Koolma, 2008). Also, most corporations face substantial waiting lists of households trying to obtain a social dwelling (PBL, 2014). Furthermore, it is often noted that there is a wide gap between private rent and social rent, meaning that there is enough scope to increase social rents (see also footnote 2). This leads us to conclude that the first reason probably is more relevant.

The aforementioned considerations lead us to expect that increases in quality do not necessarily have to be followed by equivalent increases in rents. This notion is summarized in hypothesis 1a.

Hypothesis 1a:
An increase in housing quality leads to a less than equivalent increase in rents.

The question whether or not corporations profit from quality increases cannot be given a definite answer as this would require knowledge about the precise costs of quality increases. In general, if an increase in quality would lead to an improvement of the financial position, this would provide a hint in this direction. However, if corporations would stick to the guidelines, this should not be the case. This idea is formulated in hypothesis 1b:

Hypothesis 1b:
An increase in housing quality does not lead to an improvement of the financial position of a corporation.

5.4.2 Rent mimicking

As noted, corporations have to take into account demand and supply characteristics of the market in which they operate. Indeed, housing markets have a strong regional component (Meen, 2001; Mueller and Loomis, 2008). That is, in general, housing prices (or rents) are likely to be influenced by the price (or rent) of nearby houses. When corporations decide upon their (regular) rent increases it is most likely that they will take into account the behaviour of other (nearby) corporations. Indeed, corporations operate in the lower segment of the housing market, where other (private) suppliers seldom operate. There is little mobility between the bottom segment and the middle segment of the housing market (CBS, 2012). Thus, we expect a relationship between a corporation's rent and the rent of nearby corporations (i.e., neighbours).[13] Hypothesis 2a therefore reads:

Hypothesis 2a:
Corporations engage in rent mimicking.

Note that in order to engage in rent mimicking, corporations must be aware of each other's plans. This seems plausible. Directors and managers of corporations frequently have contact with each other, both in a formal and an informal setting. Corporations may also rely on

[13] Note that it is not clear a priori which corporations should be labeled as neighbours. Section 5.5.4 and Appendix 5.A delve deeper into this issue.

annual reports to obtain information about each other's (intended) rent increases. Different tenants' organizations also frequently meet. If one tenants' organization succeeds in its attempt to restrict the rent increase of its corporation, this information will probably be exchanged with other tenants' organizations. Also, the *Woonbond* organizes regional meetings where expected rent increases are discussed. Therefore, there is sufficient reason to believe that corporations and/or tenants' organizations have the necessary information to engage in rent mimicking.

Mimicking may occur for two main reasons, which we will describe as 'competition for tenants' and 'political yardstick competition'. These reasons are closely related to the concepts used in local government studies.

First of all, if a corporation raises rents, tenants may 'move away', i.e., terminate the contract and search for another corporation to rent from. It is likely that the alternative corporation is a 'neighbour' because tenants probably search for houses in the same region. Therefore, the rent increase of a corporation cannot differ too much from the rent of its neighbours. If the difference becomes too large, dwellings may remain vacant. Note that this theoretical notion shows a close connection to the concept of 'tax competition' (Wilson, 1986) which states that if local jurisdictions raise their (property) taxes, inhabitants may move towards nearby jurisdictions. A tax raise then induces a reduction in the tax base.[14] If the tax is raised too much, too many people will move out and tax revenues may even decrease.

Whereas municipalities may compete for a tax base, corporations may compete for tenants. Therefore, for the remainder of this chapter, we denote this mechanism as 'competition for tenants'. If competition for tenants is indeed the driving force behind rent mimicking, we expect a stronger effect for corporations with low market power (or market share) compared with corporations with high market power, because for the first group, the risk of losing tenants is relatively high. Hypothesis 2b tests this proposition.

> *Hypothesis 2b:*
> *Rent mimicking is stronger for corporations with low market power than for corporations with high market power.*

Note however that one may argue that for corporations, competition for tenants may be relatively weak. First, as noted in section 2.2.2, corporations are not allowed to appropriate

[14] Either because housing prices decline due to reduced demand or because houses remain vacant.

profits, so if a neighbour increases rents, a corporation will probably not follow this increase out of profit-maximizing considerations. Secondly, many corporations will not fear the risk of losing tenants if a neighbour becomes cheaper because most corporations face substantial waiting lists of households trying to obtain a social dwelling (PBL, 2014). That is, these corporations do not have to worry that their dwellings might remain vacant.

A second potential reason for rent mimicking is political yardstick competition. The idea behind this is that if the board of directors of a corporation proposes a certain (regular) rent increase exceeding the rent increase of its neighbours, it may receive resistance from tenants' organizations or the supervisory board who will probably compare the rent increase of the own corporation with that of the neighbours as a measure of performance (i.e., in this case, if the rent increase of a corporation exceeds the rent increase of its neighbours, the board of directors will have to provide a solid explanation).

In short, a rent increase can be justified more easily if neighbouring corporations do the same. The concept of political yardstick competition originates from political economy literature applied to subnational governments (Salmon, 1987; Allers and Elhorst, 2005; Allers, 2012). According to this theory, citizens do not observe the true performance of local governments, so they rely on the local tax rate to judge local governments. If the tax rate becomes too high, compared with the tax rates in nearby jurisdictions, local politicians may be sent away because citizens believe they perform worse than their neighbours. In a similar way, for corporations, the rent level may be used as a yardstick.

In the case of corporations however, there may be reason to suspect that political yardstick competition is not very strong. Indeed, according to Dutch Parliament (2014), in many cases the corporation's board of directors had obtained a highly dominant position so that the influence of the supervisory board was limited.

If political yardstick competition is nevertheless the driving force behind mimicking behaviour, we would expect a stronger effect for corporations with a low number of neighbours compared with those with many neighbours. The idea here is that if a corporation has only few neighbours, it is easier for tenants' organizations and supervisory boards to find a proper yardstick to compare the own corporation with. For example, if there is only one neighbour, it is sufficient for the supervisory board to contact this corporation to find out its intended rent increase. Therefore, corporations with only few neighbours may experience a stronger interaction effect. This idea is captured by hypothesis 2c.

Hypothesis 2c:

Rent mimicking is stronger for corporations with only a few neighbours than for corporations with many neighbours.

Note however that one may argue the other way around by saying that if there is a single neighbour trying to hide its plans, mimicking may be more (instead of less) difficult. In this case, a yardstick can be found faster if there are many neighbours, since it is easy to get into touch with at least some of them.[15] Therefore, empirics have to resolve the question whether hypothesis 2c actually holds.

With a similar reasoning as for hypothesis 2c, one may expect a stronger spatial effect for corporations with a highly concentrated housing stock (i.e., operating in only one or a few regions) compared with those with a more dispersed housing stock (i.e., operating in many regions). Indeed, if a corporation operates in many regions, it may be more difficult to find a yardstick. This idea is formulated in hypotheses 2d.

Hypothesis 2d:

Rent mimicking is stronger for corporations with a highly concentrated housing stock than for corporations with a more dispersed housing stock.

5.4.3 Other considerations in rent setting behaviour

To take into account other relevant characteristics, we have reason to include several control variables.

First of all, as noted, because corporations have to be financially self-sufficient, rent levels in effect also have a lower bound, namely the rent level that generates just enough revenues to cover the minimum cost level of the corporation. The minimum feasible rent is therefore the lowest possible rate still sufficient to preserve the financial continuity of the corporation.[16] To some extent, the minimum cost level may differ between corporations because of exogenous circumstances. For example, if the property tax increases, corporations have higher costs. This means higher rent levels are required to break even.

Secondly, corporations have to deal with circumstances in the (regional) housing market. If the region where the corporation operates becomes more attractive, rents may be increased

[15] However, in this case, the question pops up which neighbours will be used as a yardstick then. This cannot be predicted beforehand.

[16] Of course, it is possible that a corporation sets rents below the minimum threshold for a limited time period and increasing rents thereafter, as long as this policy preserves financial continuity in the long run.

more easily. Also, changes in the composition of the local population may influence the willingness to pay for housing services. For example, if the share of poor households increases, corporations may have to demand lower rents in other to let their dwellings.[17] However, some authors argue that corporations do not respond (adequately) to changes in market conditions (Koolma, 2008). Therefore, it is questionable whether rent levels react to changes in market conditions.

In section 5.5.1, we describe our control variables in detail.

5.4.4 Dynamics

We already noted that corporations are constrained to a maximum rent increase each year. This means that if a corporation seeks for a higher rent increase, it will probably spread this increase over a few years. Also, the costs of corporations change only gradually throughout the years because a substantial share of costs is fixed to a large extent (e.g., capital costs). Therefore, it is likely that corporations will let revenues change gradually as well. Thus, there may be reasons to expect a dynamic effect in rent increases, i.e., last year's rent may influence this year's rent. This calls for a dynamic model.

5.5 Data and research set-up

5.5.1 Data

We make use of a panel data set comprising all corporations from 2001 to 2012.[18] This dataset is provided by the Central Public Housing Fund (*Centraal Fonds Volkshuisvesting*, CFV) and includes information on rents, the characteristics of the housing stock, financial position, etc.

The following dependent variables are used to test the hypotheses:

- **Rents**
    - *Rent/quality ratio.*

      To investigate the relationship between quality and rent, we use the average rent of the corporation divided by the average maximum rent, on July the 1st of the concerning year. This variable thus gives the average price/quality ratio of

[17] Note however, that this effect will be moderated due to the fact that poor households receive higher rent subsidies.

[18] A number of corporations merged in this period (see chapter 3). Therefore, the data have been converted to the corporation classification in 2012 in order to create a balanced panel.

all dwellings of a corporation. Per definition, the actual rent divided by the maximum rent is a number between 0 and 1. Because rent increases are denoted in percentages, we take the natural logarithm of this measure.[19]

- *Regular rent.*

  To investigate potential rent mimicking, we construct a dependent variable which, in the first year, equals total rent revenues divided by the total number of dwellings, and subsequently increases each year with the 'regular rent increase' (i.e., the rent increase for dwellings for which households don't leave) for the next forecast year.[20] Again, we take natural logarithms.

- **Financial position**

To investigate whether quality improvements affect the financial position of corporations, we use the following parameters of financial performance. See chapter 4 (section 4.4.5) for more information.

- *Profit.*

  The profit of the corporation during the year, divided by the number of dwellings. This variable is available for the period 2001-2010.

- *Net cash flow.*

  The net cash flow of the corporation during the year, divided by the number of dwellings.

- *Company value.*

  The company value is the net present value of future revenues and costs, divided by the number of dwellings. These future revenues and costs are estimated by the corporations themselves.

- *Long-term debt per dwelling.*

  The sum of all outstanding loans with a maturity of more than 2 years, divided by the number of dwellings.

- *Equity per dwelling.*

  This is a refined measure of the corporation's equity so as to take future prospects into account (CFV, 2012).

[19] Note however that the difference between the two approaches is minimal. If for example 'rent/maximum rent' increases from 0.7 to 0.75, this is an increase of 0.05 percentage point and an increase of 7 percent.

[20] To be more precise, corporations fill in their expected rent increases for five (forecast) years ahead. In principle, corporations may deviate from their forecast, even in the first year. We expect this deviation in the first year to be small however, since the moment at which corporations fill in this data, roughly coincides with the moment that the rent increase is announced to the tenants. Because of data limitations, for 2012, we use the rent increase predicted in 2010 (i.e., two years ahead). When removing 2012 from the analysis, conclusions don't change.

For all variables, except long-term debt, it holds that a higher value reflects a better financial position.

The independent variables comprise both corporation specific characteristics (measured at the corporation level) and exogenous factors (measured at the municipality or postal code level). In the latter case, variables are converted to the corporation level by taking weighted averages. Below, we list the variables that are included and an explanation of why the variable could be relevant. The following variables are included:

- **Corporation specific characteristics**
    - *Average quality of dwellings (in WWS-points).*

      Section 5.4.1 describes that the expected relation between quality and the rent/quality ratio is ambiguous.
    - *Number of dwellings.*

      If a corporation builds or buys dwellings (i.e., increases scale), there is an opportunity to increase revenues by setting the rent of these new dwellings at a high level (e.g., at the maximum feasible level). This means that a lower regular rent increase suffices to cover costs.

      Also, in the sensitivity analysis (see section 5.7), we use rent per dwelling as the dependent variable. If the number of dwellings increases, ceteris paribus, the rent per dwelling decreases. Therefore, we include the number of dwellings as a control variable. Note however that one may question whether this variable is exogenous. Indeed, if the rent increases, the extra revenues may be used to expand the housing stock. When removing this variable, or taking the first-order lag, conclusions don't change however (results not shown).
    - *Age of housing stock.*

      Corporations with an older housing stock may face higher maintenance costs leading to higher rents (see also chapter 2 (section 2.6.3) and Woonbond (2010)). On the other hand, the demand for a dwelling may also depend on its age. That is, old dwellings may be less attractive compared with new dwellings, meaning that the willingness to pay will be lower for the first group. Because the relation between age and popularity does not need to be linear we in-

clude six variables indicating the share of dwellings of a corporation within a certain age group.[21]

- **Exogenous circumstances:**
  - *Property tax rate.*

    Corporations – being the owners of dwellings – have to pay property tax to the municipalities in which they hold possession. If the tax increases, a lessor may attempt to shift the tax burden on to the tenant by raising the rent (COELO, 2015).
  - *Corporation specific tax (share of dwellings in problem districts).*

    In 2008, a sector-specific tax was introduced in the social housing sector. This tax was levied to provide financial support to corporations that held possession in 'problem districts' (see also section 5.3 and footnote 11). Only corporations with no possession in these areas were obliged to pay the tax. The sector-specific tax was lowered in 2011 and 2012 and abandoned altogether in 2013. We include a variable indicating the share of dwellings of the corporation located in 'problem districts'. A higher share means a larger financial benefit, so less need to increase rents.
  - *Attractiveness of location (location prices or land prices).*
    - Corporations operating in areas with high land prices may face higher (capital) costs when buying land or dwellings. This means that these corporations require higher revenues to cover costs and therefore may impose higher rents.
    - Besides inducing higher costs levels, a more attractive location may also indicate a higher demand for housing in a certain region. The attractiveness of the location may be used as an approximation of the general demand for housing in a certain region. Vermeulen en Rouwendal (2007) note that housing supply in the Netherlands is nearly perfectly inelastic, so that increases in demand will be translated into land prices to a large extent. If a region where a corporation operates becomes more attractive, the corporation may be able to demand higher rents from its tenants. Of course, note that since corporations do not (neces-

[21] Note that the age of the housing stock is also incorporated in the number of WWS-points, but in that case, all dwellings before 1976 are treated alike.

sarily) maximize profits, this relationship does not have to hold.[22] On the other hand, since this variable is based upon owner-occupied housing prices, it could also be the case that higher demand for private property is the result of a lower demand for rental housing (i.e., renting is substituted for buying). In this case, higher land prices lead to lower rent.

Combining this with the abovementioned effect of land prices on costs, the net effect of this variable is ambiguous.[23]

Appendix 2.A (at the end of chapter 2) shows how this variable is calculated.

- *Population density.*

  Calculated as the number of inhabitants per squared kilometre. If more persons move into the region where a certain corporation operates, rents may be increased more easily. One could doubt however whether this variable is strictly exogenous. Indeed, if a corporation raises rents, persons may move away. We presume that this impact is small however. Also, when removing this variable or taking the first-order lag, conclusions do not change (results not shown).

- *Average disposable income.*

  Average disposable income equals gross income minus income transfers, insurance premiums and income and capital taxes. If the average disposable income in a region increases, corporations may have less problems with increasing their rents.

- *Share of persons receiving welfare grants.*

  This is an approximation of the poverty rate within a region. If the share of persons receiving welfare grants increases, corporations may be hesitant to increase rents because people may not be able to afford them.[24]

- *Share of minorities.*

  Corporations may (either positively or negatively) discriminate minorities by demanding lower or higher rents.

[22] The opposite may still hold however: if a location becomes less attractive, rent may have to be lowered in order to let the dwelling.

[23] Note that the attractiveness of location is also incorporated in the number of WWS-points, but this measurement is rough (i.e., only a distinction is made between rural, medium-sized cities and large cities). Our location variable provides a measure of attractiveness for each municipality.

[24] Note however, that this effect will be moderated due to the fact that poor households receive higher rent subsidies.

- *Soil quality.*

  Chapter 2 (section 2.6.3) already indicated that a worse soil quality may lead to higher costs for corporations. Therefore, higher rents may be needed.[25]

The descriptive statistics of the variables are given in Table 5.1.

Table 5.1. Descriptive statistics.

	N[a]	Average	Standard deviation	Minimum	Maximum
Dependent variables					
Rent/Maximum rent (rent/quality ratio)	370	0.67	0.06	0.50	1.00
Regular rent increase (in percentages)	376	2.07%	0.75%	0.00%	7.77%
Rent revenues per dwelling (in 1,000 euros)	379	4.66	0.78	1.53	11.70
Profit per dwelling (in 1,000 euros)	381	1.12	1.60	-8.77	15.36
Net cash flow per dwelling (in 1,000 euros)	378	1.07	1.10	-8.43	27.45
Company value per dwelling (in 1,000 euros)	380	39.62	14.43	-4.34	156.36
Long-term debt per dwelling (in 1,000 euros)	380	27.63	15.03	0.00	179.42
Equity per dwelling (in 1,000 euros)	379	11.87	8.80	-54.14	176.53
Independent variables					
Average quality (WWS-points) (in 100 points)	367	1.34	0.14	0.59	2.11
Number of dwellings (in 1,000)	380	6.27	10.19	0	88
Dwellings before 1945	379	0.07	0.17	0.00	1.00
Dwellings 1945-1959	379	0.14	0.09	0.00	0.69
Dwellings 1960-1969	379	0.18	0.10	0.00	0.59
Dwellings 1970-1979	379	0.22	0.12	0.00	1.00
Dwellings 1980-1989	379	0.20	0.11	0.00	0.93
Dwellings 1990-1999	379	0.12	0.09	0.00	1.00
Dwellings 2000 or later	379	0.07	0.08	0.00	1.00
Property tax rate[b]	378	0.11	0.03	0.05	0.31
Share of dwellings in problem districts[b]	380	0.02	0.09	0	1
Attractiveness of location (location price)[bc]	380	0.97	0.22	0.48	1.95
Population density[b] (in 1,000 persons per km^2)	378	1.22	1.17	0.07	6.51
Average disposable income[b] (in 1,000 euros)	379	32.14	4.44	20.50	55.20
Share of persons receiving welfare grants[b]	377	0.02	0.01	0.00	0.08
Share of minorities[b]	380	0.04	0.03	0.00	0.32
Soil quality[bd]	380	1.10	0.15	1.00	1.86

[a] Maximum number of observations is 381.
[b] Variable converted from municipality (or postal code) level to corporation level by means of weighted averages.
[c] For the exact calculation of this variable, see Appendix 2.A (at the end of chapter 2).
[d] A higher number means a worse soil quality. To be specific, soil quality varies between a value of 1 (only high quality soil) and 2.10 (only peaty soil). Before 2007, peat had a value of 1.60 however.

5.5.2 Research set-up

To test hypotheses 1a and 1b, we first of all set up a standard fixed-effects model estimating the relationship between rent and its potential determinants:

$$Y_{i,t} = \alpha + \beta X_{i,t} + \theta_t + \mu_i + \varepsilon_{i,t} \quad (5.1)$$

[25] Note however that this variable is very rigid (i.e., hardly changing throughout the years). Therefore, the effect of this variable may be captured to a large extent by the corporation fixed effects. This holds for other variables, such as the share of minorities as well.

where $Y_{i,t}$ is the dependent variable as defined above (i.e., rent/quality ratio for hypothesis 1a and financial position for hypothesis 1b), $X_{i,t}$ is a vector of potential determinants as listed above, α is a constant and β is a (row) vector to be estimated, θ_t is a time specific effect, μ_i is a corporation specific (fixed) effect and $\varepsilon_{i,t}$ is a traditional white noise term. Finally, i is the corporation subscript ($i = 1,2,3, \dots, N$) and t is the time subscript ($t = 1,2,3, \dots, T$).

5.5.3 Dynamic model

As explained in section 5.4.4, it appears reasonable to use a dynamic – as opposed to a static – panel model, because it may take more than one year to push through a certain rent increase. This means that the lag of the dependent variable is included in the regression equation leading to the following dynamic model:

$$Y_{i,t} = \alpha + \gamma Y_{i,t-1} + \beta X_{i,t} + \theta_t + \mu_i + \varepsilon_{i,t} \quad (5.2)$$

Note that estimation of equation (5.2) under a standard fixed effects approach (i.e., the corporation specific effect is fixed) leads to a bias if T is finite (Nickell, 1981) which is clearly the case in our study since we have data from 2001-2012 only. Several approaches have been conducted to overcome this problem (see for a brief overview Allers and Geertsema, 2016). We adopt a Corrected Least Square Dummy Variable (CLSDV) approach (Kiviet, 1995;1999; Bruno, 2005) which corrects for the bias directly. Simulation analysis (Judson and Owen, 1999; Behr, 2003) suggests that a CLSDV-approach is superior compared to instrumental variables approaches (e.g., Arellano and Bond, 1991; Blundell and Bond, 1998).

5.5.4 Spatial interaction effects

To test hypotheses 2a-2d, we develop a model that accounts for spatial interaction. There are two main forms of spatial interaction models to consider: the spatial lag model and the spatial error model (Anselin, 1988). With a spatial lag model, we assume that there is a direct effect of the rent of one corporation on the rent of its neighbour(s). That is, we include a spatial lag of the dependent variable on the right hand side of the equation.

$$Y_{i,t} = \alpha + \rho W_i Y_t + \beta X_{i,t} + \delta W_i X_{i,t} + \theta_t + \mu_i + \varepsilon_{i,t} \quad (5.3)$$

Where $Y_{i,t}$ is now *'regular rent'*. Furthermore, W is a row-standardized $N * N$ spatial weights matrix denoting the spatial connection between corporations such that W_i is the matrix row for observation i. Because corporations are allowed to operate wherever they prefer, we

cannot give a corporation a single geographical location however. Therefore, to determine which corporations are neighbours we have constructed a spatial weights matrix based upon the relative share of the corporation's possession per postal code area (see Appendix 5.A for details).[26]

Note that in equation (5.3), we have extended the model beyond a basic spatial lag model, by including a spatial interaction term among the independent variables ($\delta W_i X_{i,t}$). Such a model is called a spatial Durbin model (SDM). LeSage and Pace (2009) suggest to test whether such a model is preferred over the spatial lag model (see also Elhorst, 2014).

Secondly, a spatial (Durbin) error model (SDEM) assumes that the error terms of the regression are correlated across space (this model is relevant if we omit relevant variables that are correlated across space). This model reads:

$$Y_{i,t} = \alpha + \beta X_{i,t} + \delta W_i X_{i,t} + \theta_t + \mu_i + u_{i,t} \tag{5.4a}$$

$$u_{i,t} = \lambda W_i u_{i,t} + \varepsilon_{i,t} \tag{5.4b}$$

5.5.5 Extensions of spatial interaction effects

We will consider two further extensions of the spatial Durbin model (equation 5.3). The first extension deals with the earlier observed notion that rent increases may have a dynamic effect as well. Also, the interaction effect may come with a time lag (i.e., if my neighbours increase their rents this year, I may follow them next year). This means we implement a time-lag of the dependent variable on the right hand side of the equation so that we end up with a dynamic spatial Durbin model (Debarsy et al., 2012; Elhorst et al., 2013).

$$Y_{i,t} = \alpha + \rho W_i Y_t + \lambda W_i Y_{t-1} + \gamma Y_{i,t-1} + \beta X_{i,t} + \delta W_i X_{i,t} + \theta_t + \mu_i + u_{i,t} \tag{5.5}$$

We make use of the Bias-Corrected LSDV (BCLSDV) estimator proposed by Yu et al. (2008). According to Elhorst (2010), this procedure roughly decimates the bias if T=5 and the bias will be even lower if T is larger, as in our case.

[26] One may argue that this matrix is not purely exogenous, since the location choice of a corporation may depend on the rent-setting behaviour of their neighbours. We presume that this effect will be very weak at the most, since it takes a considerable amount of time to change the composition of the housing stock. Note also that W is required to be constant over time, while in practice location decisions change gradually over the years. We have used the situation in 2010 to determine W.

Secondly, the spatial interaction effect does not have to be equal for all corporations. For example, as discussed in section 5.4.2, rent mimicking may occur because of two main reasons ('competition for tenants' and 'political yardstick competition').

As explained in section 5.4.2, if 'competition for tenants' is the (main) cause of spatial interaction, we expect a stronger interaction effect for corporations whose market power is relatively low. In this case, ρ would be relatively high. On the other hand, if a corporation's market power is high, we would expect a weaker (if any) interaction effect (thus ρ is relatively low). On the other hand, if spatial interaction exists because of political yardstick competition, we may expect a stronger effect for corporations with a low number of neighbours (compared with those with many neighbours) and for corporations with a highly concentrated housing stock (compared with those with a more dispersed housing stock).

If we believe that the spatial interaction effect is stronger for one subgroup of corporations compared with another, we may use the so-called two-regime spatial model (Allers and Elhorst, 2005; Elhorst and Fréret, 2009). This model allows us to split up the data into two groups (regimes), with different spatial interaction effects. For example, if we split up the data on the basis of market power, we may let corporations with high market power belong to regime 1 and corporations with low market power belong to regime 2. This model reads:

$$Y_{i,t} = \alpha + \rho_1[M_t W]_i + \rho_2[(I_N - M_t)W]_i Y_t + \beta X_{i,t} + \delta W_i X_{i,t} + \theta_t + \mu_i + \varepsilon_{i,t} \qquad (5.6)$$

Where M_t is an $N * N$ matrix whose diagonal elements take on the value of the regime dummy variables (i.e., if corporation *i* belongs to regime 1, element m_{ii} takes on a value of 1). Finally, I_N is the identity matrix.[27] ρ_1 now presents the interaction effect for corporations belonging to regime 1, and ρ_2 gives the effect for corporations belonging to regime 2.

We will estimate equation (5.6) with two regimes based upon (1) market power, (2) the number of 'neighbours' that each corporation has and (3) the concentration of the corporation's property.

[27] Note that this model does not allow a time lag of the dependent variable to be included.

5.6 Results

5.6.1 Rents and quality

To test hypothesis 1a, we estimate equations (5.1) and (5.2) under fixed effects. A Hausman test reveals that the difference between a random and fixed effects model is significant (at the 1 percent level) so that a random effects model would suffer from bias. Note that *Y =log(rent/quality ratio)* in this case. Table 5.2 presents the results.

Regression (1) provides a static fixed effects model (equation (5.1)), whereas regression (2) gives the results of a dynamic CLSDV-model (equation (5.2)). The dynamic effect turns out to be highly significant: an increase in this year's rent/quality ratio of 1 percent, will have an additional increase of 0.34 percent in the next year. Thus, it appears that increases in rents are often spread over the years. Besides, the models are similar in terms of sign and significance of the coefficients.[28]

The quality of the housing stock appears to have a highly significant impact on the rent/quality ratio; the relation between WWS-points and the rent/quality ratio resembles a third-order polynomial, with a negative slope between 90 and 180 WWS-points.[29] Most corporations have average WWS-points within this range meaning that increases in WWS-points nearly always lead to decreases in relative rents. This indicates that if quality increases, rents do not increase proportionally, which confirms hypothesis 1a.

Furthermore, older dwellings have lower rent/quality ratios, ceteris paribus. This suggests that older dwellings are less preferred to newer dwellings (i.e., the willingness to pay is lower). The effect is the strongest for dwellings that are built between 1945 and 1959. This confirms the notion postulated by CFV (2012) that dwellings that were built between 1945 and 1970 are least popular. This is so because during the reconstruction period after World War II, many dwellings were built fast and cheaply in order to solve the housing shortage.

[28] The number of dwellings is the main exception as this variable is only significant in model 2. Also, the coefficients of the regressors are somewhat smaller in magnitude for model 2 than for model 1. However, one should note that according to model 2, an increase in a certain variable will not only have a direct effect, but extra effects in future years (0.3410 in the next year, $(0.3410)^2$ in the year thereafter, etc.). Therefore, in the long-run, the effects will in fact be stronger for model 2.

[29] We have added these power terms because they are highly significant. Including only the linear term gives a negative effect.

Table 5.2. Regression results: effects of quality on rent/quality ratio.

	(1)	(2)
Dependent variable	Rent/quality ratio (logs)	Rent/quality ratio (logs)
Model	Static model, FE	Dynamic model, CLSDV
Lagged dependent		0.3410***
		(19.6905)
WWS-points	3.4170***	3.0749***
	(5.5766)	(8.8446)
WWS-points^2	-2.6470***	-2.3185***
	(-5.6259)	(-8.6413)
WWS-points^3	0.6177***	0.5245***
	(5.1218)	(7.7816)
Number of dwellings	-0.0020	-0.0032**
	(-1.0839)	(-2.0821)
Dwellings before 1945	-0.1405***	-0.1175***
	(-3.0559)	(-4.4209)
Dwellings 1945-1959	-0.2679***	-0.2362***
	(-5.0152)	(-5.4843)
Dwellings 1960-1969	-0.2076***	-0.1469***
	(-2.9688)	(-4.4913)
Dwellings 1970-1979	-0.1565***	-0.1353***
	(-3.3036)	(-4.2078)
Dwellings 1980-1989	-0.1155**	-0.0918***
	(-2.4148)	(-3.4965)
Dwellings 1990-1999	0.0458	0.0552*
	(0.8164)	(1.8761)
Property tax rate	0.0241	-0.0050
	(0.3001)	(-0.0673)
Share of dwellings in problem districts	0.0012	-0.0060
	(0.0714)	(-0.3862)
Attractiveness of location	-0.0187	-0.0261
	(-0.8989)	(-1.2486)
Population density	-0.0012	0.0084
	(-0.1378)	(0.6633)
Average disposable income[a]	-1.3104	-0.0056
	(-1.1065)	(-0.0065)
Share of people in welfare system	0.5841	0.3525
	(1.0842)	(0.9744)
Share of minorities	0.0369	-0.0387
	(0.2203)	(-0.2683)
Soil quality	-0.0306	-0.0158
	(-0.6245)	(-0.5277)
Constant	-1.5489***	
	(-5.3238)	
Year effects	Yes	Yes
Corporation fixed effects	Yes	Yes
R-squared	0.3357	
Number of corporations	364	364

For regression 1, robust t-statistics (based on clustered standard errors) in parentheses
For regression 2, z-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

[a] Average disposable income is expressed in millions of euros, instead of thousands of euros in order to improve readability.

In conclusion, housing corporations do not blindly follow the WWS, but take costs and/or demand factors into account when setting rents. Finally, besides the housing stock characteristics, no other variables seem to influence the rent/quality ratio.

The results also seem to imply that quality increases are not driven by a desire to raise revenues because they do not lead to equivalent rent increases. However, a definite answer to this issue cannot be given since we do not know the exact costs of quality improvements. Still, if corporations would 'gain' by improving quality this should be reflected in the financial position. Table 5.3 tests whether this relationship holds. For most parameters reflecting financial performance, such a relationship is not present. The only exception is the negative relationship between quality and equity. This indicates that quality improvements deteriorate rather that improve the financial position. This confirms hypothesis 1b.

5.6.2 Spatial interaction

This subsection investigates whether spatial interaction among corporations is present. Recall that *Y = log(regular rent)* in this specification.

The first point of concern is how to construct the spatial weights matrix. Note that there are several options to model spatial interaction (Smith, 2014) and there is no blueprint of how to model the spatial weights matrix (Stakhovych and Bijmolt, 2008). Therefore, Table 5.4 shows several possibilities. The first two matrices are based on distances. In the first matrix, each element of W equals the inverse of the distance of two corporations, i.e., $w_{ij} = 1/d_{ij}$ where d_{ij} is the distance between corporation *i* and *j*.[30] In the second matrix, $w_{ij} = 1/(d_{ij})^2$.

In matrix 3 (4), corporations are assumed to be neighbours if they are located within 15 (25) kilometres of each other. Finally, matrices 5-7 are based upon the k-nearest neighbour principle. More specifically, for each corporation, we give its k-nearest corporations a value of one, whereas all others receive a value of zero. We constructed matrices based upon k=3 (matrix 5), k=5 (matrix 6) and k=7 (matrix 7).

[30] Appendix 5.A shows how the distance between two corporations is calculated.

Table 5.3. Regression results: effects of quality on financial position.

	(1)	(2)	(3)	(4)	(5)
Dependent variable	Profits	Net cash flow	Company value	Long-term debt	Equity
Model	Dynamic, CLSDV	Dynamic, CLSDV	Dynamic, CLSDV	Dynamic, CLSDV	Dynamic, CLSDV
Lagged dependent	0.0980***	0.0960***	0.6215***	0.6204***	0.7014***
	(4.5546)	(5.1468)	(36.9397)	(50.8666)	(39.7069)
WWS-points	-0.7305	-0.0902	1.1216	-0.0012	-0.0041***
	(-1.2089)	(-0.2862)	(0.8821)	(-0.8232)	(-3.3549)
Number of dwellings	-0.1368*	0.0507	0.5629***	-0.0002	0.0000
	(-1.8983)	(1.2668)	(2.8438)	(-1.1265)	(0.2081)
Dwellings before 1945	-3.4765*	1.3678	-35.3151***	-0.0058	0.0049
	(-1.7726)	(1.5435)	(-9.2607)	(-1.3813)	(1.4828)
Dwellings 1945-1959	-3.9282*	2.6274***	-49.6522***	-0.0076	0.0084*
	(-1.8346)	(2.5935)	(-9.6212)	(-1.3951)	(1.8667)
Dwellings 1960-1969	-4.0556**	0.9451	-37.5083***	-0.0069	0.0056
	(-2.2615)	(0.9267)	(-6.9898)	(-1.3973)	(1.4234)
Dwellings 1970-1979	-4.9295***	0.7895	-41.1832***	-0.0253***	-0.0043
	(-3.4678)	(0.8732)	(-8.9278)	(-5.9337)	(-1.1665)
Dwellings 1980-1989	-3.8197**	1.5327**	-26.6405***	0.0002	0.0068**
	(-2.4861)	(2.0181)	(-7.5501)	(0.0617)	(2.2481)
Dwellings 1990-1999	-2.8929*	0.5544	-24.5218***	0.0244***	0.0173***
	(-1.7031)	(0.7211)	(-6.2663)	(5.9087)	(4.8138)
Property tax rate	-1.7905	-0.5019	2.6484	-0.0101	0.0088
	(-0.6694)	(-0.2972)	(0.3262)	(-1.5667)	(1.5808)
Share of dwellings in problem districts	0.1472	0.2404	6.3306***	-0.0062***	-0.0040***
	(0.2549)	(0.5683)	(3.7016)	(-3.6751)	(-2.6789)
Attractiveness of location	-1.5493	0.2918	-1.6602	0.0005	-0.0010
	(-1.6327)	(0.5142)	(-0.6823)	(0.1770)	(-0.4148)
Population density	-0.3203	-0.2855	-1.6264	-0.0008	-0.0012
	(-0.5978)	(-0.9526)	(-1.1081)	(-0.5914)	(-1.0302)
Average disposable income[a]	14.7339	0.0354	-96.7988	0.0996	-0.1744*
	(0.3201)	(0.0015)	(-0.8686)	(0.9735)	(-1.9239)
Share of people in welfare system	15.2998	9.0411	7.6317	-0.0125	0.0290
	(0.9555)	(1.0127)	(0.1557)	(-0.2899)	(0.7655)
Share of minorities	-6.0693	-0.1073	-19.7885	0.0343*	-0.0234
	(-0.7241)	(-0.0253)	(-1.1392)	(1.8436)	(-1.4585)
Soil quality	-0.5006	-0.7982	-1.5887	0.0000	-0.0025
	(-0.3199)	(-1.0210)	(-0.3633)	(0.0100)	(-0.7455)
Year effects	Yes	Yes	Yes	Yes	Yes
Corporation fixed effects	Yes	Yes	Yes	Yes	Yes
Number of corporations	363	364	364	364	364

z-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

[a] Average disposable income is expressed in millions of euros, instead of thousands of euros in order to improve readability.

Table 5.4 lists the log-likelihood values of the spatial Durbin model using several matrices. Concerning the first seven matrices, matrix 6 (i.e., a k-nearest neighbour matrix with k=5) is the preferred choice. Note however that such a matrix might be asymmetric; corporation B may be one of the five nearest neighbours of corporation A, but the reverse does not neces-

sarily hold, i.e., in this case $w_{AB} = 1, w_{BA} = 0$. Therefore, we add matrix 8, which is the symmetric version of matrix 6, so that $w_{ij} = w_{ji}$ for all i and j (i.e., if B is one of the five nearest neighbours of A, or vice versa, we have $w_{AB} = w_{BA} = 1$). It turns out that matrix 8 performs best (see Table 5.4), so we use this matrix for our main results.

Table 5.4. Comparison of spatial weights matrices.

	Spatial weights matrix	Log-likelihood
1	$w_{ij} = 1/d_{ij}$	15,540
2	$w_{ij} = 1/(d_{ij})^2$	15,546
3	If $d_{ij} < 15$, corporations are neighbours	15,529
4	If $d_{ij} < 25$, corporations are neighbours	15,543
5	k-nearest neighbour (k=3)	15,557
6	k-nearest neighbour (k=5)	15,563
7	k-nearest neighbour (k=7)	15,562
8	k-nearest neighbour (symmetric) (k=5)	15,567

We use a robust LM-test (Anselin et al., 1996; Elhorst, 2014) to test whether a spatial lag or spatial error model suits the data better than a non-spatial model. The results indicate that the spatial lag model cannot be rejected at the 5 percent level (test statistic 18.8087, p=0.000), and the spatial error model should be rejected (test statistic 3.6930, p=0.055). Furthermore, a Wald-test indicates that a spatial Durbin model is preferred over an ordinary spatial lag model (significant at the 1 percent level).

To answer hypotheses 2a-2d, Table 5.5 gives the results of seven different spatial interaction models.[31] Regression (1) provides estimates of the ordinary spatial Durbin model (SDM; equation (5.3)) with both time and corporation fixed effects. Both are significant at the 1 percent level. The significance of the year effects indicates that there appear to be strong nation-wide effects from year-to-year that make all corporations increase or decrease their rents in a similar way.

The spatial interaction term, ρ, appears to be highly significant as well, indicating that we find strong evidence for rent mimicking. According to regression (1), a corporation will increase its rent by about 0.19 percent if the neighbour's rent increases with 1 percent on average.[32]

Results for the spatial Durbin error model (SDEM; equation (5.4)) are given in regression (2). Just as for the spatial lag model, this model shows a highly significant spatial effect, even

[31] To estimate these, we gratefully make use of the Matlab routines which are publicly available at http://www.regroningen.nl/elhorst/software.shtml.

[32] Note that the spatial weights matrix has been row-standardized, so that all rows sum to one. Therefore, if all neighbours of corporation *i* increase their rents by 1 percent, corporation *i* increases rents by 0.19 percent.

though this model should be rejected according to the LM test. This indicates that we cannot completely rule out the possibility that we may omit relevant variables that are spatially correlated.

Table 5.5. Regression results of spatial interaction models.

Dependent variable Model	(1) Regular rent SDM	(2) Regular rent SDEM	(3) Regular rent Dynamic SDM (CLSDV)	(4) Regular rent Dynamic SDM (CLSDV, first differences	(5) Regular rent Two-regime SDM[a]	(6) Regular rent Two-regime SDM[b]	(7) Regular rent Two-regime SDM[c]
Lagged dependent			0.9955***	0.0418**			
			(104.7328)	(2.3982)			
Spatial effect (ρ or ρ_1)	0.1926***	0.198***	0.1754***	0.1577***	0.297***	0.2095***	0.2904***
	(8.0409)	(8.2471)	(6.7484)	(5.7251)	(7.9361)	(5.2775)	(5.4539)
Spatial effect (ρ_2)					0.0812**	0.1814***	0.1503***
					(2.1633)	(5.7673)	(4.9641)
Lagged spatial effect			-0.1506***	0.0287			
			(-4.3904)	(0.7103)			
WWS-points	0.0008	0.0006	0.0037***	0.001	0.0008	0.0008	0.0008
	(0.406)	(0.3239)	(3.1012)	(0.8472)	(0.4401)	(0.4149)	(0.4151)
Number of dwellings	-0.0019***	-0.002***	0.0000	0.0003	-0.0019***	-0.0019***	-0.0019***
	(-7.2734)	(-7.3863)	(0.2052)	(1.0644)	(-7.4897)	(-7.6292)	(-7.4685)
Dwellings before 1945	-0.009	-0.0101*	-0.0006	0.0037	-0.0083	-0.0091*	-0.0092*
	(-1.564)	(-1.7433)	(-0.1692)	(0.9038)	(-1.5081)	(-1.6588)	(-1.6689)
Dwellings 1945-1959	-0.0288***	-0.0298***	-0.0056	-0.0032	-0.0281***	-0.0289***	-0.0292***
	(-4.0631)	(-4.178)	(-1.278)	(-0.578)	(-4.1414)	(-4.2575)	(-4.3039)
Dwellings 1960-1969	-0.0077	-0.0086	-0.0045	0.0077	-0.0081	-0.0077	-0.0074
	(-1.1989)	(-1.3291)	(-1.1459)	(1.402)	(-1.3164)	(-1.2521)	(-1.2082)
Dwellings 1970-1979	0.0157***	0.0168***	-0.0009	0.0083*	0.0155***	0.0158***	0.016***
	(2.678)	(2.8429)	(-0.2422)	(1.7128)	(2.7614)	(2.81)	(2.8556)
Dwellings 1980-1989	-0.0005	-0.0006	-0.0039	0.0013	0.0002	-0.0006	-0.0006
	(-0.0849)	(-0.1184)	(-1.2171)	(0.3126)	(0.0406)	(-0.1122)	(-0.115)
Dwellings 1990-1999	-0.0158***	-0.0175***	0.0028	0.0014	-0.0157***	-0.0159***	-0.0157***
	(-2.7703)	(-3.0206)	(0.8039)	(0.2916)	(-2.871)	(-2.907)	(-2.8679)
Property tax rate	-0.098***	-0.0981***	0.0013	0.0164	-0.0967***	-0.0978***	-0.0985***
	(-7.1384)	(-7.3583)	(0.1516)	(1.2224)	(-7.378)	(-7.4487)	(-7.5056)
Share of dwellings in problem districts	-0.0035	-0.0021	-0.0002	-0.0033	-0.0038	-0.0034	-0.0035
	(-1.1831)	(-0.7312)	(-0.1307)	(-1.2491)	(-1.37)	(-1.2125)	(-1.2617)
Attractiveness of location	0.0138***	0.0135***	0.0003	0.0004	0.0135***	0.0138***	0.0137***
	(3.2128)	(3.2374)	(0.1112)	(0.1578)	(3.3063)	(3.3667)	(3.3395)
Population density	0.0051***	0.0047***	0.0002	-0.0007	0.0051***	0.0051***	0.0051***
	(4.024)	(3.7714)	(0.1621)	(-0.4861)	(4.2342)	(4.2114)	(4.2539)
Average disposable income[d]	-0.0669	-0.0718	0.0314	-0.061	-0.0562	-0.0694	-0.0763
	(-0.3978)	(-0.4354)	(0.3223)	(-0.4664)	(-0.3502)	(-0.4317)	(-0.4753)
Share of people in welfare system	0.0035	0.0161	0.0629	0.1253**	0.0138	0.0026	-0.0025
	(0.0522)	(0.2458)	(1.6085)	(2.0791)	(0.2167)	(0.0403)	(-0.0392)
Share of minorities	0.0488*	0.0504*	-0.0155	0.0019	0.05**	0.0489*	0.048*
	(1.8381)	(1.9417)	(-0.967)	(0.0674)	(1.9724)	(1.9278)	(1.8946)
Soil quality	0.0138*	0.0113	-0.0059	-0.0036	0.0136*	0.0137*	0.0141*
	(1.7807)	(1.5235)	(-1.3387)	(-0.6734)	(1.8401)	(1.8528)	(1.9154)
W*WWS-points	-0.005	-0.0056	0.0006	0.0033	-0.0056	-0.005	-0.0055
	(-1.0871)	(-1.1038)	(0.2187)	(1.063)	(-1.2681)	(-1.1422)	(-1.2603)
W*Number of dwellings	-0.0013*	-0.0019***	-0.0003	0.0009	-0.0012*	-0.0013**	-0.0014**
	(-1.9524)	(-2.6624)	(-0.8218)	(1.4537)	(-1.9534)	(-2.0726)	(-2.1834)
W*Dwellings before 1945	-0.0163	-0.022	-0.0072	-0.0078	-0.0154	-0.017	-0.0172
	(-1.3151)	(-1.6078)	(-1.0016)	(-0.8131)	(-1.3018)	(-1.4332)	(-1.4511)
W*Dwellings 1945-1959	-0.0182	-0.026	-0.0052	-0.0149	-0.022	-0.0184	-0.0191
	(-1.0503)	(-1.3653)	(-0.4865)	(-1.0716)	(-1.3275)	(-1.1118)	(-1.1539)
W*Dwellings 1960-1969	-0.014	-0.0216	-0.0032	0.0058	-0.0183	-0.0141	-0.0139
	(-0.908)	(-1.2802)	(-0.3266)	(0.4207)	(-1.2424)	(-0.9579)	(-0.9412)
W*Dwellings 1970-1979	0.0463***	0.0506***	-0.0094	-0.0034	0.0442***	0.0464***	0.0449***
	(3.1992)	(3.1794)	(-1.0839)	(-0.2907)	(3.195)	(3.3504)	(3.2474)
W*Dwellings 1980-1989	-0.0088	-0.0065	0.0023	-0.0126	-0.0091	-0.0093	-0.0096
	(-0.6886)	(-0.4589)	(0.3009)	(-1.2071)	(-0.7431)	(-0.7557)	(-0.7804)
W*Dwellings 1990-1999	-0.0549***	-0.0607***	-0.0031	-0.0161	-0.0558***	-0.0551***	-0.0559***

Dependent variable Model	(1) Regular rent SDM	(2) Regular rent SDEM	(3) Regular rent Dynamic SDM (CLSDV)	(4) Regular rent Dynamic SDM (CLSDV, first differences	(5) Regular rent Two-regime SDM[a]	(6) Regular rent Two-regime SDM[b]	(7) Regular rent Two-regime SDM[c]
	(-3.5069)	(-3.5322)	(-0.3241)	(-1.2835)	(-3.735)	(-3.6804)	(-3.7398)
W*Property tax rate	0.0246	0.0091	-0.0256**	0.0113	0.0202	0.0253	0.0244
	(1.1998)	(0.4177)	(-2.0793)	(0.5316)	(1.0323)	(1.288)	(1.2457)
W*Share of dwellings in problem districts	0.0362***	0.0406***	0.0008	-0.0056	0.0359***	0.0363***	0.0366***
	(6.3555)	(6.4683)	(0.2499)	(-1.3065)	(6.5847)	(6.6582)	(6.7238)
W*Attractiveness of location	-0.0069	-0.0042	-0.0041	0.0001	-0.0071	-0.0069	-0.0073
	(-1.0828)	(-0.6139)	(-1.0714)	(0.0339)	(-1.1615)	(-1.1368)	(-1.2007)
W*Population density	-0.0084***	-0.0082***	-0.0018	-0.0056*	-0.0083***	-0.0083***	-0.0082***
	(-3.1822)	(-2.828)	(-0.8577)	(-1.7386)	(-3.3067)	(-3.3212)	(-3.2737)
W*Average disposable income[d]	0.0448	0.0123	0.0618	-0.1553	0.0369	0.0452	0.0756
	(0.1601)	(0.0402)	(0.377)	(-0.6475)	(0.1379)	(0.1689)	(0.2823)
W*Share of people in welfare system	0.1929*	0.205	0.0616	0.0312	0.2156**	0.1878*	0.1952*
	(1.688)	(1.6386)	(0.9023)	(0.2881)	(1.9743)	(1.7183)	(1.7872)
W*Share of minorities	0.0373	0.046	0.0123	-0.041	0.0233	0.0386	0.0401
	(0.8086)	(0.9152)	(0.4366)	(-0.7773)	(0.5299)	(0.8747)	(0.9104)
W*Soil quality	-0.0205*	-0.0169	0.0027	0.0031	-0.0204**	-0.0205**	-0.0209**
	(-1.9594)	(-1.5619)	(0.4542)	(0.3899)	(-2.0501)	(-2.053)	(-2.0891)
Constant	1.234***	1.5245***			1.2355	1.2355	1.2409
	(93.0807)	(115.2303)					
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Corporation fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.9977	0.9976			0.9977	0.9977	0.9977
Number of corporations	364	364	364	364	364	364	364
t-value of difference between ρ_1 and ρ_2					3.7369	0.5398	2.1237

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Spatial weights matrix based on 5-nearest neighbours matrix (symmetric).
[a] Corporations with market power ≥ 0.5 belong to regime 1, all other corporations belong to regime 2.
[b] Corporations with more than 5 neighbours within 15 kilometres belong to regime 1, all other corporations belong to regime 2.
[c] Corporations with a concentration index ≥ 0.7 belong to regime 1, all other corporations belong to regime 2.
[d] Average disposable income is expressed in millions of euros, instead of thousands of euros in order to improve readability.

Regression (3) gives estimates of equation (5.5): a spatial Durbin model with a dynamic component included. In this specification, the time lag of the dependent variable turns out to be highly significant. This indicates that many corporations have a policy of increasing rents only gradually over time. The spatial interaction coefficients are significant as well. However, the model turns out to be unstable, because the sum of the lagged coefficients (in both space and time) is greater than one (i.e., $\gamma + \rho + \lambda > 1$). This may lead to inconsistent parameters. Lee and Yu (2010) and Yu et al. (2012) suggest to estimate the model in spatial first-differences in this case, because this transformation can stabilize the model.[33] However, in our case this procedure doesn't work, i.e., the model remains unstable, mainly because γ is very close to, or even greater than one. Therefore, to deal with this issue, we estimate the model in first-differences (i.e., for each variable we take the difference between *t* and *t-1* and rerun the

[33] For an excellent explanation of this issue, see Elhorst et al. (2013).

regression). Regression (4) shows that with this specification the spatial effect remains significant in the current year, but the time-lag of the spatial effect loses significance. The magnitude of the effect is about 0.16 under this specification. In short, we thus fail to reject hypothesis 2a since we find substantial evidence that corporations engage in rent mimicking.

It may be the case however that rent mimicking is only conducted by some, not all, corporations (or more generally: the interaction effect may be unequal among subsets of corporations). These considerations can be tested with the two-regime model from equation (5.6). We estimate three different models.

In regression (5) the dataset is split up into a subset of corporations with high market power (regime 1) and with low market power (regime 2). Market power is measured as the weighted sum of market shares of a corporation in the municipalities where it holds possession. A numerical example is provided in Appendix 5.B. The threshold to split up the data lies at a market power index of 0.5 (on a scale of 0 to 1).

As explained in section 5.4.2, if competition for tenants is the driving force behind potential rent mimicking, we expect spatial interaction to be stronger for corporations with low market power. Surprisingly, the results show that it is just the other way around. The spatial coefficient for corporations with high market power is larger than for corporations with low market power (i.e., $\rho_1 > \rho_2$). The difference between the two coefficients is significant. This leads us to reject the hypothesis that 'competition for tenants' is the cause of rent mimicking. This means we reject hypothesis 2b.

Regression (6) splits up the dataset into a subset of corporations with many 'neighbours' and corporations with only a few neighbours. In particular, if a corporation has more than 5 neighbours within a range of 15 kilometres, it belongs to the first regime, otherwise it belongs to the second. The results indicate that spatial interaction is significant for both groups of corporations but the difference between the two coefficients is insignificant. This fails to confirm the presence of political yardstick competition. We therefore reject hypothesis 2c.

Finally, in regression (6) we compare corporations with a highly concentrated housing stock (regime 1) with those with a less concentrated housing stock (regime 2). The concentration index is calculated as the sum of the squared possession share that a corporation has per municipality. A numerical example is provided in Appendix 5.B. The threshold to split up the data lies at a concentration index of 0.7 (on a scale of 0 to 1). We expect the spatial effect to

be stronger for corporations that belong to regime 1 (see section 5.4.2). The results reveal that the spatial effect is indeed stronger for corporations with a more concentrated housing stock and the difference between the two regimes is significant. This may serve as evidence for political yardstick competition (hypothesis 2d should not be rejected).

Next to the spatial effect, the standard spatial (lag and error) models reveal the significance of a few other (control) variables. Surprisingly, in regressions (1)-(2) and (5)-(7) the property tax rate has a negative and significant effect. In regressions (3) and (4) however, nearly all variables lose significance. We note however that for many of the control variables, variation over time is limited so that their effect will be captured by the corporation fixed effects to a large extent.

In conclusion, a large part of the rent increases can be explained by a lagged effect and the fixed year effects. Still however, we find an additional spatial effect. The significance of the dynamic effect leads us to conclude that a dynamic model is to be preferred. Because such a model turns out to be unstable, we estimate this model in first-differences. Regression (4) would therefore be the most appropriate specification. Because an LM-test reveals that a spatial lag model is preferred over a spatial error model, this means we find evidence of rent mimicking. This rent mimicking may be caused by political yardstick competition as the spatial effect is stronger for corporations with a more concentrated housing stock. We fail to find evidence in favour of the 'competition for tenants' hypothesis. The next section tests on the robustness of the results.

5.7 Sensitivity analysis

We will alter our spatial analysis in three ways to check robustness. First of all, we will choose a slightly different specification of the dependent variable. Secondly, we modify our spatial weights matrix. Thirdly, we will consider different thresholds for the two-regime models.

First of all, recall that for Table 5.5 we constructed a dependent variable, based upon the 'regular rent increase'. This variable does not capture rent increases as a result of 'rent harmonization' (i.e., rent increases in excess of regular rent increases, see also section 5.2). As noted, this harmonization is only allowed if tenants leave a dwelling. As an alternative specification, we use as dependent variable the *'rent revenues divided by the number of*

dwellings'. This variable captures rent harmonization as well. If corporations do not mimic each other's harmonization, we may expect a less significant spatial interaction. Also, this variable contains more white noise. For example, if new dwellings are built, but these are not yet inhabited, the rent per dwelling decreases although real rents have not changed.

Table 5.6 provides the results. We see that the spatial effect loses significance for all models. This indicates that rent mimicking is only conducted on the basis of regular rent increases. This is not surprising, since the regular rent increase is the increase that is observed more easily by other corporations and/or tenants' organizations. Also, the age of the housing stock becomes more relevant in Table 5.6: in general, older dwellings have lower rent increases. This may indicate that when a household leaves a dwelling, the rent will be increased more sharply if the dwelling is rather new. Also, corporations may demand higher rents for newly built dwellings.

Table 5.6. Regression results of spatial interaction models (alternative dependent variable).

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	Rent revenues per dwelling	Rent revenues per dwelling	Rent revenues per dwelling	Rent revenues per dwelling	Rent revenues per dwelling	Rent revenues per dwelling
Model	SDM	SDEM	Dynamic SDM (CLSDV)	Two-regime SDM[a]	Two-regime SDM[b]	Two-regime SDM[c]
Lagged dependent			0.5148***			
			(34.9168)			
Spatial effect (ρ or ρ_1)	0.0149	0.005	-0.0003	-0.0003	0.0143	0.106*
	(0.561)	(0.1856)	(-0.0098)	(-0.006)	(0.3211)	(1.7264)
Spatial effect (ρ_2)				0.0126	0.0014	-0.0372
				(0.3002)	(0.0383)	(-1.0791)
Lagged spatial effect			-0.0021			
			(-0.0537)			
WWS-points	0.0413***	0.0412***	0.0295***	0.0412***	0.0412***	0.0418***
	(4.493)	(4.4984)	(3.3118)	(4.6907)	(4.6936)	(4.7616)
Number of dwellings	-0.0065***	-0.0065***	-0.0076***	-0.0065***	-0.0065***	-0.0065***
	(-5.3207)	(-5.338)	(-6.1657)	(-5.5749)	(-5.5726)	(-5.5772)
Dwellings before 1945	-0.2165***	-0.2168***	-0.1364***	-0.2168***	-0.2167***	-0.2169***
	(-8.2019)	(-8.2257)	(-5.5591)	(-8.5874)	(-8.5842)	(-8.5958)
Dwellings 1945-1959	-0.4068***	-0.4068***	-0.2656***	-0.4067***	-0.4067***	-0.4088***
	(-12.4738)	(-12.4891)	(-8.1826)	(-13.0417)	(-13.0412)	(-13.1164)
Dwellings 1960-1969	-0.2825***	-0.2826***	-0.1507***	-0.2824***	-0.2824***	-0.282***
	(-9.5484)	(-9.5644)	(-5.1855)	(-9.9828)	(-9.9799)	(-9.9738)
Dwellings 1970-1979	-0.2705***	-0.2707***	-0.1589***	-0.2706***	-0.2703***	-0.2698***
	(-10.0089)	(-10.0283)	(-6.0445)	(-10.4723)	(-10.4595)	(-10.4454)
Dwellings 1980-1989	-0.1892***	-0.1895***	-0.1136***	-0.1896***	-0.1895***	-0.189***
	(-7.5204)	(-7.5455)	(-4.801)	(-7.8769)	(-7.8744)	(-7.8599)
Dwellings 1990-1999	-0.073***	-0.0734***	-0.0701***	-0.0732***	-0.0734***	-0.0731***
	(-2.7781)	(-2.7965)	(-2.7429)	(-2.914)	(-2.9209)	(-2.9085)
Property tax rate	0.0364	0.0364	0.0229	0.036	0.0361	0.0361
	(0.5759)	(0.5784)	(0.3752)	(0.597)	(0.5986)	(0.5978)
Share of dwellings in problem districts	-0.0244*	-0.0244*	-0.0184	-0.0244*	-0.0244*	-0.025*
	(-1.8197)	(-1.8191)	(-1.5159)	(-1.902)	(-1.9014)	(-1.9438)
Attractiveness of location	0.0345*	0.0345*	0.0014	0.0346*	0.0345*	0.0346*
	(1.7477)	(1.7503)	(0.0775)	(1.8318)	(1.8269)	(1.8366)
Population density	-0.01*	-0.01*	-0.0072	-0.01*	-0.01*	-0.0098*
	(-1.7316)	(-1.7288)	(-1.0129)	(-1.8066)	(-1.8067)	(-1.7685)
Average disposable income[d]	-2.0623***	-2.0568***	-1.2275*	-2.0603***	-2.0599***	-2.0831***
	(-2.6681)	(-2.6663)	(-1.707)	(-2.7877)	(-2.787)	(-2.8198)
Share of people in welfare system	-0.9867***	-0.9858***	-0.4596	-0.9874***	-0.9876***	-1.0037***
	(-3.2114)	(-3.2147)	(-1.5937)	(-3.3608)	(-3.3617)	(-3.4179)

Dependent variable	(1) Rent revenues per dwelling	(2) Rent revenues per dwelling	(3) Rent revenues per dwelling	(4) Rent revenues per dwelling	(5) Rent revenues per dwelling	(6) Rent revenues per dwelling
Model	SDM	SDEM	Dynamic SDM (CLSDV)	Two-regime SDM[a]	Two-regime SDM[b]	Two-regime SDM[c]
Share of minorities	0.3232***	0.3232***	0.1432	0.3231***	0.3234***	0.3243***
	(2.6493)	(2.6545)	(1.2141)	(2.7701)	(2.7729)	(2.782)
Soil quality	-0.0335	-0.0335	-0.0474	-0.0336	-0.0335	-0.0329
	(-0.9421)	(-0.9438)	(-1.4672)	(-0.9878)	(-0.9857)	(-0.9673)
W*WWS-points	-0.0026	-0.002	0.0004	-0.0023	-0.0023	-0.001
	(-0.1234)	(-0.096)	(0.0215)	(-0.1124)	(-0.1147)	(-0.0514)
W*Number of dwellings	-0.0059*	-0.006**	-0.0025	-0.006**	-0.006**	-0.0059**
	(-1.9455)	(-1.9928)	(-0.7941)	(-2.0631)	(-2.0642)	(-2.0492)
W*Dwellings before 1945	-0.1026*	-0.1068*	-0.0496	-0.1044*	-0.1052*	-0.1012*
	(-1.7835)	(-1.8702)	(-0.9239)	(-1.8961)	(-1.9099)	(-1.8392)
W*Dwellings 1945-1959	0.0542	0.0481	0.0015	0.0512	0.0511	0.0467
	(0.6757)	(0.6043)	(0.0183)	(0.6667)	(0.6655)	(0.6085)
W*Dwellings 1960-1969	-0.0259	-0.0305	0.0328	-0.0284	-0.0287	-0.0212
	(-0.3635)	(-0.4298)	(0.4527)	(-0.4157)	(-0.4212)	(-0.3113)
W*Dwellings 1970-1979	-0.0549	-0.0596	-0.0672	-0.057	-0.0576	-0.056
	(-0.8198)	(-0.8953)	(-1.0476)	(-0.8899)	(-0.8991)	(-0.8747)
W*Dwellings 1980-1989	-0.1232**	-0.1271**	-0.0786	-0.1251**	-0.1262**	-0.1217**
	(-2.0715)	(-2.1499)	(-1.4053)	(-2.1979)	(-2.2163)	(-2.1387)
W*Dwellings 1990-1999	-0.1873***	-0.1894***	-0.12*	-0.188***	-0.1893***	-0.1853***
	(-2.6043)	(-2.6363)	(-1.6973)	(-2.7338)	(-2.7522)	(-2.6953)
W*Property tax rate	0.0287	0.0297	0.0339	0.0292	0.0292	0.0306
	(0.3058)	(0.3162)	(0.3776)	(0.3256)	(0.3253)	(0.3412)
W*Share of dwellings in problem districts	0.0176	0.0174	0.0002	0.0174	0.0175	0.0181
	(0.6746)	(0.6668)	(0.0081)	(0.6976)	(0.6999)	(0.7262)
W*Attractiveness of location	0.0012	0.0018	0.0188	0.0015	0.0018	0.0018
	(0.0417)	(0.06)	(0.6681)	(0.0539)	(0.0627)	(0.0645)
W*Population density	0.0134	0.0134	0.0031	0.0132	0.0131	0.012
	(1.1048)	(1.1104)	(0.1969)	(1.1454)	(1.1368)	(1.0345)
W*Average disposable income[d]	1.9904	1.9773	1.3029	1.9818	1.9846	2.0849*
	(1.5451)	(1.5346)	(1.0792)	(1.609)	(1.6109)	(1.6935)
W*Share of people in welfare system	0.5239	0.5132	0.5677	0.5171	0.5133	0.55
	(0.9969)	(0.9765)	(1.1297)	(1.0289)	(1.0214)	(1.095)
W*Share of minorities	-0.115	-0.1117	-0.0897	-0.1126	-0.1102	-0.1051
	(-0.5424)	(-0.527)	(-0.432)	(-0.5557)	(-0.5434)	(-0.5187)
W*Soil quality	0.0193	0.0191	0.0457	0.0194	0.0188	0.0174
	(0.4025)	(0.3983)	(1.04)	(0.4222)	(0.4091)	(0.3791)
Constant	1.7956***	1.8225***		1.8123	1.8123	1.8111
	(29.4504)	(29.9315)				
Year effects	Yes	Yes	Yes	Yes	Yes	
Corporation fixed effects	Yes	Yes	Yes	Yes	Yes	
R-squared	0.9596	0.9596		0.9596	0.9596	0.9596
Number of corporations	364	364	364	364	364	364
t-value of difference between ρ_1 and ρ_2				-0.1913	0.2198	1.8615

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Spatial weights matrix based on 5-nearest neighbours matrix (symmetric).

[a] Corporations with market power ≥ 0.5 belong to regime 1, all other corporations belong to regime 2.

[b] Corporations with more than 5 neighbours within 15 kilometres belong to regime 1, all other corporations belong to regime 2.

[c] Corporations with a concentration index ≥ 0.7 belong to regime 1, all other corporations belong to regime 2.

[d] Average disposable income is expressed in millions of euros, instead of thousands of euros in order to improve readability.

Secondly, as noted, there are several options to model spatial interaction (Smith, 2014) and there is no blueprint of how to model the spatial weights matrix (Stakhovych and Bijmolt, 2008). We will extend the analysis by using an alternative matrix that is based on distances. We use matrix 2 in Table 5.4. Each element of W now receives a value of $1/(d_{ij})^2$ where d_{ij}

is the distance between corporation *i* and *j*. Table 5.7 presents the results of our models when using this matrix. The results are similar to the main results (Table 5.5), with the main exception that the two-regime model based upon the number of neighbours (regression (6) in Table 5.7) now indicates that a spatial effect is only present for corporations with less than five neighbours. This could serve as evidence in favour of political yardstick competition. On the other hand, for the two-regime model based upon the concentration index, the difference between ρ_1 and ρ_2 is no longer significant.

Table 5.7. Regression results of spatial interaction models (alternative spatial weights matrix).

Dependent variable Model	(1) Regular rent SDM	(2) Regular rent SDEM	(3) Regular rent Dynamic SDM (CLSDV)	(4) Regular rent Dynamic SDM (CLSDV, first differences	(5) Regular rent Two-regime SDM[a]	(6) Regular rent Two-regime SDM[b]	(7) Regular rent Two-regime SDM[c]
Lagged dependent			0.9984*** (105.2368)	0.0413** (2.377)			
Spatial effect (ρ or ρ_1)	0.1748*** (5.0967)	0.163*** (4.6798)	0.1401*** (3.6791)	0.1299*** (3.2479)	0.2789*** (5.401)	-0.0364 (-0.5011)	0.2724** (2.3043)
Spatial effect (ρ_2)					-0.048 (-0.6927)	0.2173*** (5.5953)	0.1389*** (3.6503)
Lagged spatial effect			-0.1496*** (-2.9766)	0.1134* (1.9406)			
WWS-points	0.0009 (0.4269)	0.0006 (0.3231)	0.0038*** (3.1172)	0.0011 (0.8623)	0.0008 (0.4087)	0.0007 (0.3739)	0.0008 (0.4042)
Number of dwellings	-0.0023*** (-8.5667)	-0.0023*** (-8.6478)	0.0000 (0.2779)	0.0003 (1.1796)	-0.0023*** (-8.8946)	-0.0023*** (-8.9559)	-0.0023*** (-8.9321)
Dwellings before 1945	-0.0083 (-1.4335)	-0.0079 (-1.3532)	-0.0007 (-0.2071)	0.0036 (0.8718)	-0.0087 (-1.5617)	-0.0071 (-1.2827)	-0.0082 (-1.4803)
Dwellings 1945-1959	-0.0263*** (-3.6521)	-0.0258*** (-3.5744)	-0.0054 (-1.2326)	-0.0034 (-0.61)	-0.0266*** (-3.8724)	-0.0257*** (-3.7374)	-0.0263*** (-3.8224)
Dwellings 1960-1969	-0.0109* (-1.6856)	-0.0104 (-1.6065)	-0.0046 (-1.1759)	0.0078 (1.4163)	-0.0112* (-1.8093)	-0.0105* (-1.69)	-0.0106* (-1.7152)
Dwellings 1970-1979	0.0143** (2.4167)	0.0154*** (2.5917)	-0.0009 (-0.2406)	0.0082* (1.6839)	0.0136** (2.3935)	0.0145** (2.5509)	0.0145** (2.5563)
Dwellings 1980-1989	-0.0017 (-0.3102)	-0.0022 (-0.3906)	-0.004 (-1.247)	0.001 (0.2309)	-0.0016 (-0.304)	-0.0014 (-0.2659)	-0.0018 (-0.344)
Dwellings 1990-1999	-0.0166*** (-2.8832)	-0.0179*** (-3.1067)	0.0026 (0.7525)	0.0014 (0.2929)	-0.0167*** (-3.0498)	-0.0167*** (-3.037)	-0.0166*** (-3.0139)
Property tax rate	-0.0979*** (-6.568)	-0.0984*** (-6.6486)	0.0005 (0.0578)	0.0162 (1.2026)	-0.0992*** (-6.96)	-0.0983*** (-6.9007)	-0.098*** (-6.8687)
Share of dwellings in problem districts	0.0000 (0.005)	0.0001 (0.0477)	-0.0001 (-0.0595)	-0.0036 (-1.3548)	-0.0000 (-0.0057)	0.0001 (0.0393)	-0.0000 (-0.01)
Attractiveness of location	0.016*** (3.5973)	0.0156*** (3.5215)	0.0003 (0.1033)	0.0003 (0.1358)	0.0158*** (3.6983)	0.0159*** (3.7407)	0.016*** (3.7484)
Population density	0.0066*** (5.1059)	0.0064*** (4.9861)	0.0001 (0.1069)	-0.0009 (-0.6047)	0.0067*** (5.3711)	0.0066*** (5.3214)	0.0066*** (5.3485)
Average disposable income[d]	-0.2361 (-1.2217)	-0.2285 (-1.1895)	0.022 (0.2245)	-0.0677 (-0.5163)	-0.2162 (-1.1704)	-0.2254 (-1.2212)	-0.2472 (-1.3375)
Share of people in welfare system	-0.1803** (-2.5085)	-0.1666** (-2.3308)	0.0607 (1.5438)	0.1289** (2.1304)	-0.1719** (-2.5018)	-0.1776*** (-2.5876)	-0.1814*** (-2.6392)
Share of minorities	0.0438 (1.3322)	0.043 (1.3102)	-0.0146 (-0.906)	-0.0033 (-0.1204)	0.043 (1.3707)	0.0449 (1.4325)	0.0435 (1.3854)
Soil quality	0.0268*** (3.3611)	0.0262*** (3.2844)	-0.0055 (-1.2413)	-0.0032 (-0.5833)	0.0274*** (3.5874)	0.0269*** (3.5273)	0.0269*** (3.526)
W*WWS-points	-0.0106* (-1.8457)	-0.0122** (-2.0482)	0.0007 (0.2487)	0.0038 (1.2299)	-0.0115** (-2.0962)	-0.011** (-1.9941)	-0.0107* (-1.9461)
W*Number of dwellings	-0.0011 (-0.8781)	-0.0022 (-1.6181)	-0.0004 (-0.9836)	0.0011* (1.6792)	-0.0011 (-0.9142)	-0.0012 (-0.942)	-0.0012 (-0.9618)
W*Dwellings before 1945	0.0142 (0.8446)	0.0144 (0.8253)	-0.008 (-1.1163)	-0.0078 (-0.8099)	0.0121 (0.7519)	0.0171 (1.0627)	0.0145 (0.9001)
W*Dwellings 1945-1959	0.0367	0.0386	-0.0069	-0.0158	0.032	0.0367	0.0357

Dependent variable Model	(1) Regular rent SDM	(2) Regular rent SDEM	(3) Regular rent Dynamic SDM (CLSDV)	(4) Regular rent Dynamic SDM (CLSDV, first differences	(5) Regular rent Two-regime SDM[a]	(6) Regular rent Two-regime SDM[b]	(7) Regular rent Two-regime SDM[c]
	(1.3533)	(1.378)	(-0.6422)	(-1.1281)	(1.2325)	(1.4179)	(1.3738)
W*Dwellings 1960-1969	0.0531**	0.0516**	-0.0038	0.0079	0.048**	0.0563**	0.052**
	(2.2397)	(2.0871)	(-0.3961)	(0.5748)	(2.1179)	(2.486)	(2.2922)
W*Dwellings 1970-1979	0.0789***	0.083***	-0.0094	-0.0032	0.0758***	0.0814***	0.0789***
	(3.9671)	(4.0282)	(-1.0772)	(-0.269)	(3.9858)	(4.2887)	(4.1494)
W*Dwellings 1980-1989	-0.005	-0.003	0.0007	-0.0129	-0.0062	-0.0004	-0.0051
	(-0.249)	(-0.1483)	(0.0987)	(-1.2295)	(-0.326)	(-0.0197)	(-0.2686)
W*Dwellings 1990-1999	-0.0848***	-0.0908***	-0.0036	-0.0154	-0.0861***	-0.0839***	-0.0867***
	(-3.8073)	(-3.9658)	(-0.3751)	(-1.2233)	(-4.0405)	(-3.9433)	(-4.0689)
W*Property tax rate	0.0161	0.0049	-0.0295**	0.0137	0.0173	0.0077	0.0143
	(0.5467)	(0.1601)	(-2.3978)	(0.6447)	(0.6174)	(0.2734)	(0.5077)
W*Share of dwellings in problem districts	0.0303***	0.0327***	0.0011	-0.0063	0.0318***	0.0289***	0.031***
	(2.8025)	(2.8661)	(0.3329)	(-1.4608)	(3.0779)	(2.7946)	(2.996)
W*Attractiveness of location	-0.0155	-0.0126	-0.0041	0	-0.0158*	-0.0154*	-0.0159*
	(-1.6272)	(-1.2282)	(-1.0713)	(0.007)	(-1.728)	(-1.694)	(-1.7392)
W*Population density	-0.0168***	-0.0161***	-0.0019	-0.006*	-0.0166***	-0.0169***	-0.0166***
	(-3.3489)	(-3.0535)	(-0.9049)	(-1.8605)	(-3.4646)	(-3.5121)	(-3.4591)
W*Average disposable income[d]	0.4652	0.4563	0.083	-0.1536	0.409	0.494	0.4797
	(1.2163)	(1.1111)	(0.5034)	(-0.6381)	(1.1189)	(1.3526)	(1.3114)
W*Share of people in welfare system	0.5583***	0.5538***	0.0736	0.0347	0.5724***	0.59***	0.5632***
	(2.9411)	(2.7374)	(1.0716)	(0.319)	(3.155)	(3.2527)	(3.1027)
W*Share of minorities	0.0886	0.1054	0.0154	-0.0471	0.0816	0.0817	0.0911
	(1.4366)	(1.592)	(0.5441)	(-0.8888)	(1.3836)	(1.3865)	(1.5446)
W*Soil quality	-0.0767***	-0.078***	0.0017	0.0024	-0.078***	-0.077***	-0.0766***
	(-3.9897)	(-3.9166)	(0.278)	(0.3022)	(-4.2428)	(-4.1935)	(-4.1681)
Constant	1.2957***	1.5606***			1.3717	1.3717	1.2951
	(59.4247)	(71.6515)					
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Corporation fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.9976	0.9976			0.9976	0.9976	0.9976
Number of corporations	364	364	364	364	364	364	364
t-value of difference between ρ_1 and ρ_2					3.3221	-3.0742	1.0353

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Spatial weights matrix based on distance.
[a] Corporations with market power ≥ 0.5 belong to regime 1, all other corporations belong to regime 2.
[b] Corporations with more than 5 neighbours within 15 kilometres belong to regime 1, all other corporations belong to regime 2.
[c] Corporations with a concentration index ≥ 0.7 belong to regime 1, all other corporations belong to regime 2.
[d] Average disposable income is expressed in millions of euros, instead of thousands of euros in order to improve readability.

Thirdly, we test the robustness of the main results by changing the threshold of our regime-variables. Tables 5.8-5.10 show the results. The finding that rent mimicking is stronger for corporations with high market power than for those with low market power is confirmed in Table 5.8. For all thresholds, the difference between ρ_1 and ρ_2 is significant. This means we still don't find evidence for the 'competition for tenants' hypothesis.

Table 5.9 provides the two-regime models when the regime is based on the number of neighbours. Surprisingly, for all thresholds, the coefficient is higher for corporations with many neighbours. The difference is significant for the threshold of 10 neighbours, (weakly)

significant for the threshold of 3 neighbours, and insignificant for the other thresholds. These findings do not support the theory of political yardstick competition.

Table 5.10 confirms the finding that the spatial effect is present for corporations with both a high and a low concentration index. The difference between the two groups is only significant if the threshold lies at a concentration index of 0.7 or 0.9. This means that the evidence found in favour of political yardstick competition is not entirely robust. Thus, corporations appear to mimic each other's rents, but the cause of this interaction remains uncertain.

Table 5.8. Regression (5) of Table 5.5 repeated for different thresholds of market power.

Threshold market power	0.3	0.4	0.5	0.6	0.7
ρ_1 (market power higher than threshold)	0.5021	0.4024	0.297	0.2666	0.2409
(t-value)	(10.6358)	(9.5492)	(7.9361)	(7.7274)	(7.5389)
ρ_2 (market power lower than threshold)	0.0501	0.0511	0.0812	0.0856	0.098
(t-value)	(1.6308)	(1.5315)	(2.1633)	(2.0768)	(2.1019)
t-value of difference between ρ_1 and ρ_2	7.4757	6.0251	3.7369	3.0962	2.3329
N (high market power)[a]	121	157	189	219	242
N (low market power)[a]	243	207	175	145	122

[a] Situation in 2012.

Table 5.9. Regression (6) of Table 5.5 repeated for different thresholds of number of neighbours.

Threshold number of neighbours	3	5	10	15
ρ_1 (number of neighbours higher than threshold)	0.2699	0.2095	0.2325	0.2089
(t-value)	(5.8928)	(5.2775)	(7.9671)	(8.1456)
ρ_2 (number of neighbours lower than threshold)	0.1625	0.1814	0.1079	0.0954
(t-value)	(5.5761)	(5.7673)	(2.432)	(1.455)
t-value of difference between ρ_1 and ρ_2	1.9314	0.5398	2.3059	1.6142
N (high number of neighbours)[a]	99	137	238	309
N (low number of neighbours)[a]	265	246	227	206

[a] Situation in 2012.

Table 5.10. Regression (7) of Table 5.5 repeated for different thresholds of concentration index.

Threshold concentration index	0.5	0.6	0.7	0.8	0.9
ρ_1 (concentration index higher than threshold)	0.2548	0.1734	0.2904	0.2367	0.2827
(t-value)	(3.411)	(2.9147)	(5.4539)	(4.8062)	(6.1506)
ρ_2 (concentration index lower than threshold)	0.1802	0.1966	0.1503	0.1678	0.1355
(t-value)	(6.6855)	(6.795)	(4.9641)	(5.3348)	(4.1427)
t-value of difference between ρ_1 and ρ_2	0.8988	-0.3291	2.1237	1.0877	2.3996
N (high concentration index)[a]	79	104	121	134	162
N (low concentration index)[a]	285	260	243	230	202

[a] Situation in 2012.

5.8 Conclusion

Although housing corporations have a high degree of autonomy, they have to take into account the legislation concerning maximum rent levels and rent increases. This chapter

focuses on the rent setting behaviour of housing corporations, thereby focusing on the relation between quality and rent, and on potential rent mimicking by corporations.

Social dwellings have been assigned maximum rent levels based upon their (physical) quality, according to the Housing valuation scheme (*Woningwaarderingsstelsel*, WWS). The relationship between quality and maximum allowable rents is approximately linear. However, this does not necessarily mean that the relation between quality and *actual* rent is linear as well.

The chapter finds that if the quality of dwellings increases, rent/quality ratios fall significantly. This indicates that corporations do not blindly follow the WWS-system when setting their rents, but take into account cost characteristics and/or demand circumstances. Indeed, improving quality with *x%* does not necessarily imply a cost increase of *x%*. Also, persons might not be willing to pay *x%* extra if quality increases by *x%*.

We also find that an increase in the average quality of a corporation's dwellings does not improve its financial position. This implies that corporations do not seek to profit from quality improvement by raising rents more than necessary to cover the costs of the improvement.

The chapter also finds evidence for rent mimicking among corporations. Test statistics reveal that this spatial interaction is most accurately explained by a spatial Durbin (lag) model, rather than a spatial Durbin error model. According to a traditional spatial Durbin model, a corporation will increase its rent by about 0.19 percent if the neighbour's rent increases with 1 percent on average. However, because such a model is unstable, parameters may be inconsistent. When estimating a model in first-differences, stability is regained. In this case, the spatial effect is 0.16 percent.

We fail to find conclusive evidence on the cause of this spatial interaction. A two-regime model reveals that corporations with high market power engage more strongly in rent mimicking than those with low market power. The concept of 'competition for tenants' would have predicted an opposite effect as for corporations with low market power the threat of losing tenants would be higher. Therefore, in theory, those corporations would have a stronger incentive to mimic their neighbours.

It could also be the case that rent mimicking is driven by political yardstick competition. According to this theory, supervisory boards or tenants' organizations use rent as an indicator of performance. If the own corporation proposes a stronger rent increase than its neighbours,

this would be a sign of malpractice, and would receive strong resistance. This makes it hard for corporations to push through such a rent increase.

Evidence is mixed however. We would have expected a stronger spatial effect for corporations with only a few neighbours compared with those with many neighbours. This is because tenants' organizations or supervisory boards may more easily find a proper yardstick to compare the own corporation with, if the number of neighbours is low. However, the results hint in the opposite direction; the spatial effect appears to be smaller for corporations with only a few neighbours. These findings do not support the theory of political yardstick competition. Note however that with a spatial weights matrix based on distances (instead of a k-nearest neighbour matrix), we do find the expected result.

Also, with the same reasoning we would expect a stronger spatial effect for corporations with a highly concentrated housing stock, compared with those with a more dispersed housing stock, because for the first group, it is easier to find a yardstick. When splitting up the data along these lines, we indeed find that the spatial effect is significantly stronger for the first group. This may serve as evidence for political yardstick competition, but we note that these results are not robust for all thresholds. Thus, corporations appear to mimic each other's rents, but the cause of this interaction remains uncertain.

We also note that when changing the dependent variable so that rent harmonization is included as well, the spatial effect disappears. Thus, the spatial effect is only present for regular rent increases. This is not surprising, since this rent increase is directly observed by other corporations and/or tenants' organizations. Also, when changing the spatial weights matrix (from a k-nearest neighbours matrix to a distance based matrix), the spatial effect remains.

Appendix

5.A Construction of spatial weights matrix

As noted, because corporations are allowed to operate wherever they prefer, we cannot pinpoint a single geographical location to a corporation. Therefore, we construct an alternative spatial weights matrix based upon the relative shares of the corporation's possession per postal code area.

Suppose corporation A has 100 dwellings, divided between two postal code areas and corporation B has 80 dwellings in three areas. For example:

Table 5.A.1. Dwellings per corporation, per postal code area.

Postal code area	Corporation A	Corporation B
0000	40	25
0001	60	50
0002	0	5

Suppose the geographical distances between these areas are as follows:

Table 5.A.2. Distance (in kilometres) between postal code areas.

	0000	**0001**	**0002**
0000	0	10	25
0001	10	0	5
0002	25	5	0

All postal code distances are now given a weight to determine how 'important' this distance is, determined by the relative share of possession of each corporation. For example, we give the distance between area 0000 and area 0001 a weight of:

$$\left(\frac{Dwellings_{A,0000}}{Dwellings_A} * \frac{Dwellings_{B,0001}}{Dwellings_B}\right) + \left(\frac{Dwellings_{A,0001}}{Dwellings_A} * \frac{Dwellings_{B,0000}}{Dwellings_B}\right)$$
$$= \left(\frac{40}{100} * \frac{50}{80}\right) + \left(\frac{60}{100} * \frac{25}{80}\right) = 0.4375.$$

In a similar fashion, all distances receive the following weights:

Table 5.A.3. Weights for all distances.

	0000	**0001**	**0002**
0000	-	0.4375	0.025
0001	0.4375	-	0.0375
0002	0.025	00375	-

Although in theory, the 'distance' between for example 0000 and 0000 could also be given weights, this is irrelevant, since these weights would be accompanied by a zero distance.

The total distance between A and B now is the sum of the weighted distances.

$$Distance_{A,B} = (0.4375 * 10) + (0.025 * 25) + (0.0375 * 5) = 5.1875$$

5.B Calculation of market power index and concentration index

The two-regime models used in section 5.6.2 split up the corporation data into two regimes. These regimes are based upon (1) market power, (2) the number of neighbours and (3) the concentration of the corporation's possession. The indices of market power and concentration may require further explanation.

Market power is measured as the weighted sum of market share that a corporation has per municipality. Suppose there are 100 corporation dwellings in one municipality (X) and 300 in another (Y). Suppose that a certain corporation possesses 50 and 60 dwellings in these municipalities respectively (i.e., a total of 110). This means that in municipality X, the corporation has a market share of 0.5 (or 50/100) and the market share in municipality Y is 0.2 (60/300). Furthermore, because most of the corporation's dwellings are located in municipality Y, the market share in Y should receive a (slightly) higher weight. Thus, the weight in X is about 0.45 (=50/110), and in Y it is 0.55 (=60/110). The market power coefficient of corporation A is now calculated as $\left(\frac{50}{100} * \frac{50}{110}\right) + \left(\frac{60}{300} * \frac{60}{110}\right) \approx 0.34$. For this index, a higher number implies a higher market power.

The concentration index is calculated as the sum of the squared possession share of a corporation. Thus, for the abovementioned corporation (with 50 dwellings in one municipality and 60 in another), the concentration index is $\left(\frac{50}{110}\right)^2 + \left(\frac{60}{110}\right)^2 \approx 0.50$. For this index, a higher number means a more concentrated housing stock.

Chapter 6

Conclusions and Future Research Possibilities

This dissertation has provided four studies on housing corporations; on efficiency, bailout system effectiveness and rent setting behaviour. This final chapter gives a summary of the main findings (sections 6.1, 6.2 and 6.3) and provides a few proposals for future research (section 6.4).

6.1 Operational efficiency

6.1.1 Efficiency measurement (chapter 2)

It is often argued that housing corporations lack an incentive to operate efficiently, because the current institutional setting provides them with a high degree of autonomy (without strong supervision). Also, they operate in a rather non-competitive (quasi-)market. Finally, since corporations are not allowed to appropriate their profits, they don't have much to gain by reducing their cost levels beyond the level at which the organization breaks even. It would be very helpful if statements about efficiency could be founded empirically. Chapter 2 has focused on the question whether operational efficiency can actually be measured within the current setting. Two main problems arise when conducting such an exercise. First of all, the conceptual question is how to model the production process of a corporation, and especially, which outputs to choose. The second question is whether the researcher possesses sufficient data. In chapter 2 it is argued that an output should be included in the model if it satisfies the following three criteria: (1) it should be measurable, and be measured, (2) it should be influenced by input (i.e., increasing time and effort should increase output) and (3) the variable has to add to social welfare. Within the current institutional setting, a perfect measurement is unavailable, because (1) researchers and policymakers may disagree about which variables to include in the model and (2) data availability is imperfect. A close approximation is possible however. Chapter 2 provides a few benchmark options of how efficiency can be modelled. Accordingly, a Data Envelopment Analysis (DEA) is conducted to measure relative efficiency of individual housing corporations. The results indicate that, given the current scale of operations, it should be possible to cut costs of corporations by about 15 percent on average, without decreasing output. This is a minimum estimate because it is based on a measure of *relative* efficiency. It is not unlikely that corporations that are efficient according to the DEA have potential efficiency gains as well.

The main advantage of DEA is that efficiency scores can always be traced back. That is, DEA indicates which (linear combination of) corporation(s) outperforms the corporation under

consideration. Therefore, if an organization does not agree with its score, and is able to give a solid explanation of why the score is unfair, the model might be reconsidered.

Knowing more about individual efficiency scores of public organizations, no matter in which sector, is relevant for multiple reasons. First of all, if individual scores are made publicly available, this may provide a trigger to increase efficiency, because nobody wants to be at the lower end of the rankings. In a similar way, municipalities are often ranked on the basis of their tax rates (see for example COELO, 2015). Secondly, and more drastic, central government may provide (financial) rewards to efficient organizations (or punishments to inefficient ones). Thirdly, knowledge about efficiency scores may also serve as input for subsequent research in order to answer the question what the main determinants of efficiency are.

6.1.2 Scale and efficiency (chapter 3)

One of the most eye-catching developments in the Dutch social housing sector is the merger wave that took place in the last decades. A crucial question is whether merging (or increasing scale in general) is beneficial for efficiency. A literature review suggests that only few mergers were explicitly motivated by efficiency considerations. Therefore, we would expect that at least some corporations have grown too big from an efficiency point of view and thus operate under diseconomies of scale. On the other hand, a merger might also bring in beneficial effects because the parties involved might learn from each other and reconsider existing practices.

Our empirical research finds that most corporations operate under diseconomies of scale. This would imply that for most corporations, from an efficiency point of view, merging would be undesirable as it would lower scale efficiency. A size of approximately 2,500 dwellings seems most efficient, whereas in 2012, corporations possessed about 6,300 dwellings on average. Nearly 60 percent of the corporations had more than 2,500 dwellings. However, this does not necessarily mean that a merger will not have any positive effects. Indeed, mergers force organizations to reconsider their practices, and merging organizations may learn from each other. In this case, a merger may influence not only scale efficiency but also pure technical efficiency (i.e., efficiency *given* the scale level). A Data Envelopment Analysis indeed provides evidence in favour of this hypothesis, suggesting that mergers have beneficial effects as well. However, we fail to replicate these results if we conduct a parametric approach (Stochastic Frontier Analysis). Such an analysis confirms the notion of diseconomies of scale, but fails to find a positive effect of mergers on pure technical efficiency to compensate this.

In addition, we note that even if a positive effect would be found, this should not be used as a justification to merge. Decisions concerning increasing and decreasing scale should be made on the basis of scale efficiency and besides this, pure technical efficiency should be maximized in any case. That is, no scale increase should be needed to optimize current processes.

6.2 The bailout clause of housing corporations (chapter 4)

The Dutch public sector is characterized by a unique tradition of explicit bailout clauses. For example, the bulk of the capital that housing corporations borrow is guaranteed by such a bailout clause. This means that if a corporation has difficulties with its debt and interest obligations on its guaranteed loans, it will be rescued. The bailout clause works as a safety net consisting of three layers: the first two layers rely on mutual solidarity among corporations and as a final possibility, the government will act as lender of last resort.

The goal of this clause is to communicate to creditors that lending money to corporations should be considered to be a riskless affair. Note however that not all loans to corporations are guaranteed. First of all, corporations have to be judged sufficiently creditworthy by the Guarantee Fund Social Housing (*Waarborgfonds Sociale Woningbouw*, WSW). Also, only capital that is used to invest in 'services of general economic interest' (*Diensten van Algemeen Economisch Belang*, DAEB) such as building social dwellings can be borrowed under the guarantee of the bailout clause. Moreover, loans with a maturity of less than two years are unguaranteed by definition.

Chapter 4 has compared a set of guaranteed and unguaranteed corporation loans provided by BNG Bank: the largest bank in the Netherlands specializing in loans to public sector institutions. We conclude that – indeed – the interest rates on guaranteed loans are significantly lower than on unguaranteed loans. The difference amounts to about 75 to 110 basis points. This implies that the bailout clause yields a yearly benefit to the social housing sector of about 650 million to 1 billion euros in reduced interest payments. Comparing this with the reorganization subsidies provided by the financial supervisor, the Central Fund Public Housing (*Centraal Fonds Volkshuisvesting*, CFV) to rescue corporations (1.5 billion euros in 22 years), it appears likely that the bailout regime has a positive net benefit.[1] Only if the bailout clause

[1] Note that since July 1, 2015, the CFV has been replaced by the Authority housing corporations (*Autoriteit woningcorporaties*, Aw). Although financial supervision is now in the hands of the Aw, the provision of reorganization subsidies is now a task of the WSW.

would lead to very high indirect costs (for example efficiency losses), it would become undesirable.

In most countries, bailouts are ruled out by law in order to prevent moral hazard. The idea is that organizations who expect to be rescued anyhow would behave irresponsibly. Although we do not know to what extent ending the bailout clause would improve operational efficiency, we do know that the effect would have to be very large in order to outweigh the increase in interest costs. Also, although serious incidents have harassed the sector in the past years, only the first layer of the bailout clause (reorganization subsidies from the CFV) has ever been put to use. Although some argue that these incidents might become more widespread in the future if nothing happens, one would have to be careful with abolishing the bailout system altogether. This notion is further supported by the finding that for Dutch municipalities, where a bailout clause is present as well, there are also hardly any problems of moral hazard. Therefore, until now we conclude: so far so good…It is up to the corporations themselves to keep up this high standard of responsibility.

The results further indicate that the interest paid by corporations on guaranteed loans is a few basis points higher than the risk-free reference rate. One might argue that this small interest spread could be due to the fact that even guaranteed loans might not be totally risk-free. Indeed, the creditor may have to make some extra (non-recoverable) costs in case of default, even in the presence of a bailout clause. These costs may comprise legal costs or payment delays. If non-recoverable costs would be relevant, we would expect housing corporations to pay higher interest rates than municipalities on similar loans. This is so because for municipalities the bailout clause works automatically; if municipalities face problems, they will be rescued by central government; the creditor is not involved in this process. For corporations, the creditor ís involved in this process, meaning that it has to spend time and energy in order to recover the loan. However, we find that interest spreads of corporations and municipalities do not differ significantly from each other. Therefore, we conclude that non-recoverable costs are not relevant. This implies that corporations pay a small commercial margin to BNG Bank. Such a spread may be inevitable, if there is no other bank that can make a better offer than BNG Bank. However, if this is not the case, corporations may have something to gain by putting more effort in their borrowing practices, for example by bargaining harder or searching for cheaper alternatives.

6.3 Rent setting behaviour (chapter 5)

Operationally and financially, corporations are given a high degree of autonomy in order to conduct their activities. However, corporations have to take into account the legislation on social rents. Both the level and the increase of the rent are legally constrained by central government. The maximum rent level of a social dwelling is determined by its (physical) quality, which is defined by means of the so-called Housing valuation scheme (*Woningwaarderingsstelsel*, WWS). Most corporations have average rent levels that lie (far) below the maximum rent level. This implies that the maximum rent level doesn't serve as a hard constraint in most cases.

Furthermore, the yearly rent increase of social dwellings is constrained to a maximum rate that holds for all corporations. Only if a household leaves a dwelling, or if the quality of the dwelling is improved, an extra rent increase is allowed. However, corporations cannot force households to leave a dwelling and quality improvements can only be made with approval of the tenant. Also, according to guidelines from the central government, corporations should not profit from quality increases. This makes it hard for a corporation to generate extra revenues. Still, a corporation may try to push through quality increases in order to be able to increase rents.

Our empirical results indicate however, that if the quality of dwellings increases, rent/quality ratios fall significantly. This indicates that corporations do not blindly follow the WWS-scheme when setting their rents, but take into account cost characteristics and/or demand circumstances. Indeed, improving quality with *x%* does not necessarily imply a cost increase of *x%*. Also, tenants might not be willing to pay *x%* extra if quality increases by *x%*.

We also find that an increase in the average quality of a corporation's dwellings does not improve its financial position. This implies that corporations do not seek to profit from quality improvement by raising rents more than necessary to cover the costs of the improvement. Therefore, corporations seem to stick to the guidelines that quality increases should not lead to excessive rent increases.

As a second result, we find evidence in favour of rent mimicking. This implies that if the neighbours of a corporation increase their rents, the corporation itself is likely to follow this rent increase.

Two possible explanations of this rent mimicking behaviour could be labelled as the 'competition for tenants' hypothesis and 'political yardstick competition' hypothesis. The first principle states that a corporation will not increase its rent (far) beyond its neighbour's rent because it runs the risk of losing tenants who will now find a cheaper alternative nearby. If this were to be the case, we would expect a stronger spatial effect for corporations with low market power (or market share), because for them, the risk of losing tenants would be relatively high compared to corporations with high market power. Surprisingly however, we find an opposite result: corporations with high market power engage more strongly in rent mimicking than those with low market power. This finding is robust under different specifications of the analysis. Therefore, we reject the 'competition for tenants' hypothesis.

The second hypothesis states that if a corporation's board of directors is proposing to increase the rent, it may receive resistance from tenants' organizations and/or the supervisory board, because they will compare the rent increase to that of neighbouring corporations as a measure of performance (i.e., a yardstick). If this were to be the driving force behind rent mimicking, we would expect a stronger spatial effect for corporations with only a few neighbours than for corporations with many neighbours, because for the first group, it would be easier to find a yardstick to compare itself with. However, the results hint in the opposite direction; the spatial effect appears to be smaller for corporations with only a few neighbours, although the difference between the two effects is not always significant. These findings do not support the theory of political yardstick competition. Note however that with a spatial weights matrix based on distances (instead of a k-nearest neighbour matrix), we do find the expected result. The result is thus not robust.

With the same reasoning, we would expect a stronger spatial interaction effect for corporations with a highly concentrated housing stock (i.e., operating in only one or just a few regions) compared with corporations with a more dispersed housing stock (i.e., operating in many regions). That is because, in the first case, it should be easier to find a yardstick. When splitting up the corporations along these lines, we indeed find that the spatial effect is significantly stronger for the first group. This may serve as evidence for political yardstick competition, but we note that these results are not robust for all thresholds of the concentration index.

In short, corporations appear to mimic each other's rents, but the cause of this interaction remains uncertain.

6.4 Future research possibilities

For a long time, empirical research in the social housing sector appeared to be virtually non-existent. Fortunately, in recent years, more and more attempts have been made to fill this hiatus. Conclusions shared by many authors provide a more solid foundation than a conclusion presented only once. Therefore, hopefully, researchers will continue to build on the current empirical work.

Concerning efficiency measurement, this dissertation has provided the first steps by presenting a framework from which to start and conducting an actual measurement. The accurateness of such a measurement depends heavily on data availability. Therefore, it is crucial that benchmark data are collected in a systematic way. If this leads to sufficiently creditworthy efficiency measures, it may be wise to publish these scores in order to let corporations compare themselves with each other.

There are many potential determinants that possibly influence efficiency. This dissertation has focused on the effect of scale and mergers, but other determinants might deserve special attention as well. Examples of such determinants are market power, concentration of possession, financial position and characteristics of the internal organization (e.g., organizational structure, characteristics of board members, satisfaction of employees with managers). Furthermore, in order to learn more about a possible effect of mergers on pure technical efficiency, it would be interesting to study corporation mergers in more detail: could merging have an effect on pure technical efficiency in some cases and if so, why? This would be an interesting question for future research.

The research on the bailout clause could gain credibility by extending the datasets. The current research focuses on loans made by one bank, while corporations also borrow substantial amounts of capital from other banks. Also, nearly all unguaranteed loans are short-term loans. This makes it hard to isolate the effect of the bailout, since, in principle, differences in interest spread could also be due to the loan type. Results could gain credibility if the dataset could be extended by including more long-term unguaranteed loans.

Finally, research on rent setting behaviour may gain from a further investigation in the potential driving forces of rent mimicking.

Besides the issues dealt with in this dissertation, other research areas might be explored as well. An example is the question to what extent the Dutch institutional design of the housing market influences income and wealth redistribution. Wealth is redistributed directly from rich to poor by means of the housing subsidies, but there also is an indirect effect because housing supply is subsidized. Housing corporations, partly using public resources to fulfil their tasks have an influence on the allotments of households and on the rent they pay.[2] If certain types of households are subsidized indirectly in this way, this influences the ultimate income and wealth distribution of society.

The Dutch social housing sector has a unique institutional design compared with other countries. Knowing more about the advantages and bottlenecks of this particular system may also provide foreign researchers and policy makers with valuable information. When thinking about redesigning the current institutional framework, we should be cautious not to throw the baby away with the bathwater. In the words of Priemus (2003), one cannot justify any kind of reform in the social housing sector because in the current situation "we are under-informed about the efficiency of housing corporations" (p. 269). Gandhi would probably complete this notion by adding: "Only the person who can construct a better building is allowed to demolish the existing one."

[2] Recall from chapter 2 that although housing subsidies were abandoned with the introduction of the balancing and grossing Act, the lump-sum conversion led to a substantial improvement in the financial position of corporations. That is, part of the resources of the corporations is essentially public (see also footnote 5 in chapter 2).

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Samenvatting (Summary in Dutch)

Introductie

Weinig markten zijn zo complex als de woningmarkt. Een combinatie van factoren zorgt ervoor dat er, als men niet ingrijpt, in deze markt een onwenselijke situatie kan ontstaan. Zo is er onder meer sprake van (1) onvolkomen concurrentie tussen aanbieders, (2) asymmetrische informatie tussen aanbieder en vrager en (3) verschillende externe effecten. Ook wordt 'wonen' dikwijls aangemerkt als 'bemoeigoed' (een goed waarvan de overheid het gebruik wil stimuleren omdat de consument niet ten volle beseft hoe belangrijk dit goed is). Daarnaast worden potentiële huurders of kopers vaak niet geselecteerd op basis van hun bod alleen, maar houden aanbieders rekening met het risicoprofiel van de vragende partij (*cherrypicking*). Ten slotte is een woning een rigide en heterogeen goed, waarvoor niet altijd goede substituten aanwezig zijn. Het matchen van vraag en aanbod gaat dan ook gepaard met 'zoekkosten'.

Een combinatie van factoren die leiden tot marktfalen, vraagt ook om een combinatie van overheidsinterventies. Verschillende landen gaan hier verschillend mee om. In Nederland wordt de woningmarkt inderdaad op tal van terreinen gereguleerd, bijvoorbeeld door (1) het aanwijzen van bestemmingsplannen, (2) fiscale regelingen, (3) maximering van huren, (4) huurtoeslagen en (5) het aanbieden van sociale huurwoningen door woningcorporaties (woningstichtingen/woningbouwverenigingen).

In Nederland nemen woningcorporaties een dominante positie in de huurmarkt in. In 2012 was 71 procent van de huurvoorraad (oftewel een derde deel van de totale woningvoorraad) in handen van woningcorporaties. Een dergelijke dominante rol is internationaal gezien uniek.

Woningcorporaties zijn privaat bestuurde organisaties, maar worden geacht een publieke taak uit te voeren. Ze kunnen daarom worden aangemerkt als semi-publieke (CPB, 2013a) of hybride (Blessing, 2012) organisaties omdat ze opereren tussen markt, staat en samenleving.

De vraag of de Nederlandse institutionele setting de woningmarkt adequaat reguleert is al geruime tijd onderwerp van discussie. Hoewel de heersende gedachte is dat de corporaties er behoorlijk in slagen om goede woningen tegen betaalbare huren aan te bieden, rijzen er ook twijfels. Een veelgehoord kritiekpunt is dat woningcorporaties een prikkel ontberen om doelmatig te handelen, omdat ze zich hun winsten niet toe kunnen eigenen. Ook is er weinig concurrentie in de sociale huurmarkt en kennen corporaties een hoge mate van autonomie omdat de banden met de overheid zwak zijn.

De zorgen omtrent de sector zijn de laatste jaren toegenomen, vooral omdat een aantal (grote) corporaties vanwege verschillende incidenten in een kwaad daglicht is komen te staan. Er was onder meer sprake van mismanagement, integriteitsproblemen en grote verliezen op risicovolle projecten (voor een overzicht, zie: Dutch Parliament, 2014). Het meest prominente geval was de zaak Vestia: Neerlands grootste corporatie met ongeveer 90.000 woningen leed een verlies van circa twee miljard euro op haar derivatenportefeuille. Blijkbaar kon de huidige institutionele structuur dit niet voorkomen; het ontbrak corporaties aan zelfregulerend vermogen en toezicht schoot tekort. Dit heeft ertoe geleid dat de twijfels omtrent de houdbaarheid van het corporatiebestel toenamen. De Tweede Kamer heeft daarom een parlementaire enquête uitgevoerd naar de sector (Dutch Parliament, 2014) waaruit werd geconcludeerd dat de huidige inrichting teveel ruimte geeft voor ongepast gedrag.

Het is de vraag of de incidenten een correcte weergave van de sector als geheel geven. In de laatste decennia is hier veel over geschreven, maar van empirisch onderzoek naar woningcorporaties was tot voor kort nauwelijks sprake. Hierdoor berustten meningen vaak op casuïstiek. In de laatste jaren groeit de stapel empirisch werk gestaag. Dit proefschrift probeert hieraan bij te dragen. Het combineert verschillende databronnen om een empirisch fundament te leggen voor een aantal van de belangrijkste zaken waar corporaties mee te maken hebben.

Dit proefschrift richt zich op drie hoofdthema's:

1. Het eerste deel richt zich op de vraag of het mogelijk is om de operationele doelmatigheid van woningcorporaties te meten. Ook wordt ingegaan op de relatie tussen schaalvergroting, fusies en doelmatigheid.
2. Ten tweede onderzoeken we de financieringskosten van corporaties. De aandacht gaat hierbij met name uit naar het garantiestelsel dat ervoor zorgt dat een groot deel van de leningen die corporaties aangaan, gewaarborgd is.
3. Ten derde onderzoeken we het huurbeleid van corporaties. We gaan hierbij eerst in op de relatie tussen kwaliteit en huurprijs. Vervolgens gaan we na of corporaties hun huren aanpassen aan de huur van naburige corporaties.

Hieronder worden per punt de belangrijkste bevindingen weergegeven. We sluiten af met een paragraaf over de mogelijkheden tot vervolgonderzoek.

Operationele doelmatigheid

Het meten van doelmatigheid (hoofdstuk 2)

Er wordt vaak gesteld dat woningcorporaties de prikkel tot doelmatig handelen ontberen, omdat ze een hoge mate van autonomie kennen en opereren in een (quasi-)markt waar weinig concurrentie is. Ook mogen corporaties zich hun winsten niet toe-eigenen waardoor ze weinig baat hebben bij kostenverlaging. Hoofdstuk 2 richt zich op de vraag of, en zo ja hoe, doelmatigheid van woningcorporaties gemeten kan worden. Hierbij doen zich twee knelpunten voor. Ten eerste rijst de vraag hoe het 'productieproces' van een corporatie gemodelleerd kan worden en in het bijzonder wat de 'output' van dit proces is. De tweede vraag is of de datakwaliteit momenteel voldoende is voor een doelmatigheidsmeting. In hoofdstuk 2 wordt beargumenteerd dat een output meegenomen dient te worden als het aan drie criteria voldoet: (1) de output moet meetbaar en gemeten zijn, (2) de output moet worden beïnvloed door de input (dus: als de corporatie er meer tijd en energie in steekt, zou de output moeten toenemen) en (3) de output moet iets toevoegen aan de sociale welvaart (dus: hoe meer van de output, hoe beter). Een perfecte meting is niet mogelijk omdat (1) er geen volledige consensus bestaat over de outputkeuze en (2) beschikbaarheid van gegevens nog niet volledig is. Een benadering is echter wel mogelijk.

Hoofdstuk 2 geeft een aantal mogelijke modellen. Vervolgens is een gegevensomhullingsanalyse uitgevoerd om de relatieve doelmatigheid van afzonderlijke corporaties te meten. De resultaten geven aan dat corporaties, gegeven hun huidige schaal, hun kosten met gemiddeld 15 procent moeten kunnen terugdringen, zonder de output te reduceren. Deze doelmatigheidswinst wordt bereikt wanneer minder doelmatige corporaties allemaal net zo efficiënt gaan werken als de meest doelmatige corporaties. Omdat ook de meest doelmatige corporaties wellicht nog wel beter zouden kunnen presteren is de schatting dat de kosten met 15 procent omlaag moeten kunnen een onderschatting van de werkelijke besparingsmogelijkheid.

Het grote voordeel van een gegevensomhullingsanalyse is dat men altijd kan nagaan hoe een doelmatigheidsscore tot stand is gekomen. De analyse geeft namelijk aan door welke andere corporaties, de onderzochte corporatie wordt verslagen. Als een organisatie het niet eens is met de berekende score en daarvoor een gegronde reden kan geven, kan het model worden herzien. Als bijvoorbeeld corporatie A geen maximale efficiencyscore krijgt, omdat B en C het samen beter doen, kan men terugvallen op de gegevens van corporaties B en C. Het kan zijn dat de gegevens van corporaties B en C onjuist zijn, of dat deze corporaties qua omstan-

digheden toch bevoordeeld zijn ten opzichte van A. In dit geval kan hier alsnog voor worden gecorrigeerd.

Kennis omtrent de doelmatigheid van (semi-)publieke organisaties is om meerdere redenen van belang. Ten eerste kan het publiekelijk bekend maken van doelmatigheidsscores een prikkel geven om aandacht te besteden aan doelmatigheid, omdat niemand onderaan de ranglijst wil staan. Op eenzelfde manier bestaan er al ranglijsten van bijvoorbeeld gemeentelijke belastingen (zie COELO, 2015). Ten tweede, en meer drastisch, zou de overheid ervoor kunnen kiezen om de meest doelmatige instellingen (financieel) te belonen (of ondoelmatige te bestraffen). Ten derde kan informatie over doelmatigheid worden gebruikt voor vervolgonderzoek om de determinanten van doelmatigheid te achterhalen. Kennis over wat doelmatigheid drijft kan worden gebruikt om de doelmatigheid te bevorderen.

Schaal en doelmatigheid (hoofdstuk 3)

Eén van de meest in het oog springende ontwikkelingen in de corporatiesector is de fusiegolf die zich de laatste decennia ontrolde. Een logische vraag is of een fusie (of meer algemeen: opschaling) gunstig is voor doelmatigheid. Een literatuurstudie geeft aan dat het verbeteren van doelmatigheid slechts in enkele gevallen het expliciete motief was van een fusie tussen corporaties. Een positief verband tussen opschaling en doelmatigheid wordt vaak wel impliciet verondersteld.

Ons empirisch onderzoek geeft aan dat de meeste corporaties onder schaalnadelen opereren. Dit zou impliceren dat een fusie onwenselijk is, omdat het tot een lagere schaaldoelmatigheid zou leiden. De hoogste schaaldoelmatigheid wordt gemeten voor corporaties met niet meer dan 2.500 woongelegenheden (gemiddeld hebben corporaties in 2012 6.300 woongelegenheden, bijna 60 procent van de corporaties heeft er meer dan 2.500).

Echter, dit betekent niet per se dat een fusie geen positieve effecten kan hebben. Immers, een fusie zou ook een positieve invloed kunnen hebben op doelmatigheid omdat het organisaties dwingt om nog eens naar hun bestaande werkwijzen te kijken en omdat het de mogelijkheid geeft om van elkaar te leren. In dit geval zou een fusie nadelig voor schaaldoelmatigheid kunnen zijn, maar voordelig voor puur technische doelmatigheid (doelmatigheid gegeven de schaal). Voor dit effect kan echter geen robuuste onderbouwing worden gevonden. Een gegevensomhullingsanalyse geeft aanwijzingen dat fusies wel een dergelijk positief effect hebben, maar een stochastische grensmethode kan deze uitkomst niet bevestigen. Volgens deze methode blijft alleen het negatieve schaaleffect van fusies overeind.

We merken hierbij echter op dat, ook al zou er wel een positief effect zijn, dit nog geen rechtvaardiging zou hebben gegeven om te fuseren. In principe zouden beslissingen omtrent groei of krimp moeten worden genomen op basis van schaalvoordelen of -nadelen. Voor het overige zou er geen fusie nodig moeten zijn om de bestaande werkwijzen te optimaliseren: puur technische doelmatigheid zou hoe dan ook gemaximaliseerd moeten worden.

Het garantiestelsel in de corporatiesector (hoofdstuk 4)

De Nederlandse publieke sector staat bekend om haar unieke traditie van waarborgen. Zo is het overgrote deel van het kapitaal dat corporaties lenen gewaarborgd door een garantiestelsel. Als een corporatie niet zelfstandig kan voldoen aan de rente- en/of aflossingsverplichtingen, maakt het garantiestelsel dit alsnog mogelijk. Het garantiestelsel werkt als een vangnet bestaande uit drie lagen: de eerste twee lagen bestaan uit hulp tussen corporaties onderling. Als dit nog niet voldoende blijkt, zal de overheid als laatste redmiddel rentevrije leningen verstrekken.

Het doel van het garantiestelsel is om banken duidelijk te maken dat het uitlenen van kapitaal aan corporaties volledig risicovrij is. Dit zou moeten leiden tot lagere rentes. Niet alle corporatieleningen zijn echter geborgd. Om voor borging in aanmerking te komen, dient een corporatie een positief oordeel te hebben ontvangen van het Waarborgfonds Sociale Woningbouw (WSW) voor wat betreft de kredietwaardigheid. Verder kunnen alleen investeringen in Diensten van Algemeen Economisch Belang (DAEB), zoals het bouwen en onderhouden van woningen voor lage inkomensgroepen, worden gefinancierd met een geborgde lening. Bovendien zijn leningen met een looptijd korter dan twee jaar per definitie ongeborgd.

Hoofdstuk 4 vergelijkt een aantal geborgde en ongeborgde corporatieleningen met elkaar. Deze zijn allemaal verstrekt door BNG Bank: de grootste bank in Nederland die zich specialiseert in financiering van instellingen in de publieke sector. We concluderen dat de rente op geborgde leningen inderdaad significant lager is dan op ongeborgde leningen. Het verschil bedraagt zo'n 75 tot 110 basispunten. Dit betekent dat het garantiestelsel de corporatiesector zo'n 650 miljoen tot 1 miljard euro oplevert aan bespaarde rente. Als we dit vergelijken met de saneringssteun die de financiële toezichthouder (het Centraal Fonds Volkshuisvesting,

CFV) heeft verstrekt om corporaties te redden (1,5 miljard euro in 22 jaar), lijkt het aannemelijk dat de borging van leningen een positief netto resultaat heeft.[1]

In de meeste landen zijn dergelijke garanties wettelijk uitgesloten om moreel wangedrag te voorkomen. Het idee is dat organisaties die weten dat ze sowieso gered worden, zich onverantwoord gaan gedragen. Hoewel niet precies te achterhalen is in hoeverre het garantiestelsel de operationele doelmatigheid van corporaties (negatief) beïnvloedt, wordt uit bovenstaande wel duidelijk dat dit effect zeer groot moet zijn voordat het voordeel van de borging teniet wordt gedaan.

Hoewel zich serieuze incidenten in de corporatiesector hebben voorgedaan, is tot nu toe alleen de eerste laag van het vangnet (saneringssteun van het CFV) aangesproken. Hoewel sommige auteurs waarschuwen dat deze incidenten vaker zullen voorkomen als er niets verandert in de sector, roepen onze resultaten op tot voorzichtigheid met het terugdraaien van het waarborgstelsel. We concluderen dus dat het garantiestelsel tot nu toe goed functioneert. Het is aan de corporaties zelf om deze hoge standaard van verantwoordelijkheid te behouden.

De resultaten geven voorts aan dat de rente die corporaties op hun geborgde leningen betalen gemiddeld een paar basispunten hoger ligt dan de risicovrije referentierente. Een mogelijke verklaring voor deze renteopslag zou kunnen zijn dat zelfs geborgde leningen door BNG Bank niet als volledig risicovrij worden gezien. Het kan immers zijn dat de bank, ondanks het garantiestelsel, toch extra (niet terug te halen) kosten moet maken als een corporatie verzuimt te betalen. Dit zouden bijvoorbeeld juridische kosten kunnen zijn, of uitstel van betaling. Als deze kosten relevant zijn, zou men mogen verwachten dat corporaties hogere rentes betalen dan gemeenten, op gelijkwaardige leningen. Dit omdat het waarborgstelsel voor gemeenten automatisch werkt; als een gemeente in de problemen komt wordt deze door de rijksoverheid gered zonder tussenkomst van de bank (op basis van een ‘artikel 12’-procedure). Voor corporaties is de bank wél betrokken bij dit proces; dit betekent dat de bank tijd en energie moet steken in het terugkrijgen van het geld. Onze resultaten geven echter aan dat er geen significant verschil is tussen de rentes die gemeenten en corporaties betalen. Dit betekent dus dat de kredietverstrekker het stelsel voor corporaties (waarbij individuele leningen worden geborgd) als gelijkwaardig waardeert aan het stelsel voor gemeenten (die geheel geborgd zijn).

[1] Merk op dat sinds 1 juli 2015, het CFV is vervangen door de Autoriteit woningcorporaties (Aw). Hoewel financieel toezicht nu in handen is van de Aw, gaat deze niet over saneringssteun. Deze taak ligt nu bij het WSW.

Het zou ook kunnen dat de renteopslag wordt veroorzaakt doordat corporaties een (kleine) winstmarge betalen aan BNG Bank. Een dergelijke marge kan wellicht onvermijdelijk zijn, als er geen enkele andere bank een beter aanbod kan doen dan BNG Bank. Als dit niet de reden is, zouden corporaties wellicht nog iets te winnen hebben door bijvoorbeeld scherper te onderhandelen of goedkopere alternatieven te zoeken.

Huurbeleid van corporaties (hoofdstuk 5)

Zowel operationeel als financieel kennen corporaties een hoge mate van autonomie. Corporaties dienen echter wel rekening te houden met wetgeving omtrent de hoogte van de huren. Zowel het niveau als de stijging van de huur zijn gebonden aan wettelijke maxima, bepaald door de rijksoverheid. De maximale huur van een sociale huurwoning wordt bepaald door de (fysieke) kwaliteit ervan, die wordt vastgesteld aan de hand van het zogeheten Woningwaarderingsstelsel (WWS). De meeste corporaties kennen echter een huurprijs die (ver) beneden dit maximum ligt. Dit impliceert dat het WWS in de meeste gevallen niet als een sterke belemmering werkt.

Bovendien is de jaarlijkse huurstijging gebonden aan een maximumpercentage dat voor alle corporaties geldt. Alleen als een huishouden een woning verlaat, of als de kwaliteit van de woning wordt verbeterd, is een extra huurverhoging toegestaan. Corporaties kunnen huishoudens echter niet dwingen een woning te verlaten. Bovendien kan een kwaliteitsverhoging alleen met instemming van de huurder plaatsvinden en mag een corporatie volgens richtlijnen van de rijksoverheid hier niet aan verdienen. Hierdoor is het moeilijk voor een corporatie om extra opbrengsten te genereren. Echter, een corporatie zou wellicht toch kunnen proberen om een kwaliteitsverbetering in te voeren om de huur te kunnen laten stijgen.

Uit onze empirische resultaten in hoofdstuk 5 blijkt echter dat als de kwaliteit van het woningbezit van een corporatie stijgt, de huur/kwaliteit-verhouding significant daalt. Dit geeft aan dat corporaties het WWS niet blindelings volgen, maar rekening houden met kosten- en/of vraagfactoren. Immers, het verbeteren van de kwaliteit met *x%* hoeft niet per se te leiden tot een kostenstijging van *x%*. Ook kan het zijn dat een huurder niet bereid is om *x%* extra te betalen als de kwaliteit met *x%* stijgt.

We vinden ook dat een toename van de kwaliteit van het bezit, niet leidt tot een verbetering van de financiële positie van de corporatie. Dit impliceert dat corporaties geen kwaliteitsverbeteringen uitvoeren om hier winst uit te halen door de huren sterker dan nodig te laten stijgen. Corporaties lijken zich dus te houden aan de richtlijnen dat kwaliteitsverbeteringen niet tot excessieve huurverhogingen mogen leiden.

Het tweede deel van hoofdstuk 5 richt zich op de vraag of corporaties bij hun huurverhogingen rekening houden met de huurstijging van naburige corporaties. Uit de resultaten blijkt dat dit inderdaad het geval is. Hoewel een groot deel van de jaarlijkse huurstijging kan worden verklaard door de vaste jaareffecten (dus: veel corporaties blijven dichtbij de nationale trend) en het dynamische effect (dus: bij veel corporaties hangt de huurstijging in het huidige jaar deels samen met de huurstijging in het vorige jaar), vinden we ook bewijs voor een ruimtelijk effect. Dit betekent dat als de naburige corporaties hun huur verhogen, de corporatie zelf deze stijging (deels) volgt.

Vanuit de theorie zijn er twee logische verklaringen voor dit imitatiegedrag te geven, te weten 'huurdersconcurrentie' (*competition for tenants*) en 'politieke maatstafconcurrentie' (*political yardstick competition*). Het eerste principe stelt dat een corporatie de huur niet te ver boven die van de 'buren' kan laten uitstijgen omdat het risico bestaat huurders te verliezen die dan een goedkoper alternatief in de regio weten te vinden. Als dit het geval is, zouden we een sterker interactie-effect verwachten voor corporaties met een lage marktmacht (of laag marktaandeel), omdat voor deze groep de dreiging van het verliezen van huurders groter is dan voor corporaties met een dominante marktpositie. Verrassend genoeg vinden we een tegengesteld effect: juist corporaties met hoge marktmacht kennen een sterker imitatiegedrag. Dit betekent dat de 'huurdersconcurrentie'-hypothese verworpen moet worden.

Het tweede principe geeft aan dat als de raad van bestuur van een corporatie een huurverhoging voorstelt, dit op weerstand kan rekenen van huurdersorganisaties of de raad van toezicht, als de buurcorporaties hun huur niet verhogen. Dit is het geval omdat de huur van de eigen corporatie zal worden vergeleken met de huur van naburige corporaties als een soort prestatiemaatstaf. Als het bestuur een huurstijging voorstelt die (aanzienlijk) hoger ligt dan de stijging in de rest van de regio, heeft men dus wat uit te leggen. Als politieke maatstafconcurrentie de drijvende kracht achter imitatie-gedrag is verwachten we een sterker ruimtelijk effect voor corporaties met slechts een paar buren dan voor corporaties met veel buren, omdat in het eerste geval het gemakkelijker is om een maatstaf te vinden. De resultaten geven echter

een tegengesteld resultaat: het ruimtelijke effect is juist (iets) sterker voor corporaties met veel buren. Het verschil tussen de twee groepen is echter niet altijd significant. Bovendien blijkt dat als we de ruimtelijke analyse aanpassen (door de 'ruimtelijke gewichten matrix' te definiëren op basis van afstanden in plaats van de vijf dichtstbijzijnde corporaties als buren te zien), de verwachtte resultaten wel uitkomen. Het bewijs is dus gemengd.

Met eenzelfde redenering zou men een sterker ruimtelijk effect verwachten voor corporaties met een sterk geconcentreerd bezit (dus: die slechts in één of een paar regio's actief zijn) vergeleken met corporaties met een meer gespreid bezit. Waarschijnlijk is het in het eerste geval namelijk gemakkelijker om een maatstaf te vinden om de eigen corporatie mee te vergelijken. Als we de corporaties opsplitsen op deze manier vinden we inderdaad dat het imitatie-effect sterker is voor de eerste groep corporaties. Dit zou aangedragen kunnen worden als bewijs voor maatstafconcurrentie. We merken echter wel op dat de resultaten niet robuust zijn voor alle manieren van opsplitsing. We concluderen dus dat corporaties elkaars huurverhogingen imiteren, maar de reden hiervan blijft deels onzeker.

Mogelijk vervolgonderzoek

Lange tijd kwam empirisch onderzoek naar woningcorporaties bijna niet voor. Gelukkig is daar de afgelopen jaren verandering in gekomen. Conclusies gedeeld door meerdere auteurs vormen een meer solide fundament dan een eenmalig onderzoek. Hopelijk blijven onderzoekers voortbouwen op dit werk.

Dit proefschrift heeft getracht een raamwerk op te zetten van waaruit een doelmatigheidsmeting kan worden opgezet, en zelf ook een meting uitgevoerd. De accuratesse van een dergelijke meting is sterk afhankelijk van de beschikbaarheid van voldoende en goede gegevens. Daarom is het van groot belang dat benchmarkgegevens op een systematische manier verzameld blijven worden.

Doelmatigheidsscores kunnen nuttig zijn om corporaties inzicht te geven in hun relatieve prestaties. Ook kunnen de scores worden gebruikt om determinanten van doelmatigheid op te sporen. Er zijn vele mogelijke determinanten van doelmatigheid. Dit proefschrift heeft zich gericht op het effect van opschaling en fusies; vervolgonderzoek zou zich op andere potentiële determinanten kunnen richten. Mogelijke determinanten zijn marktmacht, de mate van

concentratie van het bezit, financiële positie en verschillende kenmerken van de interne organisatie (zoals de organisatiestructuur, kenmerken van bestuurders, tevredenheid van werknemers met managers, etc.). Om een beter begrip van mogelijke leereffecten van fusies te krijgen kunnen case studies wellicht een uitkomst bieden: zijn er situaties waarin fusies leiden tot een herziening van bestaande praktijken en krijgt doelmatigheid daarbij aandacht?

Het onderzoek naar het garantiestelsel zou aan kracht kunnen winnen door verdere data-uitbreiding. Het huidige onderzoek richt zich op leningen van één bank, terwijl corporaties ook aanzienlijke sommen bij andere banken lenen. Ook is het aantal onderzochte lange-termijn ongeborgde leningen beperkt, waardoor het effect van het garantiestelsel op de betaalde rente nog niet volledig geïsoleerd kan worden.

Ten slotte zou nader onderzoek gewenst zijn om de oorzaken van imitatie-gedrag voor wat betreft huurverhogingen te achterhalen.

Behalve de kwesties die in dit proefschrift aan de orde zijn gekomen, zouden er ook nog andere onderzoeksterreinen verkend kunnen worden. Een mogelijke onderzoeksvraag is in hoeverre de institutionele inrichting van de Nederlandse woningmarkt de inkomens- en welvaartsverdeling beïnvloedt. Welvaart wordt direct herverdeeld van rijk naar arm door middel van de huurtoeslagen, maar er is ook een indirect effect omdat ook het aanbod van woningen (in het verleden) is gesubsidieerd. Woningcorporaties gebruiken immers (deels) publieke middelen om hun taken te vervullen en beïnvloeden de toewijzingen van huishoudens en de huur die men betaalt. Als bepaalde types huishoudens zodoende indirect bevoordeeld worden, heeft dit invloed op de uiteindelijke verdeling van welvaart in de samenleving.

De Nederlandse sociale woningmarkt kent een uniek institutioneel ontwerp, vergeleken met andere landen. Meer kennis over de voordelen en knelpunten van het Nederlandse systeem kan ook buitenlandse onderzoekers en politici waardevolle informatie geven. Bij het heroverwegen van de huidige situatie dienen we ervoor te waken dat we het kind niet met het badwater weggooien. In de woorden van Priemus (2003); men kan niet zomaar een herziening van de sociale woningmarkt voorstellen, omdat we in de huidige situatie “onder-geïnformeerd zijn over de doelmatigheid van woningcorporaties” (p. 269). Gandhi zou hier waarschijnlijk aan toevoegen: “Slechts diegene mag iets slopen, die iets beters kan bouwen.”