Public Management Reforms in Norwegian Higher Education Institutions

An Exploratory Study of the Relation Between Perceived Academic Freedom, Types of Institutions and Academic Performance Indicators

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Abstract

This thesis is an exploratory study of the relation between implementation of public management (PM) reforms and the level of perceived academic freedom. Both at the institutional and the individual level. Academic freedom functions as an assurance for the discovery new ideas and production of well founded knowledge that is not influenced by external factors (Shils, 1997, p. 154). The implementation of PM reform sparked a debate concerning the tension between the authorities right control and the autonomy of public organizations, in the 1980s (Christensen, 1991, p. 74). Even so, the relation between perceived academic freedom and PM reform within higher education institutions is still unclear.

Based on the literature we identified two specific performance measures with a potential relation to the level of perceived academic freedom (Aagaard, 2015; Aberbach & Christensen, 2018, p. 502). Following this, we selected two perspectives of organizational theory to be applied in this thesis: organization culture and isomorphism (Christensen et al., 2007; DiMaggio and Powell, 2010). Based on the theoretical perspectives, two dimensions of influence for perceived academic freedom were identified: performance and evaluations measures and organizational actors.

To measure variation at the institutional level the institutions were divided into four categories, based on the potential for influence of PM reform (Christensen et al., 2007). We found that the overall level of perceived academic freedom varied across types of organizations. Furthermore, that there is a relation between the level of perceived academic freedom at the individual level and publication rate.

These findings can partly be explained by viewing higher education institutions as taking part of an ongoing isomorphic process (DiMaggio & Powell, 2010). Where variation is caused by the difference in isomorphic pressure for implementation of changes that affect each dimension of influence. However, our findings also points towards the importance of culture but related to scientific fields rather than institutions. Especially related to the division between hard and soft sciences (Biglan, 1973, pp. 201-202).

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Any and all mistakes remain my own.

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Chapter 1

Introduction

In this thesis we will look closer at changes in management within the public sector and how these may influence those who work within it.

The bureaucratic structure has dominated the public sector for decades. This structure was first described by Weber as an organizational structure with six cacteristics: (1) hierarchical structure, (2) work activities are based in fixed rules, (3) separation from the private sphere in relation to resources and demands for documentation, (4) employees with expert training, (5) employment is a full time career and (6) governing is based on stable rules (Weber, Roth & Wittich, 1978, pp. 956-958). This structure aimed at providing stability and security for citizens but in practice it also resulted in stringent rules (Bromley & Meyer, 2015, pp. 10-11). Which in some contexts were inapplicable and caused lengthy decision processes (Bromley & Meyer, 2015, pp. 10-11). In spite of this, it continued to be the dominant structure for organizing the public sector for several decades.

However, during the 1970s and the beginning of the 1980s something changed and the debate regarding the structure of the public sector grew more salient (Christensen, Egeberg, Larsen, Lægreid & Roness, 2010, p. 35). With a specific focus on the potential for increased productivity and efficiency (Christensen et al., 2010, p. 74). The consequence was a shift from bureaucracy to organization because organizations were perceived as "more responsive, flexible, efficient, autonomous and accountable" (Bromley & Meyer, 2015, p. 11). This lead to a reform wave in most western countries labeled New Public Management (NPM), which aimed at transforming the public sector from bureaucracies to organizations (Bromley & Meyer, 2015, p. 12).

In Norway the start of this wave can be traced back to the introduction of Management by Objectives (MBO) in the entire public sector in 1987 (Christensen, 1991,

p. 11). MBO entailed that every public organization should develop precise goals and report back to public authorities about the achievement of these goals (Christensen et al., 2010, p. 74). This would enable public authorities to reward or punish organizations according to their goal achievement (Christensen et al., 2010, p. 74) Haga-utvalgets view was that this form of management would result in increased freedom and productivity in the public sector (NOU 1984: 23, pp. 6-7). However, while MBO gave the organizations increased control over their resources it also created a detailed report system which constrained the ability of each organization to distribute the money as they saw fit (Christensen et al., 2010, p. 74). The result, was a spark in the debate concerning the tension between the authorities right to control and the autonomy of public organizations (Christensen et al., 2010, p. 74).

Furthermore, this debate had a special relevance for parts of the public sector that can be characterized as professional bureaucracies (Christensen, 1991; Mintzberg, 1983). In professionalized bureaucracies, individual autonomy is granted because of a complex work environment, which makes supervision difficult for other groups than the professionals themselves (Mintzberg, 1983, pp. 189-190). Organizations within higher education are characterized as professional bureaucracies because of the autonomy granted to the academics within these institutions (Mintzberg, 1983, p. 189). This autonomy is described as academic freedom and can be defined as consisting of three parts: (1) the freedom to ask questions, (2) the freedom to decide what material and methods one wishes to use to find answers and (3) the freedom to present hypothesis, results and reasoning to the public (NOU 2006: 19, p. 14). As such, the specific concern related to the implementation of MBO was that the market logic embedded in MBO disregarded the importance of academic freedom (Christensen, 1991, p. 55). That the process of doing research would become more bureaucratic and the free and liberal environment needed to do proper research would be constrained (Christensen, 1991, p. 55).

Since the 1980s, several other reform initiatives have been implemented as a part of NPM (Kirke-, utdannings-, og forskningsdeparementet, 1991, 2001; Universitets- og høgskolerådet, 2004). Consequently, the debate on possible consequences of public management reform for academic freedom has not lost relevance. In light of this, we therefore ask how academics today perceive their academic freedom and look further into possible relation between the level of academic freedom and the specific measures implemented by public management reforms.

How we will proceed to answer this question is outlined at the end of this chapter. First, we focus is on what academic freedom is and why it is important. Second, we place this thesis in the context of literature and formulate research questions.

1.1 What is Academic Freedom and Why is it Important?

We have provided a definition of academic freedom. Retrieved from an Official Norwegian Report from 2006 (NOU 2006: 19). The commission behind the report had a mandate to evaluate the relationship between the higher education institutions need to steer their employees and the rights of the academics (NOU 2006: 19, p. 7). We selected this definition because we study academic freedom in a Norwegian context and it led to amendments in the University and University Colleges Act section 1-5 (University and University Colleges Act, 2005).

However, there is no clear agreement on the definition of academic freedom. From a historical perspective, Altbach (2001, p. 206) traces academic freedom back to the rise of the Humboldtian university and the ideas of "Lehrfreiheit and Lernfreiheit – the freedom to teach and to learn". These rights enabled academics to "pursue truth" in their teaching and research, and as time passed they became a fundamental part of the academic profession (Altbach, 2001, p. 206). In more recent times, Shils (1997, p. 155) defined academic freedom as: "an immunity from decisions about academic matters taken on other than academic or intellectual grounds, by academic, governmental ecclesiastical, or political authorities". Furthermore, The Global Colloquium of University Presidents (2005) defined academic freedom as: "the freedom to conduct research, teach, speak, and publish, subject to the norms and standards of scholarly inquiry, without interference or penalty, wherever the search for truth and understanding may lead". The definitions differ in terms of what aspects of academic work they include. Even so, there is a common ground. Academics should be able to go where their research leads them without fear of interference.

In this thesis, we do not aim to look further into what academic freedom should be or what the most appropriate definition would. The paragraph above aimed to highlight the diverging views on and definitions of academic freedom. In addition, we are not able to study academic freedom from an objective point of view. We are limited the academics subjective perception of academic freedom. This is referred to as *perceived academic freedom*. Therefore, the term academic freedom only refers to the objective concept, as defined in the introduction.

Following the reflections on the definitions of academic freedom, the next step is to understand why it is important. To do this, we must understand the environment in which it exists.

Shils (1997, p. 153) view academic freedom as important because it functions as an

"assurance that new ideas would be discovered, that sound old ideas would be appreciated in an a more critical way, and that unsound ones would be discarded". As such, it is fundamental in securing that the knowledge produced in society is based on a search for the truth and not a product of influence from external factors (Shils, 1997, p. 154). This leads to a university that can be described as a "rule-governed community of scholars" (J. P. Olsen, 2007, p. 29). Over time, students and staff are also incorporated in the governing of universities, making the success of universities a product of internal cooperation (J. P. Olsen, 2007, p. 32). The incorporation of these groups are justified by their contribution to increased competence and the role of universities as promoters of democracy in society as a whole (J. P. Olsen, 2007, p. 32).

The main challange to academic freedom arise when universities become an "instrument for shifting national political agendas" (J. P. Olsen, 2007, p. 32). In this situation, knowledge is valued in terms "immediate utility and applicability", in relation to the current political agenda (J. P. Olsen, 2007, pp. 29-31). For the individual academic this would result in a move away from the academic role towards a role of the traditional civil servant. Because a limited academic freedom indicate that they need to take more care in considering the "output" of their work, in contrast to basing their work on "beliefs or values underpinning professional work" (Harris, 2005, p. 425).

Consequently, that the level of perceived academic freedom relates to external factors would indicate a shift both in how we understand the role of the academic and higher education institutions.

1.2 Literature and Research Questions

In this thesis, we consider academic freedom in the context of public management reform within higher education institutions. To formulate specific research questions we need to look at the literature on such reforms and the possible consequences for academic freedom. However, we also need to define and understand what public management reform entails. Pollitt and Bouckaert (2004, p. 8) defines public management (PM) reform as: "deliberate changes to the structures and processes of public sector organizations with the objective of getting them (in some sense) to run better". In general, PM reforms aim at: "making savings (economies) in public expenditure, improving the quality of public services, making the operations of government more efficient, and increasing the chance that the policies which are chosen and implemented will be effective" (Pollitt & Bouckaert, 2004, p. 6). Consequently, the success of a PM reform is dependent on the achievement of this goal.

Hood (1995) views New Public Management (NPM) as one of the most influential reform-waves within the category of PM reform. The private sector inspired NPM, and the reform-wave represented a desire to decrease the differences between the public and private sector (Hood, 1995, p. 94). By implementing "a different conception of public accountability, with different patterns of trust and distrust and hence a different style of accountingization" (Hood, 1995, p. 94). According to Power and Laughlin (1992, pp. 116-120), the change in the style of accountingization describes the transition in how accouting is applied as a method: from a method use to measure variables against a objective reality to accounting as a method for measuring humans and their work. This results in a shift of accountability, from accountability over the process to accountability for results (Hood, 1995, p. 94). In sum, this means that public servants and professionals are not trusted to the same degree as before (Hood, 1995, p. 94).

As such, there are some common overreaching principles that characterizes NPM reforms (Hood, 1995; Pollitt, 2007). Leading to the description of NPM as a global trend because of its influence on public sectors across the globe (Christensen & Lægreid, 2001c; Pollitt, 2007; Sahlin-Andersson, 2001). However, when reforms are implemented in one single country the ideas inherit in the reform are also transformed through the process of implementation, which means that the "content, shape and scope of such reforms differ" (Sahlin-Andersson, 2001, p. 48). This belief is also reflected in the literature which emphasize that the specific implementation and the degree of implementation varies between countries (De Vries & Nemec, 2013; Greve, 2006; Hood, 1995; Pollitt, 2007). As a consequence, there is a need to narrow the scope and look further into the development of NPM within Norway.

In the literature, Norway is viewed as a reluctant reformer (Sahlin-Andersson, 2001, p. 43). While other countries initiated and implemented NPM reforms partly because of financial difficulties, this did not affect Norway to the same degree (Christensen & Lægreid, 2001a, p. 95). As a result, the need for change was not so severe and reforms were implemented at a later point in time, motivated by the potential for increased efficiency rather than financial viability (Christensen & Lægreid, 2001a). Furthermore, Norway has a strong tradition for ministerial responsibility which causes a pluralism in structure between sectors (Christensen & Lægreid, 2001b, pp. 305-306). This makes it difficult to recognize the entire public sector in Norway as one entity and causes reform implementation to be highly dependent on the initiative of each ministry (Christensen & Lægreid, 2001b, pp. 305-306). As such, Norwegian reform programs are often described as "a loose collection of ongoing reform measures and new reform ideas" rather than "a consistent, co-ordinated and unified strategic plan for changing the administrative apparatus" (Christensen

& Lægreid, 2001b, p. 305). Therefore, we should focus on the specific changes in management and the consequences of these within higher education institutions.

As in the rest of the public sector MBO was implemented in 1987 (Christensen, 1991). This was followed by a merger of 96 higher education institutions into 28 in the 1990s (Kirke-, utdannings-, og forskningsdeparementet, 1991). In 2002-2003 a new reform named "The quality reform" was implemented (Bleiklie, Lægreid & Wik, 2003, p. 25). This reform opened up for a voluntary transition to appointed leadership at the departmental level of the institutions (Dordrecht: Larsen, 2003, p. 71). Furthermore, it revised the funding system so that one part of the funding is decided by the institutions performance on several indicators (NOU 2000: 14, p. 31).

These reform initiatives are dependent upon implementation by the institutions they concern. As a result, there are several contributions in the literature on this subject. Christensen (1991, p. 13) investigated the effects of implementation of MBO at the institutional level and was interested in whether MBO was implemented as a shell of legitimacy or if it had real organizational consequences for the institutions. His findings indicate that the new system had been adopted by the institutions but that the overall effects of the new system were weak (Christensen, 1991, p. 108). In addition, he finds that the degree of adoption varied between the four cases (Christensen, 1991, p. 109). Stensaker (2006) looked into how political pressure for change affected higher education institutions in the period from 1990 to 2000. He concludes that reform initiatives can be difficult for higher education institutions to dismiss and that this results in an translation of the "organisational ideals" of the reform initiatives (Stensaker, 2006, p. 54). Which leads to diverse implementation outcomes (Stensaker, 2006, p. 54). Furthermore, Massen, Moen and Stensaker (2011, p. 492) argue that implementation within higher education institutions is dependent upon the degree of communication between policy-makers and the institutions. Lack of communication increases the risk of fragmented implementation of new initiatives (Maassen et al., 2011, p. 492).

To summarize, the literature on public management reform within higher education institutions indicate a varying degree of implementation. However, there lacks a connection between this finding at the institutional level and the potential consequences at the level of the individual academic. In terms of the potential for a variations in the influence of these reforms for academics within different types of higher education institutions. The first research question aim to explore this:

> **RQ 1: Is there a variation in perceived academic freedom for academics within different types of higher education institutions in Nor-**

way?

As a result, the first research question draws a line between how academics today perceive their academic freedom and the degree of reform implementation at the institutional level. However, the aim of this thesis is also to consider the possible relation between the level of perceived academic freedom and measures implemented as a result of these reforms. Therefore, there is a need to shift the focus from implementation to the specific measures implemented as a result of the reforms and their possible influence.

Bleiklie et. al (2003, p. 35) emphasize that that the reforms within higher education institutions led to a shift "from rule production and rule adherence to goal formulation and performance control". Because the reforms introduced and enhanced steering through performance indicators (Bleiklie et al., 2003, p. 30). Consequently, rather than steering according to projections and forecast of the development, steering is based on *ex post* evaluation of goal achievement (Bleiklie et al., 2003, p. 25).

In general, this shift is viewed having the potential to limit academic freedom (Aberbach & Christensen, 2018; Altbach, 2001; Christensen, 2011). Christensen (2011, p. 515) argues that the consequence of increased exposure for control systems and strengthened management within higher education institutions is a decreased emphasis on "the academic-professional autonomy". Furthermore, Altbach (2001, p. 216) views changes in management as one of the biggest more subtle threats to academic freedom in Western Europe. Because the restrictions are "built into the academic and political system" (Altbach, 2001, p. 211).

At the same time, Karran (2015) finds that a large part of academics in Norway (36,9 percent) agree that their academic freedom has declined in recent years (Karran, 2015). Additionally, only 31 percent of academics in Norway answered "yes" when they were asked if their administration supported academic freedom (Teichler, Arimoto and Cummings, 2013, pp. 18, 185). The average across countries was 46 percent (Teichler et al., 2013, p. 185). This is a large difference, but a different interpretation of administration in Norway compared to the other countries in the survey might be the reason (Teichler et al., 2013, p. 185).

Even so, little attention is devoted to studying the relation between academic freedom and the performance indicators that are a consequence of the shift, described above. Aberbach and Christensen (2018, p. 502) argues that increased reliance on external resources among academics may lead to more politicized research, and therefore challenge academic freedom. Furthermore, a study looking into the use of the Norwegian publication indicator and its relation to local management practices

concluded that: "It takes considerable effort from both systems designers and institutional leaders to prevent these types of quantitative measures to trickling down and affecting local management practices and ultimately individual behaviour in unintended ways" (Aagaard, 2015, p. 736). Consequently, there is a potential for a relation between perceived academic freedom, publication and source of funding. As a result, this is our second research question:

> **RQ 2: How is the individual perception of academic freedom related to publication rate and source of funding?**

Publication rate and source of funding are selected as the specific measures to look into because they represent a clear result of the shift in management and evaluation practices described by Bleiklie (Bleiklie et al., 2003, p. 25). In addition to, the potential relation to perceived academic freedom found in the literature (Aagaard, 2015; Aberbach & Christensen, 2018, p. 502).

1.3 Research Design

The research design of this thesis is a small N case study with a within case large N design (Gerring, 2016, p. 138). Gerring (2007, p. 20) as "the intensive study of a single case where the purpose of that study is - at least in part - to shed light on a larger class of cases - (a population)". At the highest level, we are studying the influences related to implementation of PM reform. Accordingly, the larger class of the cases or the population are countries where similar reforms have been implemented. PM reforms have been implemented in various countries across the globe, such as Sweden, Australia, United Kingdom, the US, New Zealand and Norway (Christensen & Lægreid, 2001c; Pollitt, 2007). For this reason, we need to answer the question of why was Norway selected as a case.

There are various strategies available for case selection but cases are often selected because they have a feature that makes them a bit different from the rest of the population (Gerring, 2007, p. 20). What the distinctive feature of a case should be depends on what we are theoretically interested in (Gerring, 2007, p. 88). In the literature review we established that Norway is seen as a reluctant reformer (Sahlin-Andersson, 2001, p. 43). With a different main motivation for PM reform (Christensen & Lægreid, 2001a, p. 95). Subsequently, this is the distinctive feature that separates Norway from the rest of the population.

Following this, we applied a crucial case strategy for case selection (Gerring, 2007, p. 116). Within this strategy we can describe Norway as a least-likely case because of the distinctive feature (Gerring, 2007, p. 116). The logic behind this choice is

that if we find support for our research questions within this case, it is increasingly probable that these can be found within the population (Gerring, 2007, p. 116).

The large N within case part of this design will be based on cross-sectional survey data (Bryman, 2016, p. 53). This allows us go within the case and identify sub-units and the findings from these sub-units "is likely to provide vital information for the main argument, pitched at the level of the primary case" (Gerring, 2016, p. 140).

1.4 Delimitations

This thesis is an exploratory study of the relation between implementation of PM reforms and perceived academic freedom. The data applied to study this relation is cross-sectional, which means that it was collected a one point in time (Bryman, 2016, p. 53). Therefore, by applying this data in a study of this relation, we accept that causality cannot be determined.

However, this relation has not been studied at length in a Norwegian context previous. As such, this exploratory study could still provide meaningful insight by considering the historical development in combination with theory. Because it enables formulations of expectations that can be evaluated based on the data we have.

It also recognized that there is a growing literature in Sweden regarding this relation that is not considered in this thesis (Sahlin & Eriksson-Zetterquist, 2016). Because the development of an quantitative measures for perceived academic freedom is given priority. Additionally, the Swedish context would have needed further exploration for this literature to be considered.

1.5 Outline

The research design of this thesis demands the formulation of clear expectations that can be considered by the data we have. The next chapter, aims at developing these expectations. Based on the historical development of higher education institutions and theory.

Chapter 3, focuses on methods, data and operationalization. The implications of case selection are considered. The concepts of reliability and validity are outlined and applied to the discussion of data quality. A measure for perceived academic freedom is developed and the independent variables are operationalized. Relevant control variables are also identified.

Chapter 4 contains the analysis. The first part of this chapter is devoted to im-

portant considerations related to index construction for the measure of perceived academic freedom. Before we continue with an analysis of variation, related to the first research question. Followed by regression analysis, which aims at providing an answer to our second research question. The findings of the analysis are discussed in chapter 5.

Chapter 6 summarizes the key findings of this thesis and concludes on the contribution, limitations and implications beyond this case. Finally, avenues for further research are explored.

Chapter 2

Background and Theory

In the introductory chapter we developed research questions based on the literature on PM reform within higher education institutions. The aim of this chapter is to connect information about the development of higher education institutions to a theoretical framework which enables us to formulate expectations for findings in the analysis. To do this we will first look into the historic development of the higher education institutions and the structure of the research oriented part of the result-based funding scheme. Second, we will look closer at the theoretical framework. Finally, expectations for findings in the analysis will be formulated.

2.1 Background

2.1.1 Historic Development

From the introduction it is clear that higher education institutions have a long history, the first university in Norway was founded in 1811 (Maassen et al., 2011, p. 483). However, to limit the scope of this overview we focus on the period after 1980 until today and provide only a brief overview of the situation before this point. The reason, is that the 1980s marked a turning point in the history of higher education institutions because it is seen as the start of the project of reforming the institutions within this sector (Bleiklie & Michelsen, 2017; Kyvik, 2008; Maassen et al., 2011).

At the beginning of the 20^{th} century there was only one university in Norway and a few scientific university colleges, only after the second world war were new universities established (NOU 2020: 3, p. 48). In the 1970s the student mass increased rapidly and there developed an increasing need for new jobs in all regions of the country (NOU 2020: 3, p. 48). This lead to a decentralization of higher education with the establishment of district vocationally-oriented university colleges (NOU

2020: 3, p. 48). As such, the higher education system was now a binary one, with a division between universities and university colleges (Maassen et al., 2011, p. 483).

When the reform movement started in the 1980s the goal was to turn higher education institutions "instruments of economic growth" (Maassen et al., 2011, p. 484). To achieve this MBO was implemented in the sector in 1987 (Maassen et al., 2011, p. 484). This entailed a delegation of autonomy to the institutions and a strengthening og internal leadership, both collegial and administrative (Maassen et al., 2011, p. 484). The leadership was strengthened by implementing the new tools that followed the implementation of MBO, such as activity planning and incentive policies (Maassen et al., 2011, p. 484). The consequence, was an increased focus on evaluation and control within the sector (Maassen et al., 2011, p. 484).

At the end of the 1980s and beginning of the 1990s it became apparent that the decentralized structure of higher education institutions had led to a fragmented system with little cooperation (Maassen et al., 2011, p. 484). There was also a growing belief that unifying these institutions would lead to increased efficiency in terms of cooperation, a more efficient spending of resources and a raise of quality in research production (Kirke-, utdannings-, og forskningsdeparementet, 1991, pp. 16, 32). This led to a merger of higher education institutions in the early 1990s, and 96 institutions were reduced to 28 (Kirke-, utdannings-, og forskningsdeparementet, 1991, p. 16). Following this merger, a common law for all higher education institutions was passed in 1995 (NOU 2020: 3, p. 52).

In 1998 a public committee was appointed that lead to a new reform of the higher education sector and its institutions (NOU 2020: 3, p. 54). "The quality reform" was implemented in 2002-2003 and continued to focus on a increased quality and efficiency (Bleiklie et al., 2003, p. 30). This reform opened up for the possibility of appointed rather than elected heads of department (Dordrecht: Larsen, 2003, p. 71). Although, this is a voluntary arrangement the idea was to give the head of department more power and thereby giving them "sufficient means to promote excellence in research" (Dordrecht: Larsen, 2003, p. 71). It also implemented a common degree structure across institutions (Kirke-, utdannings-, og forskningsdeparementet, 2001, p. 21). Furthermore, this reform revised the funding scheme so that one part of the funding is decided by the institutions performance on several indicators (NOU 2000: 14, p. 31). Only minor changes have been made to the result-based funding scheme since the implementation (Kunnskapsdepartementet, 2015a, p. 59). However, in 2015 plans were released to increased the part of the funding that is result-based, to further improve performance (Kunnskapsdepartementet, 2015a).

Following this overview of the historic development of the higher education sector we

will continue by outlining the specific parts that of the result-based funding scheme, that we are focusing on in this thesis.

2.1.2 Result-Based Funding

All research oriented performance indicators in the result-based funding scheme are a part of the closed funding for higher education institutions (Kunnskapsdepartementet, 2015b, p. 281). This means that the amount of funding each institution receives is decided by that institutions performance on these indicators, compared to the performance of the other higher education institutions (Kunnskapsdepartementet, 2015b, p. 281). In 2017, 10.7 billions, of the total funding of 34.4 billions for higher education institutions, was result-based (Kunnskapsdepartementet, 2016, pp. 47-48).

Two of the performance indicators measures the amount of funding each institution has received from external sources (Kunnskapsdepartementet, 2015b, p. 281). The first, measure the amount of funding received from the Research Council of Norway and regional research funds (Kunnskapsdepartementet, 2015b, p. 281). The second, the amount of funding recieved from the EU research program Horizon Europe (Kunnskapsdepartementet, 2015b, p. 281). Consequently, the future funding based on these indicators is decided by each institutions amount of external funding received, compared to the amount of the other institutions (Kunnskapsdepartementet, 2015b, p. 279-283). Furthermore, In 2017 a new indicator measuring the amount of contract research was also introduced (Kunnskapsdepartementet, 2015b, p. 282).

A fourth performance indicator concerns scientific publications (Kunnskapsdepartementet, 2015b, p. 281). For a publication to be considered a scientific publication it must:

1. present new insight;

2. be presented in a form that allows the research findings to be verified and/or used in new research activity;

3. be written in a language and have a distribution that make the publication accessible to most interested researchers;

4. appear in a publication channel (journal, series, book, publisher, website) that has routines for external peer review (The Norwegian Association of Higher Education Institutions, 2004, p. 12).

However, the total number of scientific publications within each institution is not measured directly. Following the implementation of the result-based funding a new

publication indicator, called "Tellekantsystemet", was developed (Sivertsen, 2009). This new publication indicator was intended to measure research activity for each institution as a whole (Sivertsen, 2009; Universitets- og høgskolerådet, 2004, p. 59). To achieve this the new publication indicator awarded "publication points" for publications according to type of scientific publication (The Norwegian Association of Higher Education Institutions, 2004, p. 8). Furthermore, since introduction of such systems in other countries had led to increased publishing in what was perceived as poorer journals and increased frequency in publishing at the cost of quality, publication channels were divided into two levels (Universitets- og høgskolerådet, 2004, p. 37). Consequently, publications at level 2 is more highly awarded and gives more publication points than publications at level 1 (Universitets- og høgskolerådet, 2004, p. 38). Because level 2 publications are seen as holding a higher level of quality and originality (Universitets- og høgskolerådet, 2004, p. 38). As a result, the total number of publication points for each institution is a combination of the type of scientific publications and the level at which they are published (Universitets- og høgskolerådet, 2004).

To summarize, the result-based funding system measures several aspects of the research activity within higher education institutions with the purpose of creating incentives for increased quality in research and to further enforce this by giving those who deliver good results increased funding (Kunnskapsdepartementet, 2015b, p. 281).

Since we now have an overview of the historic development of higher education institutions and the result-based funding system, we can turn our attention to the second part of this chapter, which is theory.

2.2 Theory

A Theoretical framework enables us to formulate expectations based on our two research questions. The choice of theoretical framework depends on what we are studying. In this thesis, we are trying to understand how organizations responds to changes in their external environment and how this response affects the individuals within it. Organizational theory therefore seems appropriate, because it connects individual factors and organizational conditions (Christiensen, Lægreid, Roness, and Røvik, 2007, p. 2). Within organizational theory there are different perspectives and we will look closer at two of them: isomorphism and organization culture.

However, before we turn to the theoretical perspectives, we need to clarify the use of two terms: organizations and higher education institutions. Organizations can be

defined as "social units or groups of people which are constructed with the purpose of realizing specific goals" (Etzioni, 1978, p. 11). Accordingly, this is what we refer to when the term "organization" is used. Higher education institutions also falls within this definition because they are units established to realize a specific goal: producing knowledge and educating the population (Frølich et al., 2014, p. 16). Consequently, the term organization refers to all organizations in general, while higher education institutions refers to organizations where the goal is to produce knowledge and educate the population.

Following this, we continue with outlining the theoretical perspectives.

2.2.1 Two Perspectives on Isomorphism

In general, isomorphism is used to describe a process "that forces one unit in a population to resemble other units that face the same set of environmental conditions" (DiMaggio & Powell, 2010, p. 149). This means that over time organizations within the same environment will become increasingly similar. Both Meyer and Rowan (1977) and DiMaggio and Powell (2010) see isomorphism as a valid process but they have different perspectives on the drivers or motivation for this process. Meyer and Rowan (1977) believe that responses to the external environment by the organization is driven by a desire to increase legitimacy and the chances of survival, while maintaining the same level of efficiency. DiMaggio and Powell (2010, p. 147), on the other hand, contend that the time when these elements drove organizational change has passed and that change is now driven by "processes that make organizations more similar without necessarily making them more efficient". These different motivations for isomorphism in turn has consequences for how they believe th organization reacts to changes in the external environment (DiMaggio & Powell, 2010; Meyer & Rowan, 1977). To start we will begin with Meyer and Rowan (1977) and the myth perspective on isomorphism.

The Myth Perspective

According to Meyer and Rowan (1977, p. 340), the external environment of the organizations in a given point in time consists of "practices and procedures defined by prevailing rationalized concepts of organizational work" that are institutionalized in the society. This could be everything from new policies developed by the government, production practices to management programs etc. These are referred to as myths (Meyer & Rowan, 1977, p. 347). When these myths are seen as "rationally effective" by the external environment the myths are adapted by the organizations within the same environment (Meyer & Rowan, 1977, p. 347). By adapting myths

the organization increases its value, legitimacy and possibility for expansion in relation to the external environment (Meyer & Rowan, 1977, p. 350).

However, adaption of myths does not only have positive effects. The problem with adaption of myths arise when the myths does not correspond with the technical demands for efficiency in production (Meyer & Rowan, 1977, p. 355). For instance, if adaption of a myth entails making changes to the formal structure which intertwine with or contradict the existing structures of the organization that acts efficiently (Meyer & Rowan, 1977, p. 356). A possible solution is then to not adapt these myths. Unfortunately, those organizations that chose this solution is more exposed to questions about the organizations legitimacy and the need of existence (Meyer & Rowan, 1977, pp. 349-350). In addition to a decrease in perceived efficiency (Meyer & Rowan, 1977, p. 355). As a result, Meyer and Rowan (1977, p. 356) see only one combined solution that allows an organization maintain efficiency, legitimacy and chances of survival: the logic of confidence and decoupling.

Decoupling is made possible by the logic of confidence, which is an assumption that "things are as they seem, that employees and managers are performing their roles properly" (Meyer & Rowan, 1977, p. 358). This enables the organization to be decoupled and divided into "autonomous sub units" (Meyer & Rowan, 1977, p. 358). This entails that work activities are delegated to the professionals, goals are made unclear and inspection and evaluations become a ceremonial practice (Meyer & Rowan, 1977, p. 357). Furthermore, adjustment between units in the organization becomes an informal practice, because applying the formal rules would lead to inconsistencies and a public "record of inefficiency and inconsistency" (Meyer & Rowan, 1977, p. 357).

In summary, the logic of confidence and decoupling enables organizations to "maintain standardized, legitimating, formal structures while their activities vary in response to practical considerations" (Meyer & Rowan, 1977, p. 357).

Different Forms of Isomorphism

As mentioned in the introduction to this chapter DiMaggio and Powell (2010, p. 147) describes isomorphism is a process "that make organizations more similar without necessarily making them more efficient". They argue that when organizational fields are highly structured "individual efforts to deal rationally with uncertainty and constraint often lead, in the aggregate, to homogeneity in structure, culture and output" (DiMaggio & Powell, 2010, p. 147). Subsequently, organizations within the same field will become similar or increasingly similar over time (DiMaggio & Powell, 2010).

DiMaggio and Powell (2010, p. 148) define an organizational field as: "those organizations that, in the aggregate, constitute a recognized area of institutional life: key suppliers resource and product consumers, regulatory agencies, and other organizations that produce similar services or products". A key condition for a organizational field to exist is that those actors that are a part of the field are aware of the fields existence (DiMaggio & Powell, 2010, p. 148). In addition, over time there needs to develop increased interaction within the field, coalitions or patterns of coalition and an increased information load within the field for the actors to deal with (DiMaggio & Powell, 2010, p. 148). Once the process of institutionalizing an organizational field begins, a path-dependency also emerges that makes it increasingly hard to make changes within the organizations later on (DiMaggio & Powell, 2010, p. 148). Changes may still occur after this point but they do not lead to any increased level of diversity within the field (DiMaggio & Powell, 2010, p. 149).

Another aspect of DiMaggio and Powell's (2010, p. 150) perspective, that separates them from that of Meyer and Rowan (1977), is that they differentiate isomorphism into three forms: (1) coercive, (2) mimetic and (3) normative. Each of these forms of isomorphism has different sources and we will therefore look into each of them in the following paragraphs.

The main sources of coercive isomorphism are other organizations within the field that that the organization depends on, and pressure derived from cultural expectations in the society (DiMaggio & Powell, 2010, p. 150). This could be the government or relevant government ministries who change regulations which leads to a pressure for changes in the structures and practices of organizations within the relevant field (DiMaggio & Powell, 2010, p. 151). Furthermore, it could also be less visible pressures which stems from cultural differences between an important economic donor and the organization (DiMaggio & Powell, 2010, p. 151).

While coercive isomorphism origins from some sort of authority within the field, mimetic isomorphism is caused by uncertainty (DiMaggio & Powell, 2010, p. 151). Either in the goals of the organization and how to achieve them or from the environment (DiMaggio & Powell, 2010, p. 151). The consequence of this uncertainty is that the organization looks around in the environment to find another organization to model, these organizations are often seen as legitimate and successful in the environment (DiMaggio & Powell, 2010, pp. 151-152). This process does not need to be a very conscious process or happen at the highest level of the organization, it could be the result of new employees bringing in models that have worked well in other organizations (DiMaggio & Powell, 2010, p. 151)

The last form is normative isomorphism which relates to professionalization (DiMag-

gio & Powell, 2010, p. 152). Professionalization can be defined as "the collective struggle of members of an occupation too define the conditions and methods of their work ... to establish a cognitive base and legitimation for their occupational autonomy" (DiMaggio & Powell, 2010, p. 152). This form of isomorphism then has two main sources. The first, is the group of professionals with the same occupation within the organization, they have a common educational background and can possibly have more in common with other similar professionals in other organizations than the other professionals in their own organizations (DiMaggio & Powell, 2010, p. 152). Correspondingly, their normative views on the organization and its activities is also a compromise with the normative views of "clients, bosses, or regulators" (DiMaggio & Powell, 2010, p. 152). The second is organizational professionals, such as people educated in professional management, that to an increasing degree have found their place within most organizations (DiMaggio & Powell, 2010, p. 152). These professionals contribute to the structuration of the field by ordering organizations after their status both by the transfer of professionals from one organization to another and transferring information on recognized organizations to the environment (DiMaggio & Powell, 2010, p. 153).

In sum, DiMaggio and Powell (DiMaggio & Powell, 2010) provides a nuanced view on the process of isomorphism and a description of the different sources of each type om isomorphism. They also note that all these forms of isomorphism can occur together and that although an increased internal efficiency is not necessary for this process to occur it might be a product of it (DiMaggio & Powell, 2010, p. 153). Because similarity with other organizations in their field is rewarded and it might make it easier to "transact with other organizations, to attract career-minded staff, to be acknowledged as legitimate and reputable, and to fit into administrative categories that define eligibility for public and private grants and contracts" (DiMaggio & Powell, 2010, p. 153).

These two perspectives on isomorphism are related but also different and DiMaggio and Powell's (2010) perspective on isomorphism is the perspective that will be applied in this thesis. The reason is that this perspective is more elaborated and would enable us to formulate clearer expectations based on theory. Furthermore, from Meyer and Rowan's (1977) perspective it is a bit unclear if we should expect that there will be variations between the sub units or not. Which makes it difficult to formulate expectations in either direction. The expectations based on theory can be found at the end of this chapter. For now, we will turn our attention to organization culture.

2.2.2 Organization Culture

While the two theoretical perspectives presented above focus on how the changes in the external environment shapes the organizations, we will no turn to organization culture which describes how input from the external environment is shaped by the organization (Christensen et al., 2007, p. 40). Organization culture can be defined as:

> The accumulated shared learning of that group as it solves its problems of external adaption and internal integration; which has worked well enough to be considered valid and, therefore, to be thought to new members as the correct way to perceive, think, feel, and behave in relation to those problems.
> This accumulated learning is a pattern or system of beliefs, values, and behavioral norms that come to be taken for granted as basic assumptions and eventually drop out of awareness (Schein, 2017, p. 6).

This is an extensive definition but it captures the important aspects of how an organization culture develops (Schein, 2017, p. 6). The most important aspect is the development of accumulated shared learning, this develops over time as a result of the accumulated beliefs, values and behavioral norms of the individual members of the organization (Schein, 2017, p. 6). At the individual level this can be thought of as a "logic of appropriateness" that guides the individuals within the organization in their actions based what is considered appropriate within a specific organization (Christensen et al., 2007, p. 41). For the individuals this logic of appropriateness has four main sources: (1) experience, (2) mental maps, (3) proximity in time and (4) experiences of other actors (Christensen et al., 2007, p. 41). For example, individuals could, when faced with a new situation that requires action, search for similar situations in the past that can tell them what actions that are appropriate (Christensen et al., 2007, p. 41). Furthermore, mental maps over norms and values could be an indication of what norms and values that should be prioritized in any given situation (Christensen et al., 2007, p. 41). Another option is to select norms and values to apply based on those that have been recently used (Christensen et al., 2007, p. 41). Finally, individuals can base appropriate action on how other actors have handled similar situations in the past (Christensen et al., 2007, p. 41). Eventually, the process of deciding appropriate action will become standardized and intuitive (Christensen et al., 2007, p. 42). It drops out of awareness (Schein, 2017, p. 6). The consequence of this is that members of the organization to a lesser degree seek to make rational decisions of action, rather they base their decisions on what is viewed as appropriate within the organization (Christensen et al., 2007, p. 40).

In the paragraph above, time is an important aspect because it takes time be-

fore the logic of appropriateness fully develops (Christensen et al., 2007, p. 40). However, time is not only important in this respect, it is also the foundation for path-dependency (Christensen et al., 2007, p. 45). Path-dependency refers to the fact that "the cultural norms and values that make their mark on an organization in its early and formative years will have great significance for the path of development it follows" (Christensen et al., 2007, p. 45). Consequently, an organization established in a period where there are strong norms for a hierarchical structure will be influenced by this both at the point in time for establishment and at later points in time, because this is the starting point for the development of the organization culture (Christensen et al., 2007, p. 45).

A consequence of the path-dependency is that it makes organizations harder to change but it also provides a stability and "depth in values and norms" that is hard to achieve if the organization changes too often (Christensen et al., 2007, p. 46). Stability makes it easier for members of the organization to maneuver within it and decide appropriate action more efficiently (Christensen et al., 2007, p. 46). A drawback is that this leads to low flexibility in the culture which makes it increasingly hard to change (Christensen et al., 2007, p. 46).

In summary, organization culture is something that develops over time through an evolution like process (Christensen et al., 2007, p. 43). The organization adapts to both external and internal pressure but because this adaption is unintended and unplanned it hard to predict how changes in the external environment of the organization will influence each organization (Christensen et al., 2007, p. 43). However, it creates organizations with their own distinct culture (Christensen et al., 2007, p. 43).

2.3 Expectations

This section of the chapter aims to connect the two previous parts and formulate expectations of findings for the two research questions. To start, we first consider the implications of applying DiMaggio and Powell's (2010) perspective on isomorphism to the context of higher education institutions.

DiMaggio and Powell (2010, pp. 147-148, 150–153) argue that if an organizational field is highly structured the organizations within it becomes increasingly similar if these three conditions are present: (1) dependence, (2) uncertainty and (3) professionalization. These conditions are derived from the sources of the different forms of isomorphism (DiMaggio & Powell, 2010, p. 150-153). Furthermore, an organizational field only exists if the organizations within it are aware of the fields exis-

tence, interaction increases, coalitions emerge and there is a growing information load within the field (DiMaggio & Powell, 2010, p. 48). As a result, for isomorphism to be applicable to the context of higher education institutions, there needs to be indications of the existence of an organizational field and presence of the three conditions.

Even though the education system of the 1970s was a binary system, it was still highly diverse and fragmented (Kyvik, 2014, p. 82). In terms of the type and length of the education provided by the institutions and their geographical location (NOU 2020: 3, p. 48). Since then several changes has occurred, which indicate that higher education institutions in Norway could be considered as belonging to the same organizational field. Most importantly, the introduction of a common management structure, a merger of institutions and the introduction of a result-based funding system (Massen et al., 2011, p. 484; NOU 2020: 3, p. 48; NOU 2000: 14, p. 31).

New forms of management have the potential to increase the information load of the institutions by implementing new and unfamiliar regulations (DiMaggio & Powell, 2010, p. 148). However, after some time, a common structure for management might ease cooperation and interaction because the structure is familiar for all relevant institutions. Additionally, a merger have the potential to establish patterns of coalition or turn existing coalitions into new institutions (DiMaggio & Powell, 2010, p. 148). These changes also contribute to increasing the awareness regarding the existence of a field because there is a common development related to changes in management (DiMaggio & Powell, 2010, p. 148). This is especially true for the introduction of a result-based funding system because a part of the funding is allocated according to relative performance (Kunnskapsdepartementet, 2015b, p. 281).

As such, there are indications that higher education institutions could be considered as belonging to the same organizational field. However, we also need to consider the presence of the three conditions for an isomorphic process (DiMaggio & Powell, 2010, p. 150-153). Higher education institutions in Norway are dependent on the government and especially the ministry of education and research for both regulations and funding (Christensen, 1991; Kirke-, utdannings-, og forskningsdeparementet, 1991; Kunnskapsdepartementet, 2015a). In terms of uncertainty, the overall goals of the institutions may have stayed the same in this period but the specific content and methods of goal achievement may have altered trough the changes in management (DiMaggio & Powell, 2010, p. 151). Additionally, academics are a highly professionalized group because they have all been trough the same though recruitment process and follow the same career track (DiMaggio and Powell, 2010, p. 155; Kyvik, 2015,

p. 176). The presence of organizational professionals is less clear, although the quality reform entailed a shift from collegial to appointed heads of department this was an voluntary arrangement (Dordrecht: Larsen, 2003, p. 71).

To summarize, the perspective of isomorphism seems applicable to the context of Norwegian higher education institutions, there are indications that they exist within an organizational field and that all conditions of an isomorphic process are present. Therefore, we expect them to become "homogeneous in structure, process and behavior" (DiMaggio & Powell, 2010, p. 154). This leads to the following expectation based on the first research question:

> 1a: The level of perceived academic freedom will be similar across types of higher education institutions.

Even so, the expected similarities at the aggregate level does not mean that the specific measures implemented cannot influence individuals differently. A central feature of the result-based funding system is that the performance of an institution is dependent on the performance of the other institutions (Kunnskapsdepartementet, 2015b, p. 281). High performance is also clearly visible because high performing institutions receive a larger proportion of the result-based funding (Kunnskapsdepartementet, 2015b, p. 281). As such, the system is a source of legitimacy and success for the high performing institutions while for the lower performing institutions it becomes a source of uncertainty and limitations (DiMaggio & Powell, 2010, p. 151). Even though this is measured at the institutional level, the performance of an institution on these indicators is ultimately dependent on the individuals within it. Consequently, we expect the system to be transferred to the individual level because of the contribution to the overall success and legitimacy of the institution (DiMaggio & Powell, 2010, p. 151). Therefore, this expectation is formulated:

> 2a: Publication rate and source of funding are related to the level of perceived academic freedom.

The second theoretical perspective applied in this thesis is organization culture. In this perspective, the most important element is the development of the logic of appropriateness, which guides the individuals within the organization in their actions (Christensen et al., 2007, p. 41). How this develops and the possibility for change is again influenced by path-dependency (Christensen et al., 2007, p. 45). The result of this evolution like process is an organization with a distinct culture (Christensen et al., 2007, p. 43). As such, we should consider how applying this perspective might change the expected findings of the analysis.

As mentioned, the main division in the higher education system is between univer-

sities and university colleges (Kyvik, 2008, p. 172). The universities have a main responsibility for basic research and research training while university colleges are more vocationally oriented (Kyvik, 2008, p. 172). Additionally, within both main types we also find institutions that have a specific connection to a certain field or subjects (Kyvik, 2008, p. 171). As a result, these differences in orientation may shape how the logic of appropriateness develops within the organization and the beliefs, values and behavioral norms that new members bring into the organization (Christensen et al., 2007, p. 41; Schein, 2017, p. 6).

Furthermore, the higher education institutions are established at different points in time. Some were established long before the changes of management began while others were established after or close to this point in time (Christensen, 1991). This might create difference between these institutions in the degree of implementation. Higher education institutions established at a much earlier point in time would have a more well developed organization culture when the changes in management began and are as a result harder to change (Christensen et al., 2007, p. 45). While institutions who were in their formative years would be more open to the changes in management and if these were the current norms and values at the point establishment these would have greater importance for future development (Christensen et al., 2007, p. 45). In sum, because of the difference in orientation and time of establishment we expect the degree of implementation to vary. This leads to the following expectation:

> 1b: The level of perceived academic freedom will vary across types of higher education institutions.

At the individual level we are looking at two specific measures that were implemented as a result a reform implemented in 2002-2003 (Bleiklie et al., 2003, p. 30). Most higher education institutions were established some time before this, either in the period up to the changes in the 1980s or as a result of the merger in the 1990s (Kirke-, utdannings-, og forskningsdeparementet, 1991, p. 16; NOU 2020: 3, p. 48). In addition, the institutions that were a part of the merge had a previous history (NOU 2020: 3, p. 51). Subsequently, there is a possibility for an established path-dependency in the development of the organization culture that has created a "depth in values and norms" that make these newer performance indicators harder to implement and especially to be transferred to the individual level (Christensen et al., 2007, p. 46). As result, the following expectation is formulated:

> 2b: The individual academics perceived academic freedom is not related to publication and source of funding.

Following the formulation of expectations, we need to establish how we could analyze these with the use of quantitative data. This and the data itself will be the topic of the next chapter of this thesis.

Chapter 3

Methods, Data and Operationalization

The previous chapter led to the formulation of specific expectations of findings for each of our two research questions. In this chapter the focus will be on the methods of analysis, the data and the operationalization of our variables.

3.1 Implications of Case Selection

We have applied a crucial case strategy for case selection, within this strategy Norway can be described as a least-likely case (Gerring, 2007, p. 116). The logic behind this strategy is to select a case that is least-likely to meet our expectations (Gerring, 2007, p. 116). Consequently, if the findings meet our expectations the belief that the same could be true in more-likely cases of the population is strengthened (Gerring, 2007, p. 119).

Another feature of this strategy of case selection is the need for explicitly formulated expectations of findings that can be confirmed or dismissed (Gerring, 2007, p. 116). These were formulated based on theory on how PM reform influences organizations in the preceding chapter. To investigate the presence of these expectations within our case we apply a within case large N design by analyzing quantitative data. This allows us to go within the case and identify sub-units, the evidence from these sub-units "is likely to provide vital information for the main argument, pitched at the level of the primary case" (Gerring, 2016, p. 140).

A central issue when doing case study research is the problem of external validity, which concerns the degree to which we are able to generalize the findings of a case to the larger population of cases (Gerring, 2016, p. 219). A case study should always

strive for generalization but the degree to which this is possible is also constrained by the case study as a research design in itself (Gerring, 2016, p. 220). Because we have a small selection of cases, or in this case just one, it difficult to argue that we are investigating all relevant aspects of a phenomenon (Gerring, 2016, p. 220). At the same time applying a least-likely strategy for case selection might aid this problem. Because we are not saying that if our findings are supported it will be true in all cases of the larger population, rather we are arguing that the probability of similar findings in other cases of the population is heightened (Gerring, 2007, p. 116). Consequently, the ambition of generalization is somewhat moderated but also more realistic and viable in terms of the research design we are applying.

However, the possibility of generalization and therefore the external validity is dependent on the degree of internal validity (Gerring, 2016, p. 240). Internal validity concerns the validity of inferences about the relationship between the studied variables (Gerring, 2016, p. 195). In this case the validity of our inferences is dependent on the methods and data we apply in the analysis. As a result, it is this that will be the focus of the remainder of this chapter.

3.2 Methods

In the analysis of our quantitative data various methods will be applied, ranging from evaluation of descriptive statistics to more complex statistical methods such as regression analysis. All of these methods have various strength and weaknesses but in general they can all be traced back to questions about reliability and validity (Bryman, 2016, pp. 148-169). Accordingly, the general concepts of reliability and validity will be outline below, while the specific concerns related to these concepts will be discussed when the data is presented, measures are operationalized and methods are applied.

3.2.1 Reliability

Reliability can be defined as: "the ability of a measure to produce consistent results when the same entities are measured under different conditions" (Field et al., 2012, p. 925). This definition has two implications. First, that the procedures of data collection should be precise and explicit, to ensure that it is possible to collect the a similar sample of entities or units of analysis (King et al., 1994, p. 8). Second, when measures are constructed based on multiple indicators these should be related to the same concept so that consistent results can be obtained (Bryman, 2016, p. 157). Measures that are constructed in such a manner are characterized as having a high degree of internal reliability (Bryman, 2016, p. 157). This form of reliability

is especially important, because in a situation were a similar or equivalent sample was collected a measure with a low degree of internal reliability would inevitably lead to inconsistent results. Because inclusion of unrelated indicators would possibly change the aggregate score of respondents on the measure (Bryman, 2016, p. 157).

In summary, reliability is therefore an important element when it comes to the trustworthiness of our result and is dependent on precision and accuracy in our decisions (Grønmo, 2004, p. 423). In this thesis reliability is especially important when it comes to the operationalization of measures to be applied in the analysis and will subsequently be discussed more in detail in relation to this, later on in this chapter.

3.2.2 Validity

Adcock and Collier (2001, p. 530) see measurement validity as "achieved when scores (including the results of qualitative classification) meaningfully capture the ideas contained in the corresponding concept". Validity is therefore a question of whether we measure what we intend to measure. Validity is closely related to reliability because a measure cannot be valid without it first being reliable (Bryman, 2016, p. 162). As such it can sometimes be difficult to differentiate between the two concepts, because both are concerned with errors in measurement (Bryman, 2016, pp. 156-162). However, we can distinguish between the two by applying a common division that see lack of reliability as being caused by random error while problems of validity is caused by systematic errors (Adcock & Collier, 2001, p. 531).

Our basis for this discussions on validity is Adcock and Collier's (2001) framework on procedures of achieving validity or validation. Furthermore, they describe the process of creating a validated measure as a process of four stages (Adcock & Collier, 2001, p. 531). The start of this process is a background concept which is all the possible definitions of what we are trying to measure, then a definition is selected which gives us our systematized concept, this followed by a selection of indicators and finally cases are given scores on these indicators (Adcock & Collier, 2001, p. 531). If we connect this process to the initial definition, a measure is validated if the indicators and the scores of cases meaningfully captures the systematized concept (Adcock & Collier, 2001, pp. 530-531).

Following this, we need to look into the three procedures for validation of a measure: (1) content validation, (2) convergent/discriminant validation and (3) construct validation (Adcock & Collier, 2001, pp. 538-542). Content validation is an evaluation of whether the indicators "capture the full content of the systematized concept" (Adcock & Collier, 2001, p. 538). A condition for using this process of validation is

that there is some form of agreement about the specific elements of the background concept or that there is a accepted systematized concept (Adcock & Collier, 2001, p. 538). If there is a range of possible definitions this method would be of little help because one could easily argue that a definition with different elements would be more appropriate (Adcock & Collier, 2001, p. 539). Leading to measure which is not validated. For this reason, and because there is a substantial element of subjective judgment involved in this process, content validation cannot alone be applied to validate a measure (Adcock & Collier, 2001, p. 539).

Convergent/discriminant validation is established by empirically assessing if indicators of the systematized concept is associated and is this association weaker with indicators of a different concept (Adcock & Collier, 2001, p. 540). This process is empirically based and although the first step of this process of validation is most often possible the second step is more complicated. The researchers would have to spend time finding another possible systematized concept and there needs to be available indicators for this concept. Furthermore statistical correlation is not always an indication of measurement of the same systematized concept and higher correlations than other indicator sets might not always indicate a validated measure (Adcock & Collier, 2001, p. 541).

Construct validation is a question of confirmed causality and is dependent on the existence of well established causal relations (Adcock & Collier, 2001, p. 542). Since, there well established causal relations are not readily available in this context this validation process is not considered relevant (Adcock & Collier, 2001, p. 543).

In summary, non of these processes can alone provide a validated measure (Adcock & Collier, 2001, p. 543). Consequently, whether or not a measure is valid or not becomes an aggregated evaluation based on evidence from these processes of validation.

3.3 Data

The data used is thesis is survey data from the R-QUEST project on research quality and policy impact. Consequently, the information provided about the sampling strategy and data collection is retrieved from the "R-QUEST survey - response analysis", which can be found in appendix D. The survey was conducted in five countries but only the Norwegian data will be applied in the analysis, as Norway have been selected as the case for this thesis.

3.3.1 Sample and Data Collection

The sample of the survey was identified based on information from a bibliometric analysis and publication data from Web of Science (WoS). The bibliometric analysis led to identification of key institutions with publications within the fields of physics, cardiology and economics. Following this, information available on the web sites of the institutions led to identification of relevant organizational units and scientific/academic staff within these units were then included in the sample. The WoS-data was used to supplement the initial sample. Based on the WoS-data persons within the key institutions, who had a minimum number of publications, were added to the sample, regardless unit affiliation. For economics the minimum number of publications needed to be included was 5, for physics and cardiology it was 10. The WoS-data was retrieved for the period from 2011-2016, which means that the minimum number of publications had to be achieved within this period. This combined sampling strategy was used in order to obtain the most comprehensive sample, with coverage of both organizational units and fields.

After the sample of the survey was identified the data collection began and a was done by an online questionnaire that included 29 questions, mostly multiple choice, written in English. The complete questionnaire can be found in appendix C. The survey questionnaire was sent out by email to the 1163 persons in the Norwegian sample. They had the period from October 2017 until February 2018 to answer the survey, in this period they received five reminders. Four of the reminders were sent by email and one by regular mail. These were written in both Norwegian and English. In total answer were received from 547 respondents, which resulted in a response rate of 47 percent, which is relatively high.

3.3.2 Data Quality

Sample

Because of the applied sampling strategy we do not have a probability sample but rather a structured or judgment based sample (Blair, 2014, p. 94). Which means that judgment has been an element in the selection of respondents into the sample (Blair, 2014, p. 94). In this case, judgment has played a role in the selection of fields, institutions and organizational units. The rationale behind the selection of fields is to select fields that possibly could function as representatives of the characteristic subject matters within different academic areas (Biglan, 1973). Biglan (1973, pp. 201-202) argue that fields could be distinguished by the characteristics of their subject matter based on to dimensions. The first is the division between hard and soft sciences, were physics and cardiology could be characterized as hard

sciences and economics a soft science (Biglan, 1973, p. 201). The second is the degree of "application to practical problems", were cardiology has a higher degree of direct application than physics and economics (Biglan, 1973, p. 202). As such the fields selected covers hard science, applied hard science and soft science (Biglan, 1973).

When it comes to judgment in terms of selection of institutions and organizational units it can be problematic because it can potentially introduce selection bias into the process (Blair, 2014, p. 96). Selection bias refers to the fact that some members of the population have a higher probability of selection than others (Blair, 2014, p. 14). When judgment is involved selection bias is often caused by selection of more well known members of the population or because some respondents are more easily accessible than others (Blair, 2014, p. 96). However, the element of judgment in the applied sampling strategy is at the point were institutions and their organizational units are selected, not in the selection between individual respondents. Furthermore, for the methods that will be applied in the analysis the main concern is sample bias, which is the product of selection bias, and this can occur even in probability samples (Blair, 2014, p. 89).

Sample bias is present if the sample differ from the population in some systematic fashion (Blair, 2014, p. 89). As such, the question of sample bias is important in terms of how representative our sample is for the larger population (Kruskal & Mosteller, 1979). For the purpose of this thesis we can define the population as: *Individuals who are employed in scientific positions at higher education institutions in Norway.* Correspondingly, sample bias is present if our sample differs systematically from this population (Blair, 2014, p. 89).

Kruskal and Mosteller (1979) discusses what representativeness of a sample entails. Often the term "representative sample" is used to describe a sample obtained using the method of random sampling (Kruskal & Mosteller, 1979, p. 256). However, they also put forth the argument that a sample can be "representative" if it permits "good estimation" or if it is "good enough for a particular purpose" (Kruskal & Mosteller, 1979, p. 259). If a sample is good enough depends on the aim (Kruskal & Mosteller, 1979, pp. 259-260). If the aim is to generalize findings to the population, this increases the demands to sampling method (Blair, 2014, p. 11). If this sample could be considered representative in terms of permitting "good estimation" relates to the presence of bias in the sample (Kruskal & Mosteller, 1979, p. 259).

Consequently, we do not have a representive sample according to the first definition (Kruskal & Mosteller, 1979, p. 256). However, we could have a representative sample because it is good enough for our purpose and provides "good estimation" (Kruskal

& Mosteller, 1979, pp. 259-260). Our aim of this thesis is to explore relationships between variables and possibly generalize the findings to the population. For this reason, it is especially important that our sample permits "good estimation" and therefore bias is ultimately what the possibility to do this depends on (Kruskal & Mosteller, 1979, p. 259).

Aside from selection bias, sample bias has two other causes: coverage and nonresponse (Blair, 2014, p. 96). Coverage bias "will occur if some segment of the population is improperly excluded from considerations in the sample or is not available through the method employed in the research" (Blair, 2014, p. 89). In this case, we should therefore consider whether academics within all types of higher education institutions were included in the sample and within all positions. Since all institutions were considered to be included and all individuals within these institutions and their units in scientific positions were included, coverage bias does not seem to be a problem in this sample. The second cause of sample bias is nonresponse, this "occur if failure to respond is disproportionate across groups" (Blair, 2014, p. 89). Remainders were sent to minimize the potential nonresponse bias and the response rate was fairly high. However, nonresponse bias might still be an issue. Hence, information about the characteristics of the population was searched for in various sources but we were only able to obtain information about different types of institutions and positions. Since, we are also applying institutions and positions as variables in the analysis the question of bias will be discussed further when these variables are operationalized.

In summary, the sampling strategy results in some challenges when it comes to applying the data in a statistical analysis. However, the data is still considered applicable in such an analysis and it is the ambitious of generalization that might be moderated because of possible sampling bias.

Data Collection

An online questionnaire was used as the method for data collection, this method has both strenght and weaknesses (Blair, 2014, p. 49). Some of the most debated weaknesses has been that lack of internet access potentially leads to a biased sample (Blair, 2014, p. 59). However, this does not seem like a very relevant weakness in this case, because it seems reasonable to expect that most academics have internet access trough their work. Accordingly, the following paragraphs will concern strength and weaknesses relating to the use of questionnaires and the data we obtain by applying this method.

To overall goal of any researcher that applies questionnaire as a method of data

collection is to develop a questionnaire that results in accurate answers, in other words: minimize measurement error (Blair, 2014, p. 171). The term measurement error "refers to the difference between the true values that we should see in the data and the observed value that we do see" (Blair, 2014, p. 171). Measurement error occurs when the respondents either interpret the question in a manner it was not intended or when there is a difference between respondents in how they understand the question (Blair, 2014, p. 171). The presence of measurement error has the potential to weaken both reliability and validity. If the error becomes systematic, all or specific groups of respondents wrongly interpret the question, it is a problem for validity (Adcock & Collier, 2001, p. 530). On the other hand, if the error is random it is a problem for the reliability of our data (Blair, 2014, p. 531).

To minimize measurement error and increase validity and reliability there are several aspects of a question we should pay attention to. We should avoid leading questions, questions that affect the respondents answer in one specific direction (Blair, 2014, p. 192). One should also avoid the use of "loaded words" as this can change the distribution of answers or make the respondents unwilling to answer (Converse, 1986, p. 41). Furthermore, questions should be as simple, direct and easily understandable as possible, to avoid confusion (Blair, 2014, p. 192). Each question should also only contain one item that the respondents needs to consider per question (Blair, 2014, p. 205).

In addition to this, there are also some important points to be made about the answer scale or categories to closed questions. All possible answers should be included and these must be mutually exclusive if the respondent should only answer one (Blair, 2014, p. 202). When a scale is applied this should go from low to high and follow the same direction throughout the questionnaire (Blair, 2014, p. 202). It is also a wise to label categories verbally as this have been shown to lead to more reliable answers (Schaeffer & Presser, 2003, p. 77).

Another relevant discussion for questionnaires using closed questions, which most of the questions in this questionnaire are, is if "don't know" should be included as a possible answer. Some argue that including it leads to more reliable answers because those who do not have an opinion on the issue at hand have a possibility express this (Schaeffer & Presser, 2003, p. 80). At the same research has shown that even though "don't know" is not included answers are still consistent and as a result we obtain more information (Schaeffer & Presser, 2003, p. 79).

The questions in the R-QUEST survey questionnaire seem to be meeting these criteria. Questions does not seem to be leading and only and are easily understandable (Blair, 2014). Since, this survey also is directed at a specific professional group it

might also be easier to achieve this, because most of the more complicated terms about specific arrangements or systems are familiar to them. Furthermore, there are no apparent "loaded words" (Converse, 1986, p. 41). When it comes to items per question this guideline appeared to have been followed as well (Blair, 2014, p. 205). However, often "/" is used to separate terms that describe the item, which might bring clarity or confusion to the respondent based on the context.

When it comes to the answer categories these are mutually exclusive (Blair, 2014, p. 202). However, it could be argued that they are not always exhaustive, on the other hand, in these instances a other category is included which does not force the respondent to answer. The scales follow the low to high format (Blair, 2014, p. 202). For the majority of the scales each category is also verbally marked (Schaeffer & Presser, 2003, p. 77). A majority of the questions also have a "don't know" category.

In sum, the question and answers are formulated in such a manner that the the potential for measurement errors are reduced which creates a potential for high realibility and validity.

3.4 Operationalization

In this section the aim is to operationalize variables that are included in the analysis, in such a manner that they are both reliable and valid. This section has three parts: dependent variable, independent variables and control variables.

3.4.1 The Dependent Variable

From the introduction chapter we have a definition of academic freedom (NOU 2006: 19, 2006, p. 7). This means that we have systematized concept of academic freedom that describes how it is defined and used in this thesis (Adcock & Collier, 2001, p. 530). In order to go one step further and evaluate how academics perceive their academic freedom, we need to select indicators that enable us to measure the systematized concept (Adcock & Collier, 2001, p. 531). In the R-Quest survey there are mainly two question with several sub-questions that touch upon this concept. These are displayed in table 3.1, on the next page. However, before we apply these questions as indicators we need to discuss what they measure and if these indicators can be considered a valid measure for the systematized concept (Adcock & Collier, 2001). Therefore, we will first have consider these possible indicators in terms of theory.

Q9	How do the following influence your research activity?
Q9a	National reviews/evaluations of my research unit/department
Q9b	Reviews/evaluations of the performance of my research group/unit organized by my institution
Q9c	Bibliometric performance indicators
Q10	To what extent do the following actors influence what research topics you focus on in your research unit?
Q10a	You
Q10b	Ordinary research staff
Q10c	Research group leaders
Q10d	Deans/department heads/leaders of academic units
Q10e	Organizational leaders (Rectorate/president team or equivalent)
Q10f	Organizations (private or public) for which you do contract research
Q10g	Topics prioritized by funding agencies/foundations/public authorities/Horizon 2020/similar

Table 3.1: Relevant Questions From the Survey

Our theoretical perspectives tell us how we can expect that the organization responds to changes in the external environment (Christensen et al., 2007; DiMaggio & Powell, 2010). If we look closer at the external environment in relation to the possible sources of influence we can differentiate between the following sources: (1) legal and quasi legal rules, (2) counting and accounting and (3) Professionalism (Bromley & Meyer, 2015, p. 93).

DiMaggio and Powell (2010) incorporates these sources in the mechanisms that drives isomorphism. While from the organization culture perspective these sources are important for the development of the culture (Christensen et al., 2007, p. 45). They are sources for the cultural norms and values at the point of establishment, which is the foundation for the development of path-dependency, the logic of appropriateness and subsequently the overall culture (Christensen et al., 2007, pp. 41, 45). Legal and quasi legal establish standards for how certain activities should be conducted (Bromley & Meyer, 2015, p. 96). Likewise, counting and accounting provide "external assessments of worth" in the form of assessing value and evaluating structures in terms of status (Bromley & Meyer, 2015, p. 96). Furthermore, professionalism is important as it relates to the professions within the organizations and how different professions within the organization interact (Bromley & Meyer, 2015, pp. 103-112). Which is fundamental for the development of the organization culture (Christensen et al., 2007, p. 41).

Our systematized concept of perceived academic freedom also exists within the same organizational environment and we could therefore use this threefold differentiation

of the external environment to identify sources of influence for this concept as well. Admittedly, by operationalizing our measure in this manner we do not measure perceived academic freedom directly but rather measure to what degree academics feel restrained by these sources of influence, and use this as a measure for perceived academic freedom. Even so, this seems like a good option as the level of perceived academic freedom and the level of restraints felt from these sources seems quite related based on our theoretical perspectives. And we therefore continue with looking at the specific content of these sources for perceived academic freedom.

First, the systematized concept of perceived academic freedom has a legal grounding. This is especially true in this context because, as we mentioned in the introduction chapter, academic freedom is incorporated into the University and University Colleges Act section 1-5 (University and University Colleges Act, 2005). However, the extent of this right has been discussed more recently (D. R. Olsen, 2020).

Second, counting and accounting or "external assessments of worth" might be an important source of influence for our concept (Bromley & Meyer, 2015, p. 93). This is not necessarily economical accounting but could also be rules that enables evaluations of something from worse to better (Bromley & Meyer, 2015, p. 96). In this case this term would be applicable to the financing system of higher education institutions which measures the performance of the institutions across several indicators (Kunnskapsdepartementet, 2015b, p. 281). Although, these are measures at the institutional level it has been showed that these have the potential to trickle down to and affect the individual level (Aagaard, 2015).

Third, professionalism which is both the professions and the relation of different professionals within the organizations (Bromley & Meyer, 2015). In this case, the question is how does other professionals than the academics see or value academic freedom. For the academics to have this freedom the professionals within the management of the organization also needs to see this as an valued freedom that is worth protecting (Bromley & Meyer, 2015, p. 108).

If we compare our three sources of influence with the indicators presented in table 3.1 we see that there are non of them that deals with the legal aspect of our concept. Depending on how we view this it might be cause for concern regarding the validity of our measure, as our measure should cover the total content of our systematized concept (Adcock & Collier, 2001, p. 537). However, we could view the legal influence as constituting a baseline, since the law applies to all academics in Norway (University and University Colleges Act, 2005). Following this, we should consider arranging our indicators into two groups representing the two other sources of influence.

It seems reasonable to assume that one group should be Q9a-c as these deals with evaluations and performance measures which were mentioned as relating to counting and accounting (Bromley & Meyer, 2015, p. 93). The term evaluations and performance measures will be used for this group of indicators, as this better describes the content of the indicators. The final group, which should be related to professionalism is a bit harder to construct. The possible indicators for this group are Q10a-g. Q10b-e seems to quite clearly deal with professionals or actors within the organization. Q10f-g might also fit into this group depending on whether the influence goes through actors within the organization. Q10a does not seem to fit into this group as high influence over your own research topic would indicate that other actors within the organization has low influence.

Although, it seems reasonable to group indicators within two groups which express degree of perceived academic freedom and treat the legal influence as a baseline, we should also consider the convergent validity of this measure (Adcock & Collier, 2001, p. 540). Convergent validity tells us that there should be an empiric relation between the indicators and strong relations indicate that the indicators measure the same systematized concept (Adcock & Collier, 2001, p. 540). To investigate whether our assumptions and grouping of indicators seems to be supported empirically we used factor analysis.

Factor Analysis

Before we run a factor analysis we need to consider the whether it is appropriate. A general rule of thumb is that 100 or more observations are needed, in addition to a substantial number of correlations between the variables above .30 (Hair et al., 1998, pp. 98-99). Furthermore, the measure of sampling adequacy (MSA) should be above .50 (Hair et al., 1998, p. 99). In this case, all conditions are meet. We have several correlations between the variables above .30 (see Appendix table C.1), we have a high enough number of observations and the overall MSA is 0.63. Factor analysis is therefore appropriate.

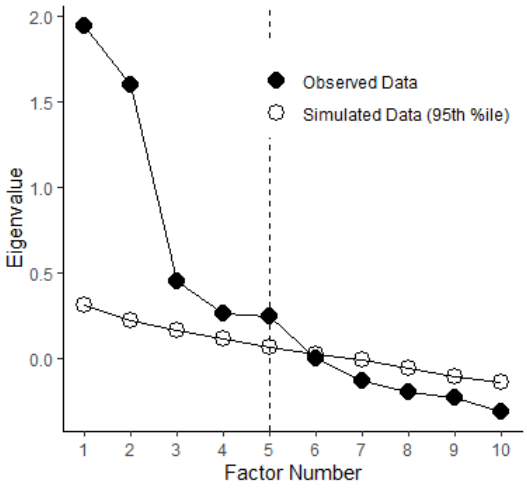
The next step is to determine how many factors to extract. Several methods will be used: The latent root criterion, the percentage of variance and the scree test criterion (Hair et al., 1998, pp. 103-105). The latent root criterion imply that factors with an eignvalue above 1 should be keept in the analysis, because "each variable contributes a value of one to the total eignvalue" (Hair et al., 1998, p. 103). The criterion of percentage of variance indicates that we should extract factors until they account for at least 60 percent of the variance (Hair et al., 1998, p. 104). If we look at table 3.2 we see that the first two factors have a eignvalue above 1 and contribute to 68.99 percent of the variance. Which indicates extraction of two factors.

Factor	Eignvalue	Cumulative Variance	Cumulative Percentage
1	2.13	0.21	37.30
2	1.81	0.39	68.99
3	0.92	0.49	85.27
4	0.85	0.57	100.00

Table 3.2: Eignvalues, Cumulative Variance and Cumulative Percentage

However, we also have to consider the scree test criterion. The scree plot (figure 3.1) is used to visualize when the "amount of unique variance begins to dominate the common variance structure" (Hair et al., 1998, p. 104). When this happens the curve becomes horizontal or the gradient decreases, and factors up to this point should be included (Hair et al., 1998, p. 104). From our screeplot we can see that the appropriate number of factors to extract based on this would be 5. Even so, to extract 5 factors might be problematic based on the data we have. Because a general rule in factor analysis is that there should be at least five indicators per factor (Hair et al., 1998, p. 98). This, in combination with the two other criteria, which also points towards extraction of two factors, leads to the conclusion that two factors should be extracted.

Figure 3.1: Screeplot



The next step is to rotate the factor matrix, to get a more easily interpretable factor matrix (Hair et al., 1998, pp. 106-110). There are two main methods for rotating VARIMAX is an orthogonal method that assumes that factors are correlated, Oblimin is a oblique method that assumes correlation between factors (Christo-

phersen, 2013, p. 103). Both methods were applied but there were small differences and low correlation between the factors. We therefore continue with the VARIMAX rotated matrix (for the Oblimin rotated matrix see Appendix table C.2). In the new matrix we set the cutoff for factor loadings at .4. The reason for this is that variables with loadings above this cutoff is seen as more important, and "in a sample with 100 respondents, factor loadings of .55 and above are significant" (Hair et al., 1998, p. 111). When respondents with missing values are excluded from this sample the N is 166, and factor loadings below are excluded because they are most likely not significant. This results in the following factor matrix:

Q	How do the following influence your research activity?	Factor 1	Factor 2
9a	National reviews/evaluations of my research unit/department		0.707
9b	Reviews/evaluations of the performance of my research group/unit organized by my institution		0.922
9c	Bibliometric performance indicators		0.674
Q	To what extent do the following actors influence what research topics you focus on in your research unit?		
10a	You		
10b	Ordinary research staff		
10c	Research group leaders	0.408	
10d	Deans/department heads/leaders of academic units	0.756	
10e	Organizational leaders (Rectorate/president team or equivalent)	0.802	
10f	Organizations (private or public) for which you do contract research	0.528	
10g	Topics prioritized by funding agencies/foundations/public authorities/Horizon 2020/similar	0.461	

Table 3.3: Factor Loadings

From the factor matrix in table 3.3 we can see that the Q9a-c indicators load high on factor 1. This is in accordance with our theoretical expectations from our initial discussion. However, for the indicators loading high on factor 2 our theoretical expectations was a bit more unclear. Q10c-e are those indicators that most clearly relates to actors with leadership positions within the organization. While Q10f-g also load high on this factor, it was not clear based on the theoretical discussion that these indicators would be a part of the second group. But as mentioned initially a possible explanation might be that getting contract research projects and focusing on prioritized topics might be something that organizational actors within the organization see as important as it increases possibility of additional funding (Kunnskapsdepartementet, 2016). Q10a-b (you and ordinary research staff) did not fit into either groups a possible explanation for this is that while the other indicators from Q10 represent a freedom from influence, these two indicators represent freedom to have influence over the research topic. Thus, these indicators reverse the relationship compared to the other indicators within the second group and are as a result not included. When these two groups of indicators are referred to in the following

sections of this thesis the term dimensions of influence will be used, as this better reflects that each group of indicators together represents two dimensions of influence on the same systematized concept (Christophersen, 2013, p. 103). Following this, we have now operationalized perceived academic freedom as having the following dimensions of influence:

Type of Source	Indicator
Evaluations and Performance Measures	National reviews/evaluations of my research unit/department
	Reviews/evaluations of the performance of my research group/unit organized by my institution
	Bibliometric performance indicators
Organizational Actors	Research group leaders
	Deans/department heads/leaders of academic units
	Organizational leaders (Rectorate/president team or equivalent)
	Organizations (private or public) for which you do contract research
	Topics prioritized by funding agencies/foundations/public authorities/Horizon 2020/similar

Table 3.4: Structure of the Measure for Perceived Academic Freedom

We have now have established what indicators that related to each of the dimensions of influence of perceived academic freedom. The question that remains is how should we apply these in an analysis and get the most reliable and valid measure. By constructing indexes we are able to capture more of the possible influence on the systematized concept which increases content validity (Adcock & Collier, 2001, p. 106). This also increases realibility because measurement error has lower impact (Christophersen, 2013, p. 108). Indexes will therefore be constructed. Additionally we should also consider the internal reliability (Bryman, 2016, p. 157). Since, our indicators are seen as being related to two different dimension a combined index consisting of the indicators for both dimensions might not be the most reliable option.

Our two option for index construction are: (1) a combined index of all indicators and (2) individual indexes for each dimension of influence. Chronbach's Alpha was calculated for both options, this can to some degree tells which option that is the most accurate or reliable measure of or concept (Field et al., 2012, p. 798). For evaluations and performance measures Cronbach's Alpha was .76, for the organizational actors dimension it was .70 and for the combined option it was .65. This result supports the option of individual indexes for each dimension, especially since an increase in the number of items included in the index often increase the score while the opposite was the case here (Field et al., 2012, p. 799). Consequently, in the analysis we will apply one index for each dimension of influence and also look into how we should define the relationship between each indicator of the indexes.

3.4.2 Independent Variables

The next step in this process is to operationalize our independent variables. The first is types of organizations, which is intended to place higher education institutions into categories based on what type of organization they are considered to be. The second is source of funding, which concerns what funding academics have received.

Type of Organization

Based on the theoretical perspectives we formulated expectations to the level of perceived academic freedom across higher education institutions. From DiMaggio and Powell's (2010) perspective of isomorphism we expect a similar level across all higher education institutions. However, based on the organization culture perspective we expect the level to vary across higher education institutions because of how the organization culture has developed (Christensen et al., 2007). Consequently, our operationalization of this variable will be based on the two important aspects that decide how an organization culture develops: path-dependency and the logic of appropriateness (Christensen et al., 2007, pp. 41, 45).

Based on the logic behind path-dependency we should differentiate between old and new organizations. Because cultural norms and values from the early years will have a greater impact on later development (Christensen et al., 2007, p. 45). Furthermore, these old organizations would have had a longer period of time to develop the organization culture which makes it harder to change (Christensen et al., 2007, p. 46). In the context of this thesis, we should therefore differentiate between higher education institutions established some time before the 1980s, when the project of reforming institutions within this sector began, and new organizations which are established around the 1980s and after (Bleiklie & Michelsen, 2017; Kyvik, 2008; Maassen et al., 2011).

Additionally, based on the sources for the development of the logic of appropriateness we should also differentiate between organizations who have a special connection to a scientific area or field and those who are more general in their focus (Christensen et al., 2007, p. 41). The reason is that characteristics of the scientific area or specific field of science might influence the development of the logic of appropriateness (Biglan, 1973; Christensen et al., 2007, p. 41). Because the field specific norms and values are more in accordance with that of the organization leading to prioritization of these in any given situation (Christensen et al., 2007, p. 41). Furthermore, since more of those who work within the organization have these in common there is a higher probability for these being viewed as appropriate (Christensen et al., 2007, p. 40).

As a result we have a type of organization variable with four categories, displayed in table 3.5 below. The table also shows which higher education institutions that have been grouped together in categories and the N of each category.

Category	Institutions	N
Old Universities	UiB, UiO, OUS, Helse Bergen	285
Business Schools	BI, NHH	37
New Universities and University Colleges	UiT, NMBU, HISN (USN), UNN, SUS	94
Technical University	NTNU, St. Olav's Hospital	92
Total N		508

Table 3.5: Categorization of Higher Education Institutions

Because of limitations in the data it was not possible to treat each institution as a unit in the analysis. However, since we have been able to create categories based on theory it could be considered a content validated measure because it captures the relevant aspects of the theory (Adcock & Collier, 2001, p. 538). Even so, this operationaliztion is dependent on viewing the connection between theory and historic development in a similar manner. Other researchers might view this differently and argue that a different operationlization is more appropriate. Which has the potential to weaken the validity of this measure (Adcock & Collier, 2001, p. 539).

The specific placement of some specific institutions should also be commented. From table 3.5 we see that university hospitals have been put in the same category as their respective university. There are two reasons for this. First, in order to be recognized as a university hospital there needs to be collaboration with a university and a participation from medical personnel in the education of medical students (Forskrift om krav til spesialisthelsetjenester, betegnelsen universitetssykehus m.m., 2010). Second, there were not enough respondents within the potential university hospital category to have this as a separate category. As a result, placement within the same category as the university they collaborate with was a natural decision considering these limitations.

Another comment that can be made with regards to placement, is that NMBU is put in the "New Universities and University Colleges" category. NMBU was established in 1859 as an university college for agriculture (NMBU, 2019). Since establishment, NMBU has been a university college, until 2004 when their application for university status was approved (NMBU, 2019). Therefore, although NMBU has a long history as a university college it is placed in the "New Universities and University Colleges" category.

The final comment to the categorization regards the "business schools" and "technical university" categories. These represent institutions that have a specific connection to scientific areas or fields. Furthermore, this is two separate categories, and not one combined, because each represent different ends of the "hard-soft" dimension of characteristics of scientific fields (Biglan, 1973, p. 201). NTNU has a strong tradition for providing technically oriented education and research in what can be characterized as hard science, compared to the other institutions in the sample (NTNU, n.d.). While the the institutions within the "business schools" category have a long tradition for providing education and research within economics (BI, n.d.-b; Norwegian School of Economics, n.d.). Which is described as a soft science (Biglan, 1973, p. 202).

In terms of reliability, this operationlization can be percieved as reliable because each category has a clear foundation and placement of institutions is clear and consistent (Field et al., 2012, p. 925). By being transparent in these decisions we also open up for the possibility to question these, which is also an important aspect of establishing reliability (King, Keohane & Verba, 1994, p. 8).

As noted in the data quality section of this chapter about the sample we are also going to consider potential bias in the sample, in terms of the number of respondents in each category of our new type of organization variable. However, as mentioned there is a lack of information about the characteristics of our population. The information available was retrieved from the Norwegian Centre for Research Data (NSD) and their database on statistics about higher education (Norwegian Centre for Research Data, n.d.-a). However, the this was statistics about the number of Man-Years for scientific positions within higher education institutions (Norwegian Centre for Research Data, n.d.-b). A man-year is the expression of how much work an individual could do in one year, measured in hours (Kenton, 2018). As a result, our statistics are not directly comparable but by calculating percentages within each type of organization we are able to compare the statistics to some degree. Thereby, get an indication of the presence of bias in our sample. The distributions are displayed in table 3.6 and 3.7, on the next page.

From table 3.6 we that a majority of the respondents belong in the "old universities" category. While the other categories have a much lower percentage. This might indicate that there is a presence of sample bias in our sample. From table 3.7 we see that universities has a percentage of 71.72, which is a bit higher than our "old universities" category. But this also makes sense because some universities are in the "new universities" or "technical universities" category. This also means that university colleges seems to be a bit underrepresented as the percentage is only

18.11, with new universities included in the same category. The category "business schools" includes both private and public schools (BI, n.d.-a; Norwegian School of Economics, n.d.). Consequently, it is hard to say evaluate if they are over or under represented based on table 3.7. In general, it seems as though the proportions in the sample and the population are somewhat similar. But again, we cannot say this for sure.

Type of Organization	Frequency	Percentage
Old Universities	285	56.10
New Universities and University Colleges	94	18.50
Technical Universities	92	18.11
Business Schools	37	7.28
Total	508	100.00

Table 3.6: Distributions of Respondents.

Type of Institution	Frequency	Percentage
Universities	14 837.69	71.72
Public University Colleges	4 785.22	23.13
Private University Colleges	1 065.54	5.15
Total	20 688.45	100.00

Table 3.7: Percentage of Man-years per Institution Type in 2017.

Publication

In this thesis we want to see if publication might influence the individual perceived academic freedom, because it represent is a part of the result-based funding scheme that lead to a shift "from rule production and rule adherence to goal formulation and performance control" (Maassen et al., 2011, p. 484). And because it is a type of measure that has been show to have the potential to affect individual behavior (Aagaard, 2015). In the background and theory chapter we provided a definition of a scientific publication and this will also be our systematized concept of publication (Adcock & Collier, 2001, p. 531). The question is then how we should operationalize this measure to get a valid and reliable measure.

Publication will be operationalized as the number of registered article publications in the Web of Science (WoS) database from 2011-2016. By using the WoS database we reduce the possibility that non-scientific publications are included, because there are strict rules for acceptance to the database (Clarivate Analytics, 2020). However,

books and conference proceedings who might fit the definition of a scientific publication are not included. This might threaten the validity of our measure but it is also a known problem in Norway that it is difficult to differentiate between scientific book publications and teaching or informational books (The Norwegian Association of Higher Education Institutions, 2004, p. 15). Which potentially could lead to a less consistent measure and thereby threaten reliability (Field, 2009, p. 925). We therefore continue with the initial operationalization.

An important aspect when using bibliometric data is the time span of the data (Aksnes, Langfeldt & Wouters, 2019, p. 3). This is especially important when using citation indicators, because more recent publications have a shorter period of time to acquiring citations, compared to older publications (Aksnes et al., 2019, p. 3). In this case, we are only looking at the number of publications per respondents and therefore this problem is not as relevant. But it should still be considered because a short window would mean that many works published right after or before our window would not be included. As a result, a short window would increase the possibility that respondents who do publish, but not within our narrow window, would be perceived as non-publishing respondents. Another, important aspect in relation to the time span or window for collection of publication data is that academics the number of publications increase with age (Gingras, Larvière, Macaluso & Robitaille, 2008). Up to a certain age the average number of publication per year also increases (Gingras et al., 2008). To use all publications up to the point of data collection would therefore have favored academics with longer careers. By applying a shorter window we thereby reduce the impact of this favoritism.

Another important note is that coverage of the different databases may vary (Aksnes et al., 2019, p. 7). This is problematic because "the validity of bibliometric analyses for research evaluation lies in large part on the databases' representativeness of the scientific activity studied (Mongeon & Paul-Hus, 2016, p. 2). As mentioned above the bibliometric data used here is retrieved from the Web of Science (WoS) database. The main focus of this database has been journal articles and to a lesser extent other types of publications, such as books (Mongeon & Paul-Hus, 2016, p. 2). Since only articles are used as a measure for publication in this thesis this is not a relevant problem. However, whether or not the database has sufficient or somewhat similar coverage of the fields is an important question. The respondents in the survey work within three different fields: cardiology, economics and physics. Aksnes and Sivertsen (2019) investigated to what degree the scientific publications in Norway between 2015-2016 was covered by the WoS database. According, to their findings the WoS database covered 72 percent of the total output, classified as scientific publications (Aksnes & Sivertsen, 2019, p. 6). For the fields the coverage

varied. 87 percent was covered in medicine and health sciences (cardiology), 84 percent in natural sciences and technology (physics) and 40 percent in social sciences (economics) (Aksnes & Sivertsen, 2019, p. 8). A possible explanation, is that within social sciences it is a higher percentage of publications than within the other disciplines that are written in Norwegian and therefore less likely to be covered since Norwegian is a minor language in terms of use (Aksnes & Sivertsen, 2019, p. 10). The substantially lower coverage of publications within social sciences might in part also be explained by the different publication patterns (Mongeon & Paul-Hus, 2016, p. 2). While journal article is the most common form of publication within natural sciences, the same is not true for economics (Mongeon & Paul-Hus, 2016, p. 2). To some extent within the social sciences publishing books have a greater importance, which naturally also decreases publication frequency within fields such as economics (Mongeon & Paul-Hus, 2016, p. 2). This is also evident in our data, see table 3.8 on the next page.

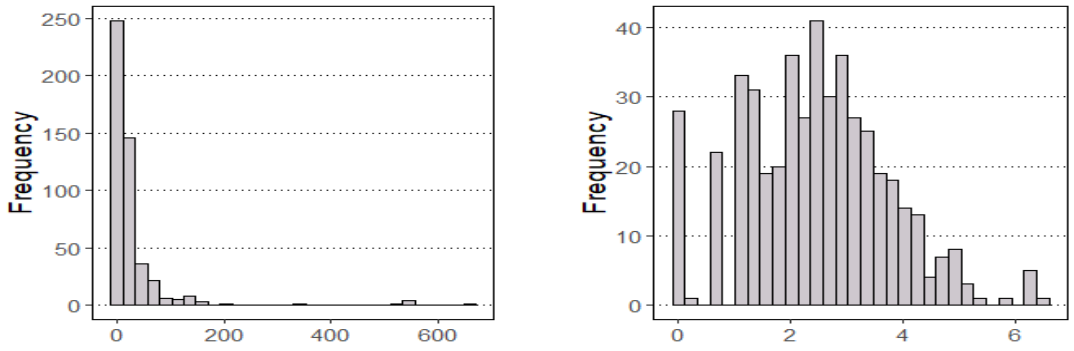
Field of Science	Max	Median	Min
Cardiology	203.25	15.00	0.00
Economics	32.00	4.00	0.00
Physics	659.00	12.50	0.00

Table 3.8: Descriptive Statistics for Publication according to Field of Science.

It should also be noted that the different co-authorship traditions also influence the differences in publication count between the natural sciences and economics (Ioannidis, 2008). Especially, within certain sub-fields within physics there is an increasing number of publications with above 100 authors (Ioannidis, 2008, p. 6). Within medicine an increasing number of co-authors is also becoming more common but not to the same extent as within physics (Ioannidis, 2008, p. 6).

Furthermore, the large differences in publication count also results in a very skewed distribution for the variable. Which we can se from the distribution displayed in figure 3.2a below. A very skewed distribution causes problem for the analysis (Christophersen, 2013, p. 80). A solution to this is to log transform the variable which unusually works well when the minimum value of the variable is around 1, because the logarithm of values between 0 and 1 are negative and not applicable in an analysis (Christophersen, 2013, p. 85). The minimum value on the publication variable is 0, as we can see in table 3.8, however only a few respondents have a value of 0. The problem with including the variable as it is, is that it has a potential to make it hard to fulfill the conditions of regression analysis (Christophersen, 2013, p.

80). Therefore, the variable was log transformed and this led to a much distribution much closer to a normal distribution (see figure 3.2b) than before. Consequently, it is the log transformed variable that will be used in the analysis.



(a) Number of Publications (b) Number of Publications (Log)

Figure 3.2: Distributions

Source of Funding

Source of funding was also a part of the shift we mentioned when publication was operationalized (Maassen et al., 2011, p. 484). However, there is less literature on the influence or association between source of funding and perceived academic freedom, than for publication. Aberbach and Christensen (2018) underline the need to know more about this relationship. In their view, there is potential for the academic freedom to be challenged by increased dependence external resources, because the research becomes "politicized" and inference from external stakeholders in research increases (Aberbach & Christensen, 2018, p. 502). Consequently, it is important to explore this relationship further and we need to operationalize a variable that enables us to measure differences between different sources of funding.

In our data we have the following variables that are potential indicators for source of funding:

Q5	How has your research been funded the last five years?
Q5a	My position/research time funded by my institution
Q5b	Grants from my institution
Q5c	Competitive grants form external public sources
Q5e	Business firms/industry
Q5f	Private not-for-profit foundations/organisations

Table 3.9: Potential Indicators for Source of Funding.

The indicator Q5d is not included because it concerned "other public sources" and based on the specificity of the other possible indicators it was unclear what this

referred to. Furthermore, an overwhelming majority of the respondents reported it as not being a source of funding.

Since we are connecting the influence or association between perceived academic freedom and source of funding to result-based funding we should select indicators that enable us to have a measure similar to this system. In the Norwegian financing system source of funding is measured by three separate indicators: financing from the EU, The Research Council of Norway (RCN) and financing for contract research (not from the EU or RCN) (Kunnskapsdepartementet, 2016, p. 61). Nevertheless, from table 3.9 we see that there is not a direct overlap between our possible indicator and the performance based indicators of result-based funding (Kunnskapsdepartementet, 2016, p. 61). However, there seems to be a division between external and internal sources of funding. Were Q5a and Q5b can be considered internal and Q5c-f can be considered external. In terms of content validation this might be problematic because our operationalization does not cover all aspect of the systematized concept (Adcock & Collier, 2001, p. 531). Which can be considered to be the three performance indicators of the result-based funding system (Kunnskapsdepartementet, 2016, p. 61). Even so, based on Aberbach and Christensen's (2018) reflection on the topic it seems reasonable to assume that we are able to measure an important division by operationalizing the measure in terms of dependence on external or internal sources of funding.

Each variable have the following categories: "no source", "minor source", "moderate source" and "major source". In the first option for construction of a measure respondents were perceived as dependent on external funding if they had answered that at least one of the sources in Q5c-f was a moderate or major source and that both sources in Q5a-b was not a source or a minor one. Those who were perceived as dependent on internal funding answered that all the sources in Q5c-f was not a source or a minor one and that at least one of the sources in Q5a-b was a moderate or major source. This lead to the following distribution of respondents:

Source of Funding	Frequency	Percentage
Internal	202	50.12
External	201	49.88
Total	403	100.00

Table 3.10: Distribution of Respondents according to Source of Funding.

The second option is a more conservative funding variable. In order to be perceived as dependent on external sources of funding at least one type sources in Q5c-f has to be reported as a major source and the sources in Q5a-b must all be reported as

not being a source, minor source or moderate source. To be perceived as dependent on internal sources of funding at least one type sources in Q5a-b has to be reported as a major source and the sources in Q5c-f must all be reported as not being a source, minor source or moderate source. The distribution of respondents on this conservative source of funding measure can be found in table 3.11.

Source of Funding	Frequency	Percentage
Internal	278	69.33
External	123	30.67
Total	401	100.00

Table 3.11: Distribution of Respondents according to Source of Funding for the Conservative Option.

If we compare table 3.10 and 3.11 we see that the conservative source of funding variable results in a majority being placed in the internal funding category. In table 3.10 the respondents were quite evenly distributed across categories. It is not clear which of the two options that would be best suited to apply in the analysis but the conservative would possibly be more appropriate if we are to describe the respondents as dependent on internal or external sources of funding. Consequently, both versions will be applied in the analysis.

Since we now have operationalized all independent variable we can turn our attention to control variables.

3.4.3 Control Variables

Control variables are variables that are expected to influence one or more of the independent variables and the dependent variable (Christophersen, 2013, p. 58). Control variables should therefore only be included in the analysis if we expect them to have an influence on both of these variables, in order to obtain the effect of independent variable on the dependent variable controlled for a confounding variable (Christophersen, 2013, p. 58). If relevant control variables are not included we run the risk that relationships between variables appear stronger than they actually are (Christophersen, 2013, p. 58).

The control variables that will be included in the analysis of this thesis are: gender, field of science and position.

Gender

That gender plays role in various aspects of an academics work is well established in the literature on gender differences in science (Abramo, D'Angelo & Caprasecca,

2009; Abramo, D'Angelo & Murgia, 2013; Leahey, 2006). Research have shown that women more often than men participate in nearly all types of research collaboration (Abramo et al., 2013, p. 820). That women seem to be less productive than men in terms of publication (Abramo et al., 2009; Leahey, 2006). Furthermore, they are also evaluated differently than their male peers when it comes to applications for funding (Brouns, 2000). The is also indications that grant applications with femal principal investigators are evaluated less favorably (Witteman, Hendricks, Straus & Tannenbaum, 2019). This appeard to be caused by "individual bias, systemic bias, and lower performance" (Witteman et al., 2019, p. 536).

It therefore seems reasonable to assume that gender also plays a role in the level of perceived academic freedom. It is therefore included as a control variable in the analysis.

Field of Science

When we discussed both the type of organization variable and publication field of science was mentioned as an important factor because of the division between hard and soft sciences and the degree of application (Biglan, 1973; Mongeon & Paul-Hus, 2016).When it comes to fudning there also seems to be field differences in terms of proritation of funding across fields (Kyvik, 1997).

There has also been made a connection between the division of hard and soft sciences and the pressures and challanges to academic freedom (Askling, 2001; Rostan, 2010). Consequently, we include field as a control variable.

Position

The first thing that should be addressed is that age is not included as a control variable because of the high correlation with position (.58). Second, the remarks about age from the discussion about publication is therefore also relevant for position (Gingras et al., 2008).

There also seems to be a relation between position and academic freedom (Schmidt & Langberg, 2007; Waitere, Wright, Tremaine, Brown & Pausé, 2011). Especially, there seem to be a difference between academics in early career positions and the academics in more established positions (Schmidt & Langberg, 2007; Waitere et al., 2011). Position is as a result a relevant control variable.

As noted in the data quality section of this chapter about the sample we are also going to consider potential bias in the sample, in terms of the distribution of respondents according to position. However, as mentioned there is a lack of information

about the characteristics of our population. The information available was retrieved from the Norwegian Centre for Research Data (NSD) and their database on statistics about higher education (Norwegian Centre for Research Data, n.d.-a). However, the this was statistics about the number of Man-Years for different types of scientific positions (Norwegian Centre for Research Data, n.d.-b). A man-year is the expression of how much work an individual could do in one year, measured in hours (Kenton, 2018). Furthermore, the positions in the data were not directly equivalent to the positions in the statistics we retrieved, because there are some differences between the Norwegian and the International system (Kyvik, 2015; Norwegian Centre for Research Data, n.d.-b). Too see which Norwegian positions-codes that are included in each category of table 3.12 see the appendix table C.5.

To investigate the presence of bias the percentage of respondents within each position was calculated, this information can be found in the "data" section of table 3.12. To have something to compare to the percentage of man-years within each position were also calculated, based on the statistics we retrieved, this information can be found in the "population" section of table 3.12 (Norwegian Centre for Research Data, n.d.-b). If we compare the percentages in table 3.12 we can see that there are some differences in the proportions. Full professors are over represented while Associate professors are under represented. The same seems to be true for assistant professors and medical positions. Medical positions are over represented, while assistant professors under represented in the sample. A problem, however, is that we are not sure that the correct positions are included in the "population" section of table 3.12. As a result it is hard to conclude about the severeness of this problem and we need to take this uncertainty into consideration when we conclude based on the results from the analysis.

	Data		Population	
Position	Frequency	Percentage	Frequency	Percentage
Full professor	189	44.37	4 343.78	34.56
Associate professor	96	22.54	4 350.90	34.62
Assistant professor	100	23.47	3 803.70	30.26
Medical position	41	9.62	70.48	0.56
Total	426	100.00	12 568.86	100.00

Table 3.12: Distribution according to Position in the Data and the Population.

In this chapter numerous aspects relating to the methods, data and operationalization have been covered. The most important aspect are concerns how sampling

strategy and data collection influence our analysis and the conclusions we are able to draw based on the analysis that follows this chapter. Furthermore, how operationlization influences the validity and reliability of our measures. Based on the reflections and the measures we have constructed in this chapter we continue by applying them the analysis of our research questions.

Chapter 4

Analysis

In the previous chapter we operaritionalized perceived academic freedom as having two main dimensions of influence: evaluations and performance measures and organizational actors. Conversely, each respondents perceived academic freedom will be dependent on their score on these two dimensions. Furthermore, we concluded that indexes should be created of the indicators within each dimension, so that the our operationalized measure would be less influenced by measurement errors to increase reliability (Christophersen, 2013, p. 108). Indexes are also perceived to have a higher degree of validity, as we are able to capture more of the concept we are trying to measure (Christophersen, 2013, p. 108). However, the potential of increased validity is also dependent upon our specification of the relationship between the indicators. We could have a reliable measure with a wrongly specified relationship between the indicators if it was consistent but as validity concerns the degree to which we measure what we intend to measure and whether it is measured correctly, we also need to look at how the indicators relate to each other (Bryman, 2016, pp. 156-159). Subsequently, this is the first issue we will address in the analysis. We then continue by looking into and analyzing our first research question of variation. Finally, we turn to the second research question and analyze the relationship between publication, source of funding and perceived academic freedom.

4.1 Construction of Indexes

As mentioned above the construction of indexes is dependent upon how we expect the indicators within each dimension to relate to each other. In this analysis we will consider three different types of indexes: additive index, additive index with weights and a multiplicative index. Each index entails a different assumption of the relation between the indicators. By applying an additive index we assume that the

score of each respondent contributes equally to the overall score on each dimension. The second option, is an additive index were each indicator is weighted according to the factor loading of each indicator on the relevant dimension (Christophersen, 2013, p. 108). By applying this type of index we assume that the score on one indicator is more important than the scores on the other indicators within the same dimension (Christophersen, 2013, p. 108). The final option for the construction of an index is a multiplicative index, in this instance we assume that the overall score on the dimensions is dependent upon the score on all indicators within the dimension. Consequently, we have three options that each entails a different assumption of the relationship between indicators and it is not clear which option that would be the most appropriate.

To decide what assumption that is most appropriate about the relationship between the indicators we have two possible approaches: deductive and inductive (Bryman, 2016, pp. 690-691). A deductive approach would be to make inferences about the relationship between indicators based on theory (Bryman, 2016, p. 690). In order to make inferences in a deductive manner the theory needs to be clear enough that we can turn theory into "researchable entities" (Bryman, 2016, p. 21). An inductive approach goes in the opposite direction and we would apply research and data to make inferences about the relationship between indicators (Bryman, 2016, p. 691). Both are valid and useful approaches to conducting research, both will therefore be applied to consider the assumptions of the relationship between indicators (Bryman, 2016, p. 21). To start we will first consider the deductive approach.

From the perspective of DiMaggio and Powell (2010) organizations become increasingly similar over time as a result of different types of isomorphic processes. As such, it largely depends on how the different indicators have been applied within the organizational field whether or not we should assume that all indicators have equal importance, that some are more important than others or all are dependent on each other (DiMaggio & Powell, 2010, p. 147). From the organization culture perspective the relationship between the indicators is dependent upon what individuals within each organization see as appropriate application of these indicators and how this has developed over time (Christensen et al., 2007, pp. 41-45). To put in differently, it might be the case that all organizations view all indicators as equally important or not important. That one indicator is seen as more important than the others, that they are applied as a package or that this is dependent on what type of organization the respondent belongs to. Accordingly, it seems reasonable to further explore the different options available us, when it comes to the construction of indexes, in an inductive manner. The indicators of each dimension of influence will be dealt with separately.

4.1.1 Evaluations and Performance Measures

We will now look at how the distributions of respondents on the performance and evaluations measure dimension is affect by the use of different indexes. Each indicator in this dimension has a scale ranging from 0 to 1, where 0 indicates negative influence and 1 indicates no or positive influence of the different evaluations and performance measures on research activity. By constructing an additive index for this dimension we get the following distribution of respondents:

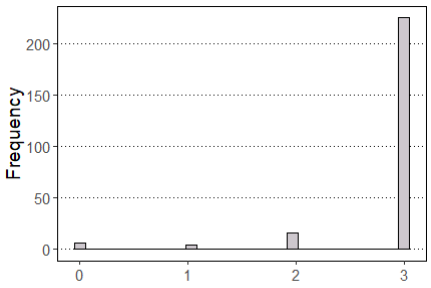


Figure 4.1: Additive Index

The result is a four scale index, were a large majority of the respondents are found at the high end of the scale. Indicating that a majority of the respondents feel that evaluations and performance measures to a low degree influences their research activity. The second option for the construction of our index, the additive index with weights, results in the same overall distribution as we can see from figure 4.2. However, since the score of each respondent is weighted according to that indicators factor loading on the overall dimension we get a somewhat different scale with a maximum score of 2.3.

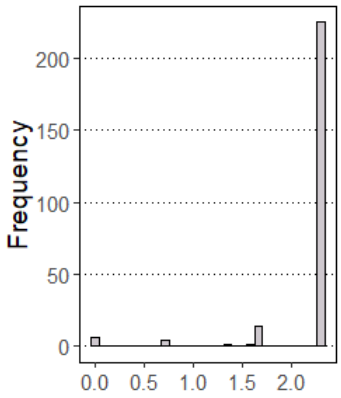


Figure 4.2: Additive Index With Weights

The third, and final option, is an multiplicative index. The difference between this and the two other indexes is that applying this index we create a binary categorical

variable. Here, respondents get a score of 0 if they report that one or more forms of evaluations and performance measures influences their research activity. To get a score of 1 respondents would have had to report no or positive influence of all evaluations and performance measures. As a result, we remove the possibility that evaluation and performance measures could have a gradual influence, it either has influence or it does not. Even so, the overall distribution compared to the other indexes is the same (see figure 4.3 below). Although, there is a slightly higher number of respondents who has a score of 0, because those respondents who were around the center of the scale on the two other indexes have been moved to the 0 category.

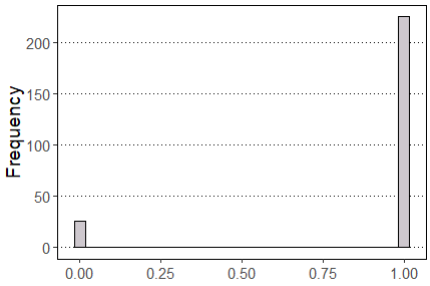


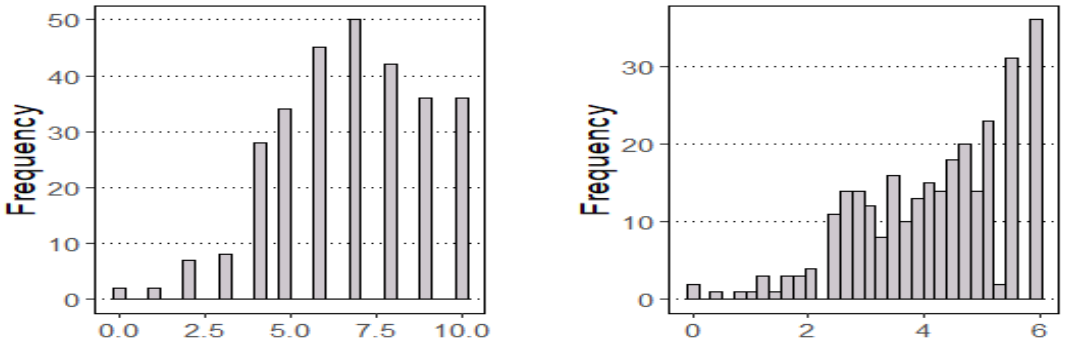
Figure 4.3: Multiplicative Index

In summary, the main difference is between the two types of additive indexes and the multiplicative index. As we turn the measure for this dimension into a binary outcome. All three options for the construction of index will be considered in the following initial analysis and by applying the indexes in the analysis we will also evaluate which of them that are the most appropriate measure for this dimension when methodological considerations are also taken into account.

4.1.2 Organizational Actors

The second dimension of the measure for perceived academic freedom consists of the combined influence organizational actors has on the academics research topic. Within this dimension we have 5 indicators, compared to three in the first dimension. Each individual indicator also have an increased number of values. With the scale ranging from 0 to 2, where 0 indicates high influence and 3 indicates no influence. If we create an additive index of the indicators it we see that a majority of the respondents report low influence on this dimension (figure 4.4a on the next page). The number of respondents first substantially start to increase around the value of 3. For the weighted index the distribution of respondents is quite similar, a majority report low influence, but the increase in the number of respondents is more gradual

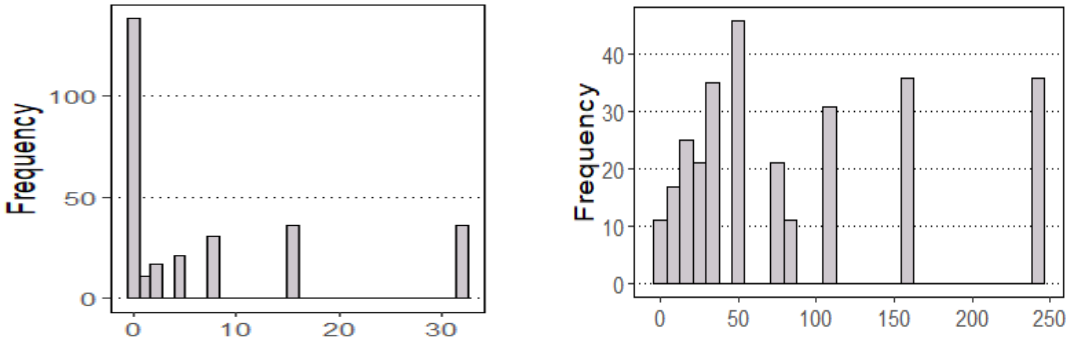
as we move to the right on the x-axis (figure 4.4b). Compared to the first additive index.



(a) Additive Index (b) Additive Index with Weights

Figure 4.4: Distribution of Respondents Across Indexes.

The third option for the construction of an index for this dimension is a multiplicative index where we assume that the overall score on the index is dependent on the score of all indicators. The results in the following distribution of respondents:



(a) Orginal Multiplicative Index (b) Recoded Multiplicative Index

Figure 4.5: Distribution of Respondents Across Multiplicative Indexes.

From figure 4.5a we see that that the distribution changes substantially when an multiplicative index is applied. A majority of the respondents now report a low level of influence on their research topic from organizational actors. This might be a result of the selected values that represent the category of each indicator, since the lowest value on each indicator is 0 those who reported this value on one of the indicators also have this score on the index. Applying a multiplicative index therefore partly leads to a index consisting of two groups. The first group is those who report no influence on one of the indicators and have a value of 0 on this index. The second group is those who report some level of influence on all indicators, and then we see

that the degree of influence varies within this group. When the lowest value was changed to 1 on the indicators the scale of the index changed, but we see from figure 4.5b that the overall distribution is mostly the same.

In summary, if we consider the information provided both from the deductive and inductive approach, in regards to the most appropriate assumption for the relationship between indicators, there is no clear indication which assumption that would be most appropriate. For the evaluations and performance measures dimension the distribution of respondents across indexes is mostly the same, regardless of index type. However, for the organizational actors dimension the majority in terms of number of respondents shifts with the application of the multiplicative index. This seems a bit questionable when the two other types of indexes are more stable on this dimension. Even so, it does not mean that it is a wrong assumption but if we disregard the respondents with a value of 0 on the multiplicative index there seems to be a more gradual increase as we move towards the high values on the x-axis, indicating that additive indexes might be more appropriate.

We should also be aware of the fact that different assumptions might be appropriate within each dimension off influence. That all performance and evaluations measures indicators are interrelated and that the influence from organizational actors are more additive in nature, could be a possibility. Moreover, each of these indexes also represent different methodological challenges when they are applied statistical analysis. The applicability of these different types of indexes in an analysis should therefore also be considered. Even so, it should not be the solely decisive factor and it should not be used as arguments for selection of the index that gives us the results we want.

4.2 Variations in the Level of Percieved Academic Freedom

The first research question asks if there are differences in perceived academic freedom between different types of higher education institutions in Norway. In order to investigate this we have categorized the higher education institutions into four organization types: business schools, old universities, new universities and university colleges and technical universities. We will begin this analysis of this question by looking at descriptive statistics for respondents within each type of organization across indexes for each dimension of influence for perceived academic freedom. For the first dimension we will also look into comments to an open question regarding how evaluations and performance measures affect research activity. To

further unpack how evaluations and performance measures possibly influence perceived academic freedom. This is followed by a difference means test before we turn to regressions in the next section of this chapter.

4.2.1 Evaluations and Performance Measures

To take a first look at the score of different types of organizations on the variables the mean score on the indexes for the respondents within each category of the organization variable was computed. In addition to the aggregated mean and standard deviation for all respondents independent of what organization type they belong to. The result is displayed in table 4.1.

	Additive Index		Additive Index With Weights		Multiplicative Index	
Type of Organization	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Business Schools	2.73	0.77	2.10	0.59	0.86	0.35
New Universities and University Colleges	2.80	0.58	2.16	0.44	0.87	0.34
Old Universities	2.81	0.60	2.16	0.45	0.88	0.33
Technical Universities	3.00	0.00	2.30	0.00	1.00	0.00
All	2.83	0.56	2.18	0.43	0.89	0.31

Table 4.1: Mean and Standard Deviation across Indexes for Each Type of Organization.

In general, the means are at the high end of the index scale, indicating no or positive influence of this dimension and a higher level of perceived academic freedom. Furthermore, for the additive indexes we see that there are minor differences in the mean score of the respondents within different organizations. In addition, the standard deviation of each mean provides additional information. This tells us how much the respondents within each type of organization on average deviate from the mean (Christophersen, 2013, p. 17). Since we have a scale ranging from 0-3/2.3 for the additive indexes the standard deviation seems quite large, which tells us at that we cannot be sure that the minor differences in mean between the organization types are actual differences or random variations. These findings also apply to the aggregate mean compared to the mean of each organization type.

In table 4.1 we also report the mean and standard deviation of the multiplicative index. However, the mean of this index is interpreted in a different manner than for the other two indexes. The multiplicative index results in a binary outcome, the mean should therefore be interpreted as the proportion of respondents within each organization type who report that performance and evaluations measures have no or positive influence on research activity (Christophersen, 2013, p. 23). For business schools the proportion of respondents who report a high score on this dimension is therefore 0.86. Which indicates that a majority of the respondents within this type of organizations category report low influence on this dimension of influence, and

therefore have a high level of perceived academic freedom.

It should also be noted that for the category technical universities the mean is equal to the highest score possible on all indexes. In addition to this, the standard deviation is 0. This is caused by the fact that all respondents belonging to this organization category has the highest score on all indexes. In total there are 92 respondents in this organization category, but some of these are "Not Available" NA on this measure. Either because they did not answer any of the three questions that were used to construct the indexes or that they did not answer one or two of the questions. As a result, we have 42 respondents within this category who answered all questions. It is possible that evaluations and performance measures have a very low influence on academics within technical universities, in general. But another possible explanation is that those who feel that these measures do influence simply did not answer the questions or that they are a not a part of the sample.

Consequently, there is a rather high degree of uncertainty when it comes to how we should conclude based on this initial analysis. However, after the respondents were asked these three closed questions that we use as indicators for this dimension of influence. They were also asked to leave a comment to the following question (9d): "Please enter any comments on how these kinds of reviews/evaluations/indicators have influenced your research (or more generally your research unit/department) negatively or positively" (see appendix figure **??**). If we look at the comments to this question this might enables us to say something more about the possible variations between different types of organizations. Moreover, we could take a closer look at how academics within technical universities see and feel the possible influence from evaluations and performance measure and see which of the explanations seems more likely for this somewhat special category. The next section will therefore look more closely into the answers to question 9d.

Evaluation of Comments

In total 84 respondents left a comment to question 9d. For the purpose of this analysis the respondents and their comments were grouped according to what type of organizations they belonged to. Thereafter, the comments were analyzed using quantitative content analysis. The aim of this method is to summarize textual content into quantitative measures (Bratberg, 2017, p. 101). This could mean everything from counting how many times a specific word is mentioned to counting the presence of specific formulations in text (Bratberg, 2017, pp. 103-104). When this method is applied to the comments to question 9d our aim is to be able to place the comments into one of two categories: no or positive influence and negative influence. Which could enable us to say something more about the findings in table

4.1.

To analyze the comments in this manner puts increase weight on the importance of reliability. This means that the analysis should be able to be reproduced with the same result (Bratberg, 2017, p. 119). This leads to strict demands of objectivity and neutrality, to avoid over interpretation of comments in a certain direction to obtain a desired result (Bratberg, 2017, p. 119). As a response to this challenge we will include an additional category in addition to those we already have. In this category comments that are unclear and difficult to place in any of the other categories without adding additional assumptions to the formulations will be placed. These comments will not be a part of the following analysis.

The analysis resulted in 18, of 84 comments in total, being placed in the unclear category. Consequently, 66 comments were classified and will be the basis for this analysis. Table 4.2 displays the frequency of respondents within each type of organization according to the type of comment they left to question 9d. Most of the comments are from respondents within old universities and technical universities, followed by new universities and university colleges. The lowest number of comments was form respondents within business schools. But this is also the category with the lowest number of respondents in the sample as a whole.

	Type of Organization				
Classification of Comments	Business Schools	New Universities and University Colleges	Old Universities	Technical Universities	Sum
Positive/No Influence	3	4	18	10	35
Negative	0	5	20	6	31
Sum	3	9	38	16	66

Table 4.2: Frequency of Respondents according to Type of Comment and Organization.

In order to be able to say something more about the relationship between evaluations and performance measures and the different types of organizations a second table was calculated. Table 4.3 displays percentage within each category of the performance and evaluations measures dimension according to the total number of respondents within each type of organization.

	Type of Organization			
Classification of Comments	Business Schools	New Universities and University Colleges	Old Universities	Technical Universities
Positive/No Influence	100.0	44.4	47.4	62.5
Negative Influence	0	55.6	52.6	37.5
Total	100.0	100.0	100.0	100.0

Table 4.3: Percentage of Respondents according to Type of Comment and Organization.

The percentages for the two categories varies across types of organizations. The difference is smallest betweeen "new universities and university colleges" and "old universities", where there only is a 3 percent difference between the positive/no influence and the negative influence category. Furthermore, for these two types of organizations a majority of the respondents report negative influence, while for business schools and technical universities a majority of the respondents report positive or no influence.

In this analysis we are also especially interested in the technical university category. A majority of those who left a comment (62.5 percent) reported positive or no influence from evaluations and performance measures. This finding moderates the finding in section 4.2.1 where all respondents working in technical universities had the highest possible score across all indexes. As a result, this support the explanation given section 4.2.1 to this finding. That those who are affected in a negative manner by evaluations and performance measures have not answered the questions related to this dimension and are possibly underrepresented in the sample. Even so, technical universities still have the second highest percentage of respondents in the positive/no influence category, with the exception of business schools. Where a 100 percent of the respondents report a positive influence, which is a contradiction to our findings in the previous section of this analysis. Where business schools had the lowest score across indexes. However, the total number of respondents is only 3. Which limits our possibility to use the findings of this category to draw any conclusion. Consequently, for technical universities the overall findings seems to be that a majority of the respondents within this category are not affect by evaluations and performance measures in a negative manner, compared to other types of organizations.

In summary, the analysis of the comments also points towards some variations between types of organizations on this dimension of influence. Furthermore, it points towards somewhat larger variations than the initial quantitative analysis but the number of respondents is lower. This makes is difficult to draw a solid conclusion but based on these findings a preliminary conclusion could be that there seems to be some degree of minor variations. However, the degree of variation is unclear and we cannot say anything definite. Further analysis is therefore needed. Additionally, one of the most important findings the analysis of the comments contributed to, is that we are able to moderate the findings of the first initial analysis when it comes to respondents within technical universities. There are respondents within this category that report influence of performance and evaluations measures but the percentage is lower than within most of the other types of organizations.

From this initial conclusion of minor variations we continue with an investigation of

variation within the second dimension of influence: organizational actors.

4.2.2 Organizational Actors

The initial analysis for of this dimension will be done in a similar fashion as with the first dimension. A table with mean and standard deviation for respondents within each category of the type of organization variable has been calculated. The difference between this dimension and the first is that more indicators are included in this dimension. In addition, the range of the scale for each indicator is different. 0 indicates high influence and 2 indicates no influence of influence.Table 4.4 displays the results of the calculation of mean and standard deviation.

	Additive Index Without Weights		Additive Index With Weights		Multiplicative Index	
Type of Organization	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Business Schools	7.77	1.90	4.74	1.12	11.77	12.58
New Universities and University Colleges	6.36	2.43	3.93	1.41	6.56	10.22
Old Universities	6.99	2.00	4.35	1.16	7.22	10.85
Technical Universities	6.12	2.41	3.76	1.42	6.29	9.86
All	6.77	2.20	4.19	1.29	7.26	10.72

Table 4.4: Mean and Standard Deviation across Indexes for Each Type of Organization.

The general interpretation of this table is the same as for table 4.1. High values indicate no or a positive influence of this dimension and a higher level of perceived academic freedom. In comparison to the first dimension, there seems to be more variation between types of organizations on this dimension. Business schools has the highest mean on this dimension across indexes. Old universities are second, followed by new universities and university colleges and then technical universities has the lowest mean across indexes. Compared to how the different types of organizations scored on the first dimensions the relationship is almost reversed. Business schools had the lowest mean on the first dimension and technical universities had the highest mean across indexes. The mean for each type of organization also differs from the aggregate mean of all respondents, independent of what organization type they belong to.

It should also be noted that the standard deviation for each estimation of the mean is also rather large here as for the first dimension. For this dimension this especially applies to the means of the multiplicative index. However, the range of the scale for the multiplicative index is also larger: 0-32. Which will increase the standard deviation, even so it is still quite large.

In brief, there are larger variations between types of organizations on this dimension of influence than for the evaluations and performance measure dimension. Furthermore, if we rank the organization types based on their scores on these dimensions

the ranking is reversed from one dimension to the other. Which possibly indicate that those who are influenced by evaluations and performance measures are less influenced by organizational actors and so on. However, we cannot be sure that these differences in means are actual differences between the groups of respondents within different types of organization. We therefore continue this analysis by testing this.

4.2.3 Difference in Means?

So far, we have seen that there are indications of differences between different types of organizations on both dimensions of influence on perceived academic freedom. However, we have not been able to conclude on whether these differences are actual variations or random variations in the sample. Therefore, we continue this analysis with a test for difference in means.

Since we have more than two groups that we are comparing the difference in means between, using a t-test to compare the mean would increase the probability of falsely rejecting the null hypothesis (type 1 error) to an unacceptable level (Field, 2009, p. 348). Because we would have to run several t-tests to compare all groups and thereby the probability of type 1 error would increase with each test, a t-test for three groups would result in a 14.3 percent probability of type 1 error (Field, 2009, p. 348). This is well above a significance level of 5 percent which is most used and accepted in the social sciences (Christophersen, 2013; Field, 2009). It is also the level of significance that will be applied in this analysis.

To avoid the problem of increased probability for type 1 error we will use a statistical method developed to analyze the difference of means between more than two groups. This method is referred to as ANOVA, the test tells us if one or more of the groups of our independent variable have a mean on the dependent variable that is not equal (Field, 2009, p. 349). It does not tell us which of the group means that are different only that there are differences (Field, 2009, p. 349). Since this is a parametric test based on the normal distribution the next step is to check if the underlying assumptions of the test hold (Field, 2009, p. 359). The first assumption is that the distribution within each group should be approximate to a normal distribution (Field, 2009, p. 359). In section 4.1.1 and 4.2.2 histograms were displayed that showed the distributions of our indexes for our two dimensions of influence on perceived academic freedom. Most of these distributions were not similar to a normal distribution. However, this might be caused by our somewhat limited sample and the central limit theorem tells us that an increase in the sample size will make the distribution of our variables increasingly similar to a normal distribution (Christophersen, 2013, p. 26). This entails that if the distributions of

our indexes deviate from the normal distribution to a small degree we could invoke the central limit theorem (Christophersen, 2013, p. 26). Unfortunately, when we generated histograms for each group on the indexes the distributions were similar to the overall distribution. This does not mean that our distributions are not normal but that we are not able to invoke the central limit theorem simply by looking at the distributions, the distributions might still be a product of the limited sample. A method for investigating if this is the case is bootstrapping (Field, 2009, p. 163). By using this method we treat our sample data as a population where samples are drawn from and put back before a new sample is drawn, at the same time the mean or other relevant statistics are estimated for each sample (Field, 2009, p. 163). By estimating the mean for each sample we can see whether the mean if normally distributed and if this is the case then we could also assume that the distributions for the sample is also normal (Christophersen, 2013, p. 26).

Inspection of the bootstrapped distributions within each group leads to a conclusion that we can assume normality within each group for the indexes on the organizational dimension of perceived academic freedom. For the indexes on our evaluations and performance measures dimension we could not assume the same. Histograms displaying the result of the bootstrap are found in the appendix, figure D.1 to D.8. An ANOVA test would therefore only be appropriate for our second dimension (Field, 2009, p. 359). For the first dimension, we therefore apply a non-parametric Kruskal-Wallis rank-sum test to evaluate difference in means (Field, 2009, p. 559). Table 4.5 displays the results of this test. There were no significant differences between groups for any of the indexes. As a result, the means for the different types of organizations are most likely equal for the evaluations and performance measures dimension.

Type of Measure/Index	Chi-squared	Degrees of Freedom	P-value
Additive Index	5.884	3	0.117
Additive Index With Weights	5.873	3	0.118
Multiplicative Index	5.879	3	0.118

Table 4.5: Kruskal-Wallis Ranked Sum Test for the Indexes on the Evaluations and Performance Measures Dimension.

For the second dimension ANOVA seems to be appropriate, but we also need to consider the assumption of homogeneity or constant variance (Field, 2009, p. 559). Many view the ANOVA test as quite robust for influence by lack of constant variance when the group sizes are equal (Field, 2009, p. 360). In this analysis we have a quite unequal number of respondents in each group and we therefore tested for presence

of heterogeneity or non constant variance. A Levene test can be used to test for this and a significant Levene test would indicate lack of homogeneity (Field, 2009, p. 150). The Levene test was significant for the two additive indexes but not for the multiplicative. As a result, there seems to be non constant variance within our groups. Furthermore, since the groups with the largest sample also have the smaller variances we get a liberal ANOVA which is more inclined to give us significant results even if there are no differences in means (Field, 2009, p. 360). Consequently, both ANOVA and a Kruskal-Wallis test was calculated for the indexes on this dimension. The results fo these two test is displayed in the tables 4.6 and 4.7.

Type of Measure/Index	F Value	P-Value
Additive Index	4.443	0.005*
Additive Index With Weights	5.241	0.002*
Multiplicative Index	1.541	0.204

Table 4.6: ANOVA Test for the Indexes on the Organizational Actors Dimension.

Type of Measure/Index	Chi-squared	Degrees of Freedom	P-Value
Additive Index	11.806	3	0.008*
Additive Index With Weights	13.811	3	0.003*
Multiplicative Index	5.009	3	0.171

Table 4.7: Kruskal-Wallis Ranked Sum Test for the Measures on the Organizational Actors Dimension.

Both the ANOVA test and the Kruskal-Wallis test gave significant results for the additive indexes but not for the multiplicative index. Therefore, it seems that there is variation, at least one of the group means are not equal, but this finding is also somewhat contradicted by the insignificant result for the multiplicative index. This might be caused by how this index is constructed, that it not a good fit to the data. As mentioned when discussed the construction of the indexes in the beginning of this chapter this index changed the distribution of respondents quite substantially, compared to the two additive indexes. While a majority of the respondents reported low influence from organizational actors on the additive indexes, while only a minority did it on the multiplicative index.

As such, we find no support, at least to some degree, for our expectation of variation between different types of organizations on this dimension of influence.

4.2.4 Findings and Expectations of the first RQ

This first stage of the analysis aimed at exploring the possibility of variation between the level of perceived academic freedom, at the aggregate level of each type of institution. This relates to the first research question and the expectations of findings we formulated in the background and theory chapter. Based on DiMaggio and Powell's (2010) perspective on isomorphism, we expected a similar level of perceived academic freedom across types of higher education institutions (expectation 1a). From the perspective of organization culture, we expected the level of perceived academic freedom to vary across types of higher education institutions (expectation 1b) (Christensen et al., 2007).

The calculation of mean and standard deviation for each dimension of influence and each type of organization indicated variation on both dimensions. Even so, the standard deviation was rather large for both dimensions, which makes it difficult to conclude in either direction. For the evaluations and performance dimension, we also did a quantitative content analysis of comments to an open question about the influence of these measures that pointed towards variation. However, the number of respondents in some categories of the type of organization was rather low. Consequently, there are indications of variations and support for expectation 1b but there is also a degree of uncertainty.

As a result of the uncertainty, we performed statistical tests for difference in means. These tests challenged the initial indication of variation on both dimensions of influence. For the evaluations and performance measures dimension, the tests for difference in means was not significant for any of the indexes. Indicating that the means are equal across groups and no variation (Field, 2009, p. 349). For organizational actors dimension, the tests were significant for the two additive indexes but not for the multiplicative index. However, the ability of the multiplicative index has been questioned previously in this chapter. As such, the trustworthiness of the findings based on this index is weakened. Accordingly, we base our initial conclusions on the results of the additive indexes.

In other words, both expectations related to the first research question finds partial support depending on the dimension of influence. Still, there is a need for further analysis. By applying regression analysis and including type of organization as an independent variable we if the variation of influence is reflected at the individual level, when relevant variables are controlled for. However, the main focus of the following sections of this analysis is the second research question. For this reason, findings that relates to the first research question will be dealt with further in the discussion.

4.3 Regressions Analysis

So far in the analysis we have focused on the question regarding variations between different types of organizations in their level of perceived academic freedom. In this next stage of the analysis this will still be considered but we will also incorporate the second question of possible influence from publication rate and source of funding by running regressions. Each dimension of influence on perceived academic freedom will be analyzed separately and we will first look at the evaluations and performance measures dimension.

4.3.1 Evaluations and Performance Measures

The first step of this analysis was to run OLS-regressions with the two additive indexes of this dimension as the dependent variables. However, when the underlying assumptions of OLS-regression was looked further into for these regressions it revealed that the assumptions of linearity in the relationship between the dependent and the independent variables, normally distributed and homoskedastic residuals was violated (Field, 2009, pp. 220-221). Plots displaying the background for this conclusion can be found in the appendix figure E.1, E.2 and E.3. As a result, we needed to look more closely on the dependent variable and how it relates to the independent variables. In the presentation of the possible indexes for this dimension in section 4.1.1 we also created a multiplicative index, which resulted in a binary variable. Because of the uncertainty regarding the relationship between the indicators within the indexes. For the analysis on the first research question on variations we analyzed the comments to question 9d, and these comments might help us unpack the relationship between indicators and decide whether or not measures should be taken to enable use of the continuous dependent variables options, or if a reduction to a binary dependent variable would be more appropriate.

Often, those comments that mentioned several indicators report that they pull in the same direction and that the direction of influence is dependent on the result. This means that positive reviews/evaluations and a high enough publication rate lead to a positive influence, while poorer reviews/evaluations and a too low publication rate lead to a negative influence. In addition to a potential for no influence because evaluations/reviews are not field specific and become too superficial. To exemplify, a few comments to question 9d are included below and in appendix E.

> (1) National reviews on the department level are too superficial to give much feedback on my own activity. If there is an effect, it could be both positive and negative, depending on the review & recommendations.

(2) Positive influence, as a potentially useful feedback, but not very important.

(3) Evaluations that are not specific to Scientific Fields ... are not very relevant to us and sometimes make us look like we are not accommplishing very much. For example - publication Points from the university.

In sum, it seems reasonable to assume that the respondents score on one indicator is dependent on the score on the other indicators. As such, a binary dependent variable seems appropriate when we consider both the comments to question 9d and the distributions of respondents across indexes. Therefore, we continue with the binary variable as the dependent variable in this analysis.

Since our dependent variable is now a binary outcome we need to apply binomial logistic regression rather than OLS-regression. The transition to a binary variable changes the relationship between our dependent and independent variable from a linear to s-shaped (Skog, 2004, p. 354). This is caused by the fact that when the share of respondents with a high value on the dependent variable reaches a certain level the dependent variable cannot continue to increase as it has reached the maximum value (Skog, 2004, p. 354). Consequently, the gradient of our curve flattens when we move towards high and low values of our independent variable (Skog, 2004, p. 354). By using binomial logistic regression this change of relationship between the variables is incorporated into the model. We therefore estimated initial models to be able to evaluate if binomial logistic regression could ba a better fit to our data (table 4.8).

For binomial logistic regression to be considered a better fit to our data there are several assumption that must be considered (Field, 2009, p. 273). The first of these are the shape of the curve, which should be s-shaped and then linear on the logit scale (Field, 2009, p. 273). A Hosmer-Lemeshow test can tell us if this is a correct assumption to make about the relationship between our variables (Skog, 2004, p. 381). If the test is not significant we are able to keep the null hypothesis of a linear logistic curve (Skog, 2004, p. 384). The Hosmer-Lemeshow test on the full model (4) gave no significant result (p-value of 0.81) and we can therefore assume that a binomial logistic regression fits our data and gives a good description of the relationship of between the dependent and independent variables (Skog, 2004, p. 384).

One important aspect for evaluating if binomial logistic regression is a better fit to our data and if the model meets the assumptions of this type of regression, is to check the shape of the curve . The curve should be s-shaped and then linear on the logit scale . A Hosmer-Lemeshow test can tell us if this is a correct assumption

(Skog, 2004, p. 381). The Hosmer-Lemeshow test on the full model gave no significant result (p-value of 0.61) and we can therefore assume that a binomial logistic regression fits our data and gives a good description of the relationship of between the dependent and independent variables (Skog, 2004, p. 384).

	Dependent variable:			
	Evaluations and Performance Measures			
	(1)	(2)	(3)	(4)
Publication	.492*	.449*	.464	.923**
	(.209)	(.227)	(.240)	(.341)
External Funding	.365	.569	.764	.553
	(.544)	(.588)	(.608)	(.632)
Female		−.197	−.221	.076
		(.672)	(.719)	(.816)
Assistant Professor		−.801	−.598	.323
		(.789)	(.861)	(1.034)
Associate Professor		−.047	−.259	−.130
		(.681)	(.717)	(.773)
Medical Position		15.933	18.065	19.629
		(1,591.948)	(4,213.807)	(4,098.791)
Business Schools			1.475	.229
			(1.198)	(1.419)
New Universities and University Colleges			.552	.398
			(.774)	(.855)
Technical Universities			18.258	18.679
			(2,010.917)	(1,875.214)
Cardiology				−3.012*
				(1.247)
Physics				−1.914
				(1.043)
Constant	.555	.674	.016	.661
	(.537)	(.752)	(.843)	(1.072)
Observations	123	123	123	123
Log Likelihood	−45.949	−44.172	−38.858	−35.303
Akaike Inf. Crit.	97.897	102.345	97.716	94.606
Note:	*p<0.05; **p<0.01; ***p<0.001			

Table 4.8: Binomial Logistic Regression Initial Models.

The second assumption in binomial logistic regression is that the residuals should be independent, there should be no autocorrelation in the model (Field, 2009, p. 220). High levels of autcorrelation is most common in longitudinal studies but with the structured data we use in the analysis this can be a relevant problem (Christophersen, 2013, p. 78). A Durbin-Watson test for autocorrelation led to a

estimate of 1.9554. An estimate of 2 indicates no autocorrelation in the data, since our estimate is quite close to 2 autcorrelation does not seem to be at a problematic level for our model (Christophersen, 2013, p. 78). This was also confirmed by a Breusch-Godfrey test for autocorrelation which yielded insignificant results.

The third assumption concerns multicolinearity, the independent variables or predictors should not correlate at a too high level (Field, 2009, p. 273). If there was perfect colinearity between predictors in the model we would not be able to "obtain unique estimates of the regression coefficients because there are an infinite number of combinations of coefficients that would work equally well" (Field, 2009, p. 223). Calculation of the variance inflation factor (VIF) can be used to detect multicolinearity in the model, and this should not be above 10 (Field, 2009, p. 224). The highest estimate of VIF for a variable in our model was 3.52, which is well below 10, and multicolinearity therefore seems to be a minor problem.

In sum, it seems fair to conclude that our full binomial logistic model does not violate any assumption and it is an appropriate method to use for the analysis of this data. We can therefore continue our analysis with this model and go one step further to look at potential problems related to the model and goodness of fit.

One problem that should be addressed concerning the initial models in table 4.8 above is that the technical university category for the type of organization variable and the medical position category has very high estimates compared to the other estimates in the model. This is caused by quasi complete separation, which means that in the technical university and medical position category all respondents are in one category of the dependent variable (Allison, 2008, p. 7). From section 4.2.1 and table 4.1 we know that all respondents in the technical university category report no influence or positive influence on all indicators in the evaluations and performance measures dimension. Therefore, all respondents in the technical university category have a value of 1 on the binary dependent variable which causes quasi complete separation (Allison, 2008, p. 7). The same is true for medical position. According to Allison (2008, p. 7) a common method for dealing with quasi complete separation is to delete the variable entirely from the model. However, this method is not recommended as it also has consequences for the estimates of the other variables included in the model (Allison, 2008, p. 7). As such, these variables will still be included in the model but we will also consider two additional methods for dealing with quasi complete separation: combining categories and keeping the variables as it is (Allison, 2008, p. 8).

Combining categories might be a viable option. To look into this the technical university category was combined with the new universities and university colleges

category. Then, the models in table 4.8 was estimated again with the new type of organisation variable. The results can be found in the appendix table E.1. Overall this resulted in minor changes in some of the estimates for the other independent variables and the estimate for the new universities and university colleges became significant. This is clearly related to the combining of the two categories as an introduction of several respondents with a high value on the dependent variable would change the internal dynamics of this category, especially if we take the total number of observations into account. As a result it gives us no more information than the initial models in table 4.8. Furthermore, we have already established in section 3.2.3 that technical universities is an relevant category because the respondents within this category belong to an organization with a distinct applied profile (NTNU, n.d.).

For the medical position category combining categories does not seem to be a viable option. If they are included in any of the other position categories we are not sure what a medical position would be equivalent to. Persons within the category could be well established professors or persons who have just started their academic career in medicine. This proposed solution would therefore possibly reduce reliability of our position variable as a whole and is as a result included in the model as it is (Field et al., 2012, p. 925).

Conversely, we are left with the third and last option which is to leave the variable as it is, for both technical university and medical position (Allison, 2008, p. 8). With all initial variables intact. While the estimate for the technical university category and medical position is problematic the other variables in the model can still provide useful and reliable information (Allison, 2008, p. 8). Because "the coefficients, standard errors, and test statistics for the remaining variables are still valid maximum likelihood estimates" (Allison, 2008, p. 8). However, we would have to interpret the coefficients in a special manner (Allison, 2008, p. 8). Due to the quasi complete separation in the two categories the estimates of the other variables in the model are not valid for the respondents within the problem categories (Allison, 2008, p. 8). This means that the estimates in the model are not valid for respondents within technical universities or those respondents who hold a medical position. In spite of this, keeping the variables as it is seems to be the most viable option, but we will also consider this question in regards to goodness of fit.

For the time being, we have two different full models to consider in regards to goodness of fit. But we also have a third option for our full model. As mentioned in section 3.4.2 we have two versions of the source of funding variable. The one used in the models in table 4.8 is a liberal version were respondents who reported

that external sources was a moderate or major source both were put in the external funding category. A more conservative version of this variable was also created where only those who reported that external sources was a major source were put in the external funding category. The models that were estimated using this variable can be found in the appendix table E.2. In summary, we now have three different full models which are model number 4 in the following tables: 4.8, E.1 and E.2. It is these three models that will be compared in regards to goodness of fit.

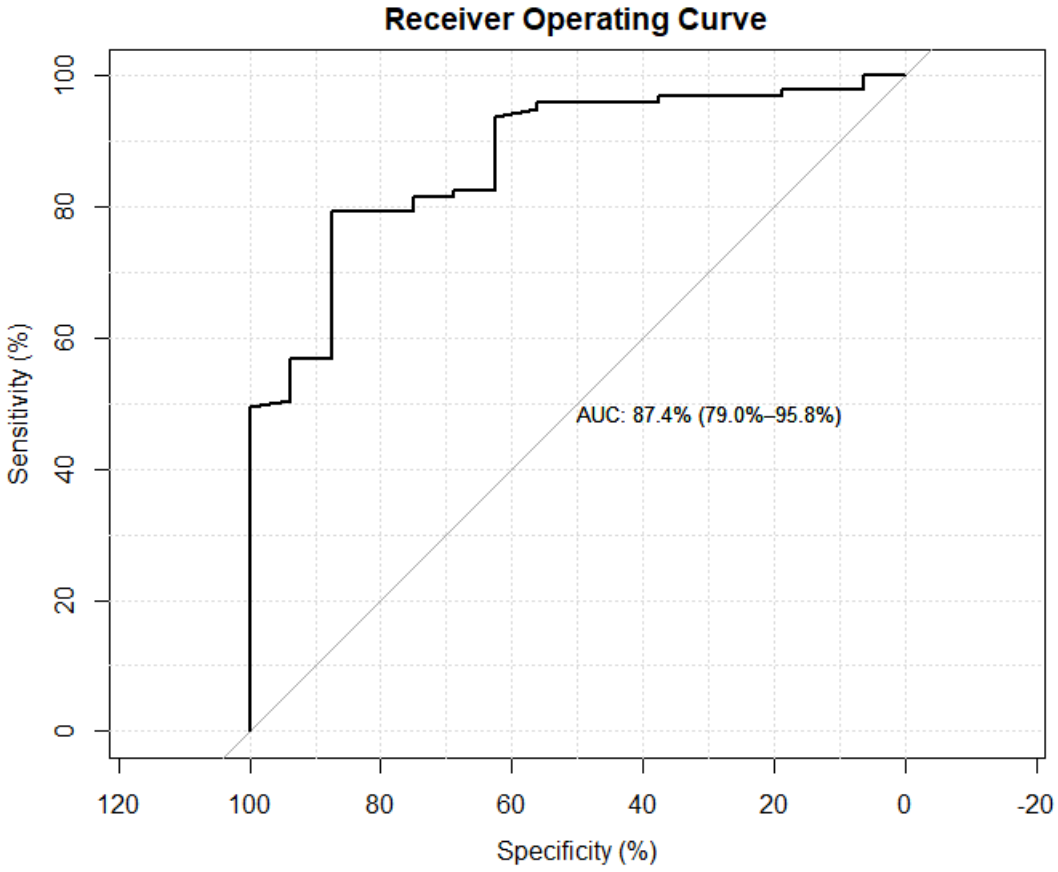
The first goodness of fit we will look at is Psuedo R2 which is both an indication of model fit and the relevance of the model, as it is the logistic regression version of R^2 in OLS-regression (Field, 2009, p. 268). However, while regular R^2 measure how much of the variance in the dependent variable the independent variables explain, Psuedo R2 is a measure for how much variance that is left unexplained (Skog, 2004, p. 418). Moreover, Psuedo R2 rarely reaches the max value of 1 and there are different version of this measure that give different estimates based on their method of calculation (Skog, 2004, p. 419). Therefore, several types of Psuedo R2 was calculated for the three alternative models. From table 4.9 we see that the model with the conservative funding variable consistently has the highest Psuedo R2 across types, subsequently this model is the one who leaves less variance in the dependent variable unexplained.

	Model	McFadden	CoxSnell	Nagelkerke
1	Initial Model	0.286	0.205	0.371
2	Model with Alternative Type of Organization Variable	0.222	0.163	0.295
3	Model with Conservative Funding Variable	0.310	0.223	0.400

Table 4.9: Psuedo R2 for the Alternative Models

Another method for deciding between models is to estimate AUC and plot the ROC curve (Faraggi & Reiser, 2002, p. 3093). A value of approximate to 1 for the AUC indicates that the model is able to distinguish very well between respondents and place them in the correct category of the dependent variable (Faraggi & Reiser, 2002, p. 3094). The AUC was highest for the model with the conservatives fundning variable (0.87), the ROC curve for this model is displayed in figure 4.6. The initial full model had an estimate of 0.86 and the model with the alternative type of organization variable had an estimate of 0.82. Which indicates that the latter of these models has a lower ability to distinguish between respondents (Faraggi & Reiser, 2002, p. 3094). However, the confidence bands for the estimates of AUC overlap so we cannot say that one model is significantly better than any of the other models.

Figure 4.6: ROC Curve for the Model with a Conservative Funding Variable.



The last method for goodness of fit evaluation is AIC and BIC (Field, 2009, p. 737). These measures builds on log-likelihood but includes model complexity in the equation, BIC more than AIC (Field, 2009, p. 737). In both cases a lower value means a model is better at predicting the outcome of the dependent variable, relative to how many independent variables that are included in each model (Field, 2009, p. 737). From table 4.10, below, we see that both measures indicate that the model with the conservative funding variable has the lowest value of AIC and BIC, and would be the best fit to the data when the number of variables is also taken into consideration. In conclusion, the model with the conservative source of funding variable seems to be the model that overall fits the data best.

	Model	AIC	BIC
1	Initial Model	94.606	128.352
2	Model with Alternative Type of Organization Variable	98.929	129.863
3	Model with Conservative Funding Variable	87.650	120.378

Table 4.10: AIC and BIC for the Alternative Models.

However, until now we have focused on the selection of the most appropriate model and it could also be discussed if all variables should be included in the selected model. In the methods, data and operationlization chapter we gave theoretical background on why the independent and control variables should be included. Furthermore, it is important in binomial logistic regression that all variables that are related to the dependent variable and correlated with an independent variable are included, there should not be omitted variables because this could lead to conclusions about the relation between variables based on spurious relationships (Skog, 2004, p. 381). From this perspective all variables should be included.

In addition, we could also evaluate models were the independent variables and control variables are included step-wise and see how estimates are affected by the introduction of new variables. When independent variables were included step-wise the majority of the estimates were approximately at the same level as before and going in the same direction. Some of the estimates were moderated slightly when we ran the full model, indicating that all variables should be included (Skog, 2004, p. 381). The variables were the direction changed are mainly control variables and based on the standard error of these estimates we can see that there is a high degree of uncertainty, which can explain this shift. The goodness of fit statistics also indicated that the full model was the better option. These statistics can bee found in the appendix table E.3. Since, the models are nested, based on the same number of observations, we are also able to compare -2LL (Skog, 2004, p. 413). -2LL also indicates that the full model is the better model.

As a result, the model with the conservative funding variable will be the basis for the discussion on the influence of evaluations and performance measures that follows this chapter. The estimates for each independent variable based on this model can be found in table 4.11. Positive estimates indicate decreased probability for influence of evaluations and performance measures and thereby increased perceived academic freedom. Negative estimates indicates increased probability for influence from evaluations and performance measures and thereby a decreased level of perceived academic freedom.

In other words, the model with the conservative funding variable and the results of this analysis will be the basis for our discussion on this dimension of perceived academic freedom. In the discussion we will look further into the implications of this analysis and see how the results relate theoretically to our research questions. Before this we will first continue with an analysis of the second dimension of perceived academic freedom: organizational actors.

	Dependent variable:			
	Evaluations and Performance Measures			
	(1)	(2)	(3)	(4)
Publication	.459*	.429	.469	1.087**
	(.211)	(.227)	(.241)	(.383)
External Funding	−.156	.144	.196	.068
	(.645)	(.718)	(.729)	(.770)
Female		−.068	−.215	.105
		(.668)	(.749)	(.894)
Assistant Professor		−.799	−.394	.908
		(.833)	(.881)	(1.139)
Associate Professor		.024	−.220	−.025
		(.690)	(.726)	(.791)
Medical Position		15.988	18.128	20.215
		(1,751.048)	(4,557.385)	(4,363.638)
Business Schools			−.813	.780
			(1.284)	(1.598)
New Universities and University Colleges			−1.499	.476
			(1.217)	(1.635)
Technical Universities			16.619	19.034
			(2,168.295)	(1,979.031)
Cardiology				−4.203**
				(1.515)
Physics				−3.106*
				(1.339)
Constant	.792	.863	1.753	.950
	(.518)	(.715)	(1.221)	(1.276)
Observations	113	113	113	113
Log Likelihood	−43.514	−41.944	−37.588	−31.825
Akaike Inf. Crit.	93.028	97.888	95.176	87.650
Note:	*p<0.05; **p<0.01; ***p<0.001			

Table 4.11: Binomial Logistic Regression Final Model.

4.3.2 Organizational Actors

From the ANOVA test we did earlier in this chapter we expect to find differences between different types of organizations on this dimension. However, the differences indicated by these tests might also be caused by other variables that we were not able to control for when we did the ANOVA and Kruskal Wallis tests. Therefore, we continue with the regression with by using the indexes for this dimension as the dependent variables. Since we have three different indexes we also have to consider which of these that are applicable in an analysis and is the best fit to the data. All three indexes on this dimension are continuous and it is therefore reasonable to start with OLS-regressions. Consequently, three initial OLS-regression were estimated, each with one of the indexes as the dependent variable. This enable us to evaluate whether or not the models meet the assumptions for OLS-regressions. The tables reporting the estimates for our initial models can be found in the appendix tables F.1, F.2 and F.3.

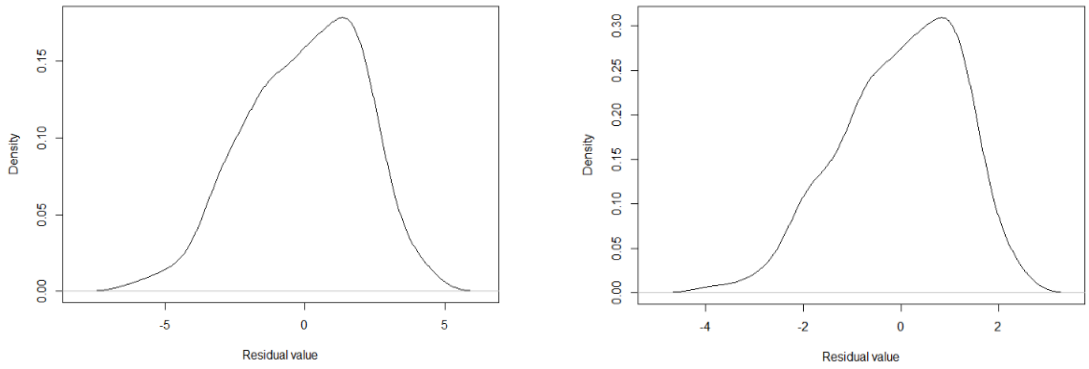
For OLS-regression to be an appropriate method of analysis the relationship between the dependent and independent variables needs to be linear (Christophersen, 2013, p. 74). By creating plots for the residuals versus fitted values for the three models we are able to see how the dependent and independent variables relate to each other (Field, 2009, pp. 247-248). The tables are found in the appendix table F.2 and F.1.

For the additive indexes the assumption of linearity seems to hold, as the red line is approximately horizontal and there is no clear indication of other types of relations between the variables (Christophersen, 2013, p. 74). For the multiplicative index it was problematic to make the assumption of linearity between dependent and independent variables, based on the residuals versus fitted values plot. Furthermore this index seems to create additional problems when it comes to other assumptions of OLS-analysis, such as the assumption of normally distributed residuals (table F.3) (Christophersen, 2013, p. 75). In section 4.1.2 we also questioned the ability of this index to describe the relationship between the indicators, as it shifted the majority of the distribution of respondents compared to the other two indexes. Consequently, we will not be applying the multiplicative index as a dependent variable in the analysis.

As in binomial logistic regression there should not be high levels of multiscollinearity or autocorrelation in the model (Christophersen, 2013, pp. 77-78). Multicollinearity cause inconsistent estimates and both increases the standard errors of the estimates which makes it difficult to obtain significant results (Christophersen, 2013, p. 77-78). The two initial models were tested for multicollinarity by checking VIF, which should not be above 10 (Field, 2009, p. 224). For the two models the VIF for each

of the variables was well below 10 which indicates that multicollinearity should not be a problem. In order to check for autocorrelation a Durbin-Watson test was done on both initial models, the result of this test should be around 2, which indicates no autocorrelation (Christophersen, 2013, p. 78). For both models the Durbin-Watson test resulted in a value close to 2. The two models therefore meeys the assumptions in OLS of no perfect multicollinearity and no autocorrelation (Field, 2009, p. 220).

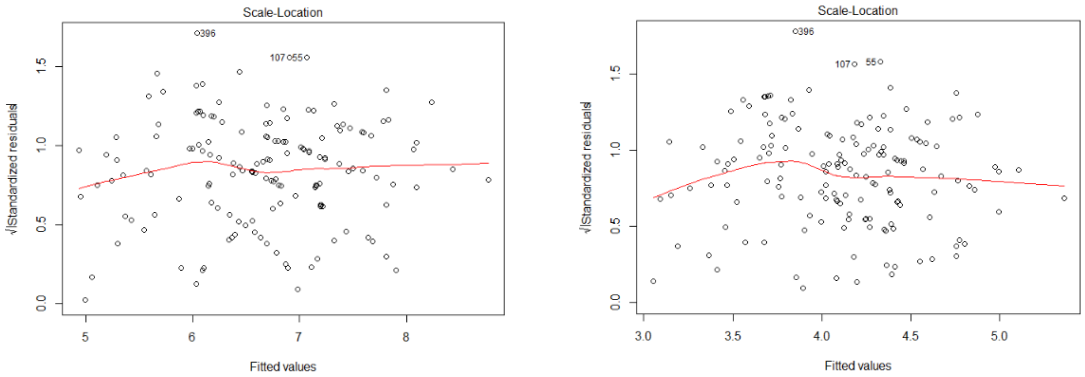
Next, we will look into the assumption of normally distributed residuals (Christophersen, 2013, p. 80). From the histograms presented in section 4.1.2 we remember that the distributions for the two additive indexes are skewed if we compare them to a normal distribution. This is not necessarily very problematic as there are no demands for the distribution of the dependent variable to be normal, but it might be an indication that residuals are not normally distributed, which is important for estimating standard error and consequently significance testing (Christophersen, 2013, p. 80). From table 4.7 we can see that both distributions of residuals from the regressions of are left skewed (Christophersen, 2013, p. 18). The initial analysis also resulted in insignificant estimates with large standard errors (see table F.1 and F.2), since we also have a limited sample increased standard errors as a result of non-normal residuals is a possible explanation of this (Christophersen, 2013, p. 75). This will be looked further into but first we will consider the assumption of homoskedastic residuals.



(a) Additive Index (b) Additive Index with Weights

Figure 4.7: Distribution of Residuals

Homoskedastic residuals means that "the variance of the residuals should be constant" (Field, 2009, p. 220). By creating plots of the standardized residuals and the fitted values we are able to see if it is reasonable to assume homoskedastic residuals, if this is the case there should be an even distribution of observations over and under the horizontal line (Christophersen, 2013, p. 76).



(a) Additive Index (b) Additive Index with Weights

Figure 4.8: Scale Location Plots.

In figure 4.8a we see that the distance between observations increases for high and low values of the x and y axis and there are more respondents in the center of the plot. The same is true for figure 4.8b but not to the same degree. However, we cannot assume that the residuals are homoskedastic in either of the two plots as there clearly are variations in the variance of the residuals. The residuals in our models are therefore heteroskedastic rather than homoskestic (Christophersen, 2013, p. 76). The problem with heteroskedastic residuals is that the standard error of our estimates increases, it gets harder to obtain significant results and we have less efficient models (Christophersen, 2013, p. 76). There are methods that can be used to mediate this problem but before we look into this we should see if the estimates or coefficients for each model is reliable or if some observations has an undue influence over them.

Influential observations are observations that have an strong influence over the coefficients of a model (Field et al., 2012, p. 269). The reason for checking for this is that if our estimates are the result of the influence of one or two observations we cannot assume that our model is stable across samples (Field et al., 2012, p. 269). The first thing we will look at is whether we have observations with high leverage or hat-values in our model, the limit of this value is calculated for each regression depending on the number of observations and independent variables (Christophersen, 2013, pp. 78-79). For these models an observation will be considered to have a high hat-value when it is above 0.12. When the hat-values for the observations were calculated several observations had hat-values above 0.12 but only two or three, depending on the model, had a hat-value above 0.14. Hat-values are calculated based on the values of the dependent variable and does not necessarily affect the coefficients but it is an indication that the observations should be studied more in detail in combination with other measures for influential observations (Field et al., 2012, p. 270).

The second measure for influential observations is Cook's distance which measures "the overall influence of a case on the model", Cook's Distance above 1 should be considered concerning as these cases or observations affect the regression and coefficients (Field, 2009, pp. 269-270). We do not have any observations with a Cook's distance above 1 but we have a few observations in both models with a value above 0.04. Finally, we can check the DFbeta values for each observation, these indicate how much coefficients change when one observation is excluded, the DFbeta score should not be above 1 as this indicates substantial influence (Field, 2009, p. 219). No observations in our two models had a Dfbeta value above 1.

In sum, there are no observations in our models that alone drive the overall results of the regressions. Even so, it is worth checking how the model changes with the removal of observations that consistently had the highest scores on these measures because it provides information about the overall fit of the model to the data (Field et al., 2012, p. 271). 5 such observations were identified. To see how these influenced the coefficients they were first all removed from the model to see if this changed the estimates. Afterwards, each observation was removed individually. The result was that some estimates changed in size but the direction of the relations were mostly the same. We also considered to what degree the two indexes were influenced by these specific observations. From this we can conclude that the additive index was to a larger degree affected by influential observations than the additive index with weights. The weighted index was more robust and estimates were approximately the same even if observations were removed. As a consequence, the weighted index seems more reliable and will be used to estimate the final model for this dimension of influence.

To conclude, we have established that the model with the weighted index meets the assumption of linearity, no multicollinearity and autocorrelation but not normal and homoskedastic residuals. One method for dealing with non-normality is to transform the data using a log transformation but this will not necessarily make the residuals more normally distributed (Christophersen, 2013, p. 84). A log transformation of the index did not seem to make the distribution of residuals less skewed (see figure F.4). Furthermore, we still have a problem with non-constant variance of residuals. Both of these issues results in a less efficient model with larger standard errors (Wilcox, 2017, p. 518). There are various methods available for dealing with either of these problems but bootstrapping is a method that could be applied to remedy both issues, as bootstrapping does not assume normality (Field et al., 2012, p. 298). Bootstrapping has also proven to work well in situations were both problems are prominent (Wilcox, 2017, p. 522). As a result, we continue this analysis by applying bootstrapped standard errors. These are calculated by taking

a random sample from our sample, running the regression and then generating the variance covariance matrix and standard error for each repetition. This gives us the bootstrapped estimated standard error for the estimates in our regression. The results are presented in table 4.12, several estimates are now significant.

	Dependent variable:			
	Organizational Actors			
	(1)	(2)	(3)	(4)
Publication	−.064*	−.045*	−.045*	.076*
	(.005)	(.007)	(.007)	(.01)
External Funding	−.183*	−.159*	−.123*	−.194*
	(.009)	(.012)	(.013)	(.018)
Female		−.210*	−.138*	−.200*
		(.018)	(.019)	(.023)
Assistant Professor		−.200*	−.225*	−.025
		(.022)	(.023)	(.034)
Associate Professor		.200*	.250*	.434*
		(.021)	(.021)	(.025)
Medical Position		−.534*	−.619*	−.529*
		(.074)	(.074)	(.091)
Business Schools			.483*	.308*
			(.064)	(.068)
New Universities and University Colleges			−.578*	−.413*
			(.019)	(.027)
Technical Universities			−.686*	−.722*
			(.017)	(.021)
Cardiology				−.344*
				(.038)
Physics				−.318*
				(.032)
Constant	4.395*	4.396*	4.611*	4.482*
	(.014)	(.023)	(.029)	(.041)
Observations	224	191	191	154
R^2	.010	.029	.106	.122
Adjusted R^2	.001	−.002	.062	.054
Note:	*p<0.05; **p<0.01; ***p<0.001			

Table 4.12: OLS-Regression with the Additive Index with Weights as the Dependent Variable.

The models in table 4.12 are generated using the liberal version of the source of funding variable. For the the evaluations and performance measures dimension, we also considered the conservative version of this variable and determined that the model that applied this variable was a better fit to the data (section 4.3.1). Therefore, we should also consider it for this dimension. The result of applying the conservative source of funding to generate regression on this dimension is displayed in table 4.13.

	Dependent variable:			
	Organizational Actors			
	(1)	(2)	(3)	(4)
Publication	−.070*	−.043*	−.029*	.073*
	(.005)	(.007)	(.007)	(.011)
External Funding	−.261*	−.242*	−.118*	−.003
	(.011)	(.015)	(.016)	(.020)
Female		−.227*	−.163*	−.175*
		(.018)	(.018)	(.023)
Assistant Professor		−.250*	−.305*	−.269*
		(.022)	(.024)	(.033)
Associate Professor		.236*	.289*	.465*
		(.020)	(.020)	(.023)
Medical Position		−.350*	−.440*	−.056
		(.107)	(.101)	(.131)
Business Schools			.289*	.229*
			(.055)	(.055)
New Universities and University Colleges			−.425*	−.157*
			(.021)	(.029)
Technical Universities			−.683*	−.721*
			(.019)	(.025)
Cardiology				−.472*
				(.034)
Physics				−.077*
				(.028)
Constant	4.464*	4.439*	4.549*	4.307*
	(.014)	(.022)	(.026)	(.033)
Observations	224	189	189	154
R^2	.016	.042	.098	.138
Adjusted R^2	.007	.011	.052	.072
Note:	*p<0.05; **p<0.01; ***p<0.001			

Table 4.13: OLS-Regression with Additive Index with Weights as the Dependent Variable, Bootstrapped Standard Errors and the Conservative Funding Variable.

For our independent variables the estimates are mostly the same even though the conservative source of funding variable is applied. However, in model 4 of table 4.13 the estimate for external funding much lower compared to the estimate in model 4 of table 4.12. The implication of this is considered further in the discussion. Another aspect to note, is that R^2 is consistently slightly higher for the models in table 4.13 than for the models in table 4.12. R^2 indicates how much of the total variance the models explain (Field et al., 2012, p. 58). The aim is to explain as much of the variance as possible. Consequently, we should base our discussion on the model that explains the most of the total variance, in this case it is model 4 in table 4.13.

In both tables an estimate indicate the expected change in the value of the dependent variable when the value of an independent variable increases with one unit, all else equal (Field et al., 2012, p. 252). For instance the estimate for females in table 4.12 indicate that when we go from men to women the expected value of the dependent variable decreases with -0.200 scale units. The more substantial interpretation is that men are less influenced than women by organizational actors and have a higher level of perceived academic freedom.

Chapter 5

Discussion

This part of the thesis aims to discuss the findings of the analysis in relation to our research questions. We will assess thesis' expectations, and determine which expectations that find support in the data. We continue the discussion on the first research question from section 4.2.4 and connect this to the findings of the regressions in section 4.3.1 and 4.3.2, to shed further light on the question of variation. With this in mind, we examine the findings of the regression analysis related to our second research question. This question concerns the relation between the level of perceived academic freedom and the performance indicators.

5.1 Variation Between Different Types of Higher Education Institutions?

Our first research question was formulated as follows:

> RQ 1: Is there a variation in perceived academic freedom for academics within different types of higher education institutions in Norway?

Based on the two theoretical perspectives and what we know about the historic development of higher education institutions, we formulated the following expectations:

> 1a: The level of perceived academic freedom will be similar across types of higher education institutions.
>
> 1b: The level of perceived academic freedom will vary across types of higher education institutions.

The initial analysis of variation, only indicated differences in means between types of

organizations for the second dimension of influence: organizational actors (section 4.2 and 4.2.4). For the evaluations and performance measures dimension, there were indications of minor variations. These indications of variation were found in the descriptive statistics and the quantitative content analysis of the comments to question 9d. Even so, for some of the organization types the number of respondents who commented this question was very low, which makes it difficult to base our conclusion of variation on this alone. Furthermore, the difference of means tests on this dimension gave no significant results.

With this in mind, we consider the findings of the regression analysis. Each regression had a dimension of influence as the dependent variable. For the first dimension of influence, we applied a binomial logistic regression. This enables us to calculate the predicted probability of influence on this dimension for academics within different types of organizations. To do this, we fixed the values of the other variables at the mean, median or the category with the highest frequency. The predicted probabilities of influence for academics within each type of organizations are displayed in figure 5.1.

Figure 5.1: Predicted Probability for Reporting Influence from Evaluations and Performance Measures.

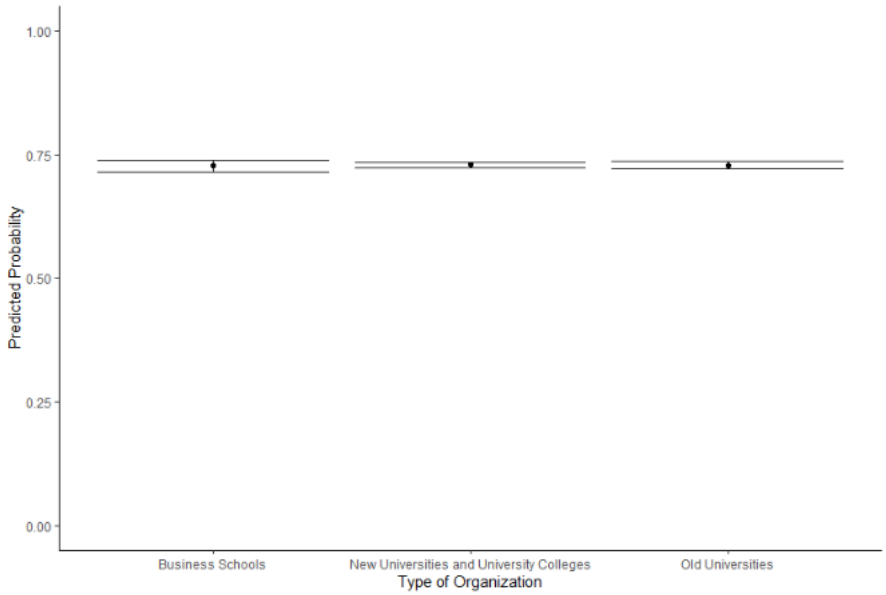


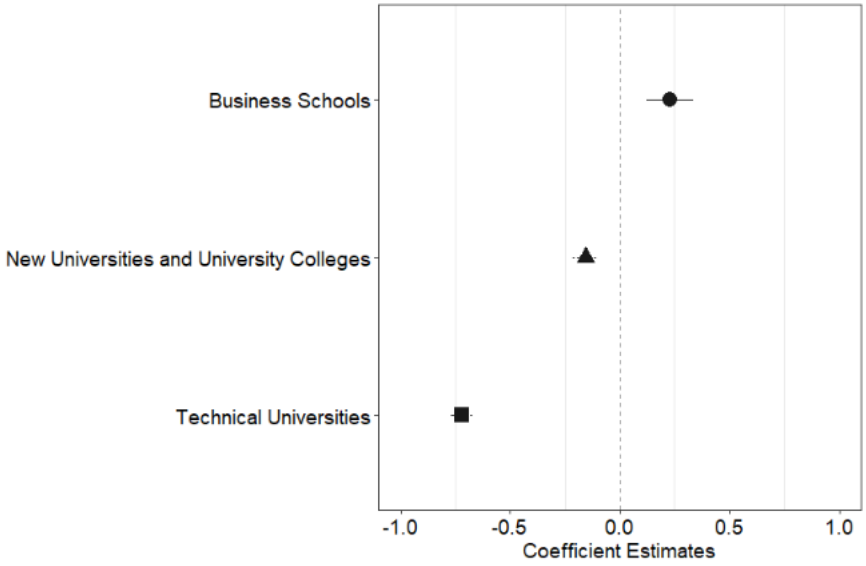
Figure 5.1 indicate no significant differences in the predicted probability of reporting influence from evaluations and performance measures between academics in different types of organizations. The overlapping confidence bands, which are the horizontal lines over and under the black dots, show this. The confidence bands indicate within what range we believe that the true value of the estimate can be found (Field et al., 2012, p. 915). Consequently, when they overlap, the true value could be the

same. Subsequently, figure 5.1 indicate that academics within different types of organizations have the same level of perceived academic freedom. This means that we find support for expectation 1a, of no variation.

However, as mentioned at the beginning of this section, there were indications of variations on the organizational actors dimension of influence. The ANOVA test and the Kruskal-Wallis ranked sum test in section 4.2.3 indicated that at least one mean of the respondents within different types of organizations, was not equal. There were also a larger difference between the means on this dimension, compared to the evaluations and performance measures dimension when the descriptive statistics were considered.

Furthermore, the OLS-regression (table 4.13) with the organizational actor dimension of influence as the dependent variable also indicate significant differences. Figure 5.2 show the regression estimates for the categories of the type of organization variable.

Figure 5.2: Coefficient Estimates for Academics within Different types of Organizations.



Due to the selection of "Old Universities" as the reference category, figure 5.2 do not show an estimate for this category. Therefore, the estimates in the figure in figure 5.2 are interpreted a bit differently (Christophersen, 2013, p. 54). The estimates are interpreted as the expected change in the value of the dependent variable when we go from "Old Universities" to any of the other categories of the type of organization variable. As such, figure 5.2 indicate that there is variation in the influence of organizational actors for academics within different types of organizations.

The more substantial interpretation of these coefficients is that to be an academic within a business school decreases the influence of organizational actors, compared to being an academic within old universities. While to be an academic within new universities and university colleges increases the influence of organizational actors, compared to being an academic within old universities. Consequently, academics within old universities and business schools seem to have a higher level of perceived academic freedom.

The overall level of perceive academic freedom is dependent on the influence across both dimensions of influence. As a result, we find support for expectation 1b, of variation in the level of perceived academic freedom across types of higher education institutions. Because of the variation of in the influence of organizational actors according to type of organization. The question is then, how can this be explained by the theoretical perspectives used to formulate these expectations.

Expectation 1b was formulated based on the perspective of organization culture. It argues that differences in orientation and the point in time when the institutions are established would cause a variation in the degree of implementation (Christensen et al., 2007, pp. 41, 45). Because the institutions orientation towards a specific field or type of research shape how the logic of appropriateness develops and the creates a difference in beliefs, values and behavioral that new members bring into the organization (Christensen et al., 2007, p. 41; Schein, 2017, p. 6). Additionally, if institutions were established at a point in time were the current norms and values were those that lead to changes in management these will have greater importance for future development. Consequently, a problem of this perspective is that the finding of variation should also apply to the evaluations and performance measures dimension. Because the norms and values that are viewed as creating a potential for increased influence from organizational actors are also those that led to implementation of evaluations and performance measures later on in the development (Maassen et al., 2011, p. 484). As such, the potential exploratory power of this theoretical perspective is weakened. Therefore, we should also consider other explanations of this finding.

DiMaggio and Powell (2010, p. 154) argue that organizations within a structured organizational field become "homogeneous in structure, process and behavior", as a result of the different forms of isomorphism. This fits well with the finding of no variation on the first dimension of influence and can be explained through two forms of isomorphism. Performance and evaluations measures were introduced by the government and the ministry of education and research, which higher education institutions are highly dependent on for both funding and regulations (Christensen, 1991; Kirke-

, utdannings-, og forskningsdeparementet, 1991; Kunnskapsdepartementet, 2015a). Through this dependence, coercive isomorphism arise and creates a pressure for implementation (DiMaggio & Powell, 2010, p. 150). Furthermore, the introduction of a result-based funding system led to new methods for measuring the overall goal of higher education institutions: to produce knowledge and educate the population (Frølich et al., 2014, p. 16; Kunnskapsdepartementet, 2015b, [p. 281). Changes to the methods for measuring goal achievement has the potential to create an uncertainty that encourages a mimetic form of isomorphism, that causes organizations who are affected by this uncertainty to model themselves after other organization within the field (DiMaggio & Powell, 2010, p. 151). As such, this form of isomorphism increases similarities between higher education institutions.

However, we also expected a similar level of influence from organizational actors based on DiMaggio and Powell's (2010) perspective of isomorphism. Since the influence of organizational actors varied across types of organizations, this finding needs additional attention. Evaluations and performance measures were implemented across institutions while the transition from elected to appointed leadership within institutions was a voluntary arrangement (Dordrecht: Larsen, 2003, p. 71). The rationale behind this transition was to give the leadership within each institution "sufficient means to promote excellence in research" (Dordrecht: Larsen, 2003, p. 71). Consequently, it has the potential to cause variations in the influence of organizational actors across institutions. Additionally, because this transition was a voluntary arrangement the pressure of implementation caused by the coercive form of isomorphism was not as strong as for evaluations and performance measures (DiMaggio & Powell, 2010, p. 150). Thereby, giving more room for normative forms of isomorphism were academics play an important role (DiMaggio & Powell, 2010, p. 152). As a result, this could be a possible explanation for the finding of variation relating to the influence of organizational actors.

We now have discussed the findings in relation to background, theory and expectations. However, we should also be aware that other forces might also be at play. Significant field differences were found for both dimensions of influence. On the evaluation and performance measures dimension economics had a somewhat higher predicted probability than cardiology and physics. Furthermore, for the field of science variable economics was selected as the reference category. If we revisit table 4.11 in section 4.3.1 we can conclude that while physics and cardiology are not significantly different from each other, economics is significantly different from both. This division between fields can also be found on the organizational actors dimension of influence, figure 5.4.

Figure 5.3: Field Differences on the Evaluations and Performance Measures Dimension.

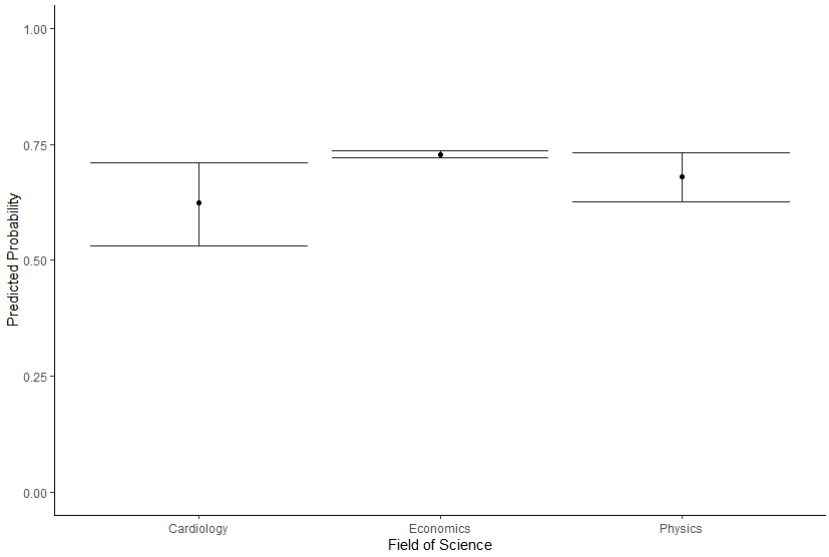
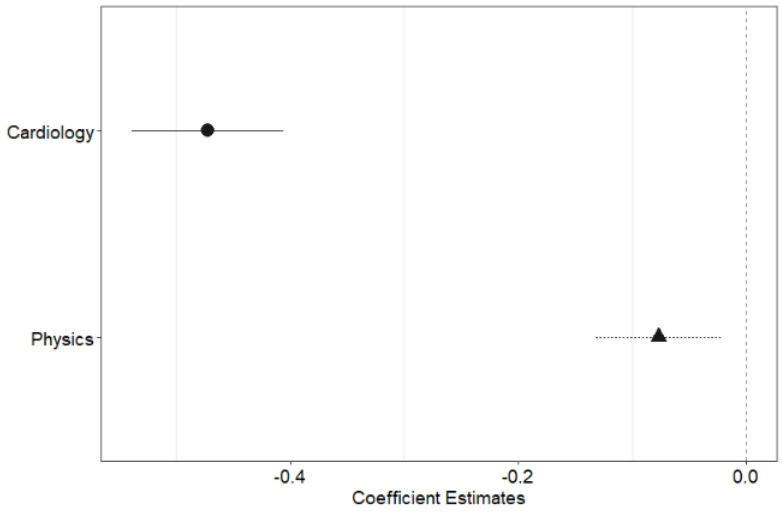


Figure 5.4: Organizational Actors - Field Differences.



This division has relevance because of Biglan's (1973, p. 201-202) division between hard and soft sciences according to their subject matter and practical application. He characterizes economics as a soft science while physics and cardiology are characterized as hard sciences. As a result it is possible that this division between fields also affect how they are influenced by evaluations and performance measures and organizational actors. Consequently, also the level of perceived academic freedom.

In sum, we found support for the second expectation (1b) and the answer to our first research question is that findings point towards variation. However, because one dimension indicated variation and the other did not, it proved difficult to explain

this as a result of variations in organization culture. Consequently, we relate the findings to the perspective of isomorphism and argue that the variation found is related to the differences in the pressure for implementation caused by the coercive form of isomorphism within each dimension (DiMaggio & Powell, 2010, p. 150). Furthermore, culture also seems to be a relevant factor but rather than in terms of different types of organizations it seems more reasonable to look at differences in the tradition or culture within different scientific fields (Biglan, 1973, p. 201-202).

5.2 Publication and Source of Funding

The second research question was formulated as follows:

> RQ 2: How is the individual perception of academic freedom related to publication rate and source of funding?

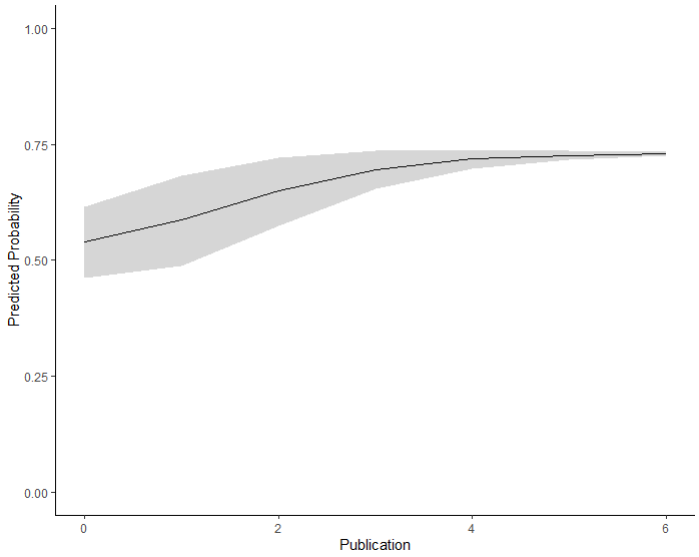
The expectations were formulated as follows:

> 2a: Publication rate and source of funding are related to the level of individual perceived academic freedom.
>
> 2b: Publication rate and source of funding are not related to the level of individual perceived academic freedom.

The idea behind the formulation of this research question and the following expectations was to dig a bit deeper and take two very specific measures that can be viewed as a product of the shift "from rule production and rule adherence to goal formulation and performance control" (Bleiklie et al., 2003, p. 25). To be able to say something more about the specific relationship between academics perception of their academic freedom and these independent variables, at the individual level.

The basis for this discussion is the two regression analysis in section 4.3.1 table 4.11 and section 4.3.2 table 4.13. We start by investigating the findings relating to publication. For the influence of evaluations and performance measures we did the same as above and calculated predicted probabilities. Figure 5.5 show the result. From figure 5.5 we see that the predicted probability for reporting no or positive influence of evaluations and performance measures increases as we move towards high values of the x-axis. Which indicates that for this dimension increased publication can contribute to a higher level of perceived academic freedom. As the respondents are less likely to report influence from these dimension when they have a higher publication rate.

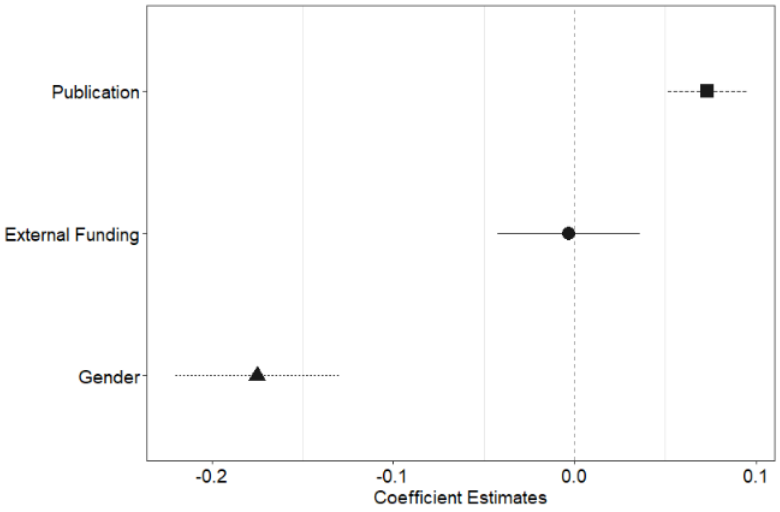
Figure 5.5: Evaluations and Performance Measures.



We were not able to draw any conclusions based on the source of funding variable for this dimension because of a high degree of uncertainty regarding the direction and size of the relation between the variables. This could also be an indication of no relation between the influence of evaluations and performance measures and source of funding.

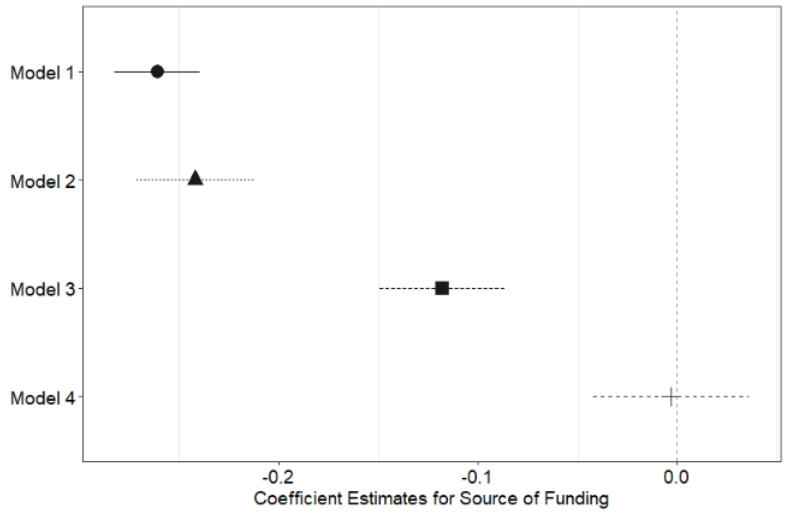
For the second dimension, regarding the influence from organizational actors, the relationship to publication was unclear. In table 4.13 the estimate was first negative before it turned positive in the final model. Therefore, we cannot draw any conclusion for publication on this dimension of influence. For source of funding, figure 5.6 show that a transition from internal to external funding has a small but positive effect.

Figure 5.6: Organizational Actors.



The estimate for the source of funding variable on this dimension is very close to zero, see figure 5.6. Admittedly, this is interpreted as whether or not academics receive internal or external funding does not make much difference when it comes to the influence of organizational actors and the level of perceived academic freedom. Even so, inspection of the estimates of each model in table 4.13 showed that the estimate for source of funding decreased when the type of organization variable was introduced in model 3 and became insignificant and close to zero when the field of science variable was introduced. This is displayed in table 5.7.

Figure 5.7: Source of Funding Estimate for Each model in Table 4.13



Since our type of organization variable was operationalized with potential field influence for field specific or specialized institutions taken into account (section 3.4.2) and because field makes the estimate insignificant the relation between source of funding and influence of organizational actors could potentially be field specific. For example, that source of funding is important for those within more practical and applied field of science, such as cardiology (Biglan, 1973, p. 201-202).

It is also interesting to note that women have a lower value on this dimension, compared to men. Which indicates that they are more negatively influenced by organizational actors an potentially have a lower level of perceived academic freedom. This finding is in accordance with the existing literature on gender differences in academia (Abramo et al., 2009; Abramo et al., 2013; Brouns, 2000; Leahey, 2006; Witteman et al., 2019). Which demonstrate that women are evaluated differently and possibly less favorably, when it comes to funding applications (Brouns, 2000; Witteman et al., 2019).

Based on the findings related to the second research question we find support for expectation 2a. Publication rate is related to the individual perception of academic

freedom. Furthermore, it has the potential to increase the level of perceived academic freedom. Expectation 2a was formulated based on the perspective of isomorphism and we argued that performance indicators would be transferred to the individual level partly because the institutions performance on these indicators is clearly visible and an important source of legitimacy and success (DiMaggio & Powell, 2010, p. 151). Most importantly, because the institutions performance is ultimately dependent on the performance of the individuals within it. However, for source of funding the negative estimate was significantly reduced when field of science was introduced as a variable. Indicating that rather than source of funding being related to the level of perceived academic freedom the relation is between field of science and perceived academic freedom. Which further indicates the importance of differences in the tradition or culture within different scientific fields and the relation to perceived academic freedom (Biglan, 1973, p. 201-202).

5.3 Concluding Remarks

In light of the development of PM reforms within higher education institutions, we asked how academics today perceive their academic freedom and questioned the relation between perceived academic freedom and specific measures implemented as a result of these reforms. We found that the overall level of perceived academic freedom varied across types of organizations. Furthermore, that there is a relation between the level of perceived academic freedom at the individual level and publication rate.

The findings of this thesis, can to some degree be explained by viewing higher education institutions as a part of an ongoing isomorphic process that make the institutions increasingly similar (DiMaggio & Powell, 2010, p. 154). And that overall variation is related to the differences in the pressure for implementation, caused by the coercive form of isomorphism within each dimension (DiMaggio & Powell, 2010, p. 150). Even so, these findings also suggest that the level of perceived academic freedom is related culture, not in terms of organizational culture but rather differences in traditions and culture of scientific fields (Biglan, 1973, p. 201-202). More specific, that there is a division between hard and soft sciences in the level of perceived academic freedom (Biglan, 1973, p. 201-202).

Finally, although the findings indicate that there are limitations to perceived academic freedom we should not consider higher education institutions merely "instrument for shifting national political agendas" and academics as a civil servant (Harris, 2005, p. 425; J. P. Olsen, 2007, p. 32). Even so, a need to take external priorities into account. Especially for academics within certain fields.

Chapter 6

Conclusion

6.1 Summary and Key Findings

The background and starting point for this thesis, is the implementation of PM reforms and the debate concerning the tension between the authorities right to control and the autonomy of public organizations (Christensen et al., 2010, p. 74). Therefore we asked how academics today perceive their academic freedom and look further into possible relations between the level of academic freedom and the specific measures implemented by public management reforms.

Academic freedom is important because it functions as an "assurance that new ideas would be discovered, that sound old ideas would be appreciated in an a more critical way, and that unsound ones would be discarded" (Shils, 1997, p. 153). Furthermore, limitations to this freedom changes how we view the role of higher education institutions and the role of the academic. That we should view higher educations institutions as "instrument for shifting national political agendas" and that the role of the academic has moved towards that of the traditional civil servant (Harris, 2005, p. 425; J. P. Olsen, 2007, p. 32).

The literature on PM reform within higher education institutions argue that degree of implementation vary (Christensen, 1991, pp. 108-109; Maassen et al., 2011, p. 492; Stensaker, 2006, p. 54). Therefore, the first research question aimed to connect this to the level of percieved academic freedom: (1) Is there a variation in perceived academic freedom for academics within different types of higher education institutions in Norway? The second research question was based on the literature related to the specific measures implemented as a result of PM reform. This literature suggests the changes in management and increased focus on evaluations and goal achievement had the potential to decrease the emphasis on "the academic-professional autonomy"

(Bleiklie et al., 2003, p. 25; Christensen, 2011, p. 515). As such, publication rate and and source of funding were selected as the specific measures to look into because their implementation is a clear result of this shift in management (Bleiklie et al., 2003, p. 25). In addition to their potential relation to academic freedom that was found in the literature (Aagaard, 2015; Aberbach & Christensen, 2018, p. 502). This led to the formulation of the second research question: (2) How is the individual perception of academic freedom related to publication rate and source of funding?

Following this, the historic development of PM reform within higher education institutions in Norway was outlined. To be able to look into both the institutional and the individual level we selected different perspectives within the framework of organizational theory. The first was DiMaggio and Powell's perspective on isomorphism, Meyer and Rowan's (1977) myth perspective was also considered but because it was unclear in regards to whether or not we should expect variation within institution, this was not applied further. From the perspective of DiMaggio and Powell (2010) we expected a similar level of perceived academic freedom between types of higher education institutions. In addition to a relation between perceived academic freedom and source of funding at the individual level. The second perspective was organization culture. Based on organization culture we expected to find a variation in the level of perceived academic freedom between types of higher education institutions but not a relation between perceived academic freedom and source of funding.

The next step was too discuss issues related to the data we would be using in the analysis and to operationalized a measure for perceived academic freedom. Based on the initial definition retrieved from an Norwegian Official Report (NOU 2006: 19, p. 7) we operationalized perceived academic freedom as having two dimensions of influence: evaluations and performance measures and organizational actors. Subsequently, we operationalized the independent variables: type of organization, publication rate and source of funding. Relevant control variables were also identified.

Following this, we started with an analysis of the first research question based on descriptive statistics and difference in means tests. These lead to initial conclusions of variation on the second dimension but not the first. This was also confirmed by the regression analysis. Because these dimensions constitutes a joint measure for perceived academic freedom we therefore concluded that there were variations between types of higher education institutions. However, because of the lack of variation on the evaluations and performance measures dimension of influence, the

findings were ascribed to the perspective of isomorphism (DiMaggio & Powell, 2010). Through the difference in the degree of pressure for implementation caused by the coercive form of isomorphism, within each dimension (DiMaggio & Powell, 2010, p. 150). Even so, we also find the perspective of organization culture relevant but in terms of differences between scientific fields (Biglan, 1973, pp. 201-202).

For the second research question we find a relation between perceived academic freedom at the individual level and publication rate but not for source of funding. We argue that these performance measures are transferred to the individual level because the institutions performance on these indicators is an important source of legitimacy and success of the institutions (DiMaggio & Powell, 2010, p. 151). Which ultimately depends on the performance of the individuals within these institutions. However, this explanation did not seem to be appropriate for source of funding. Rather the findings related to source of funding pointed towards the importance of culture and tradition within different scientific fields (Biglan, 1973, pp. 201-202).

Consequently, we find the findings can partly be explained by an ongoing isomorphic process but that the different culture and traditions of scientific fields should also be taken into account when studying perceived academic freedom (Biglan, 1973; DiMaggio and Powell, 2010). Finally, although the findings indicate that there are limitations to perceived academic freedom we should not consider higher education institutions merely "instrument for shifting national political agendas" and academics as a civil servant (Harris, 2005, p. 425; J. P. Olsen, 2007, p. 32). Even so, a need to take external priorities into account. Especially for academics within certain fields.

6.2 Contribution

This thesis contributes to literature on implementation of PM management reform by exploring the relation to the level of perceived academic freedom. There are contributions in the literature that concerns the implementation of PM reform within higher education institutions, these suggests a variation in the degree of implementation (Christensen, 1991, pp. 108-109; Maassen et al., 2011, p. 492; Stensaker, 2006, p. 54). In addition to contributions that look into the implications of the specific performance measures (Aagaard, 2015; Aberbach & Christensen, 2018, p. 502). However, few contributions were found that established a connection between the two.

The findings of this thesis also points towards an important difference between how we should study the implementation PM reform in general and within higher ed-

ucation institutions, when it is related to the level of perceived academic freedom. In general, variation in the degree of implementation is often explained by the process of implementation or the culture of the organization (Maassen et al., 2011, p. 492; (Stensaker, 2006, p. 54). However, when we study the relation between implementation and the level of perceived academic freedom, our findings points towards importance the difference in cultures and traditions within scientific fields (Biglan, 1973, pp. 201-202).

Furthermore, this was studied quantitatively which enabled inclusion of an increased number of higher education institutions compared to previous more qualitative oriented studies of related topics (Aberbach & Christensen, 2018; Christensen, 1991; Maassen et al., 2011; Stensaker, 2006).

Additionally, one important contribution is the development of a quantitative measure of perceived academic freedom. Which enables further development and improvement of a measure for perceived academic freedom based on the findings of this thesis and the challenges highlighted in the development of this measure.

6.3 Limitations

There are four clear limitations to this study. The first is that we are not able to study change in the level of perceived academic freedom over time. Even though, there is literature that suggest a the level of perceived academic freedom has decreased at the same time as PM reforms have been implemented (Karran, 2015;Teichler et al., 2013, p. 185). This is not enough to establish causality. This also has implications for our theoretical perspectives because they suggest a gradual development over time. Consequently, this challenges how certain we can be about the proposed explanation of our findings. However, this does not mean that our findings are wrong but rather that there is need to be open to other explanations of the findings based on other theoretical perspectives. Even so, at the current point in time, given the findings and what we know about the historical development an ongoing process of isomorphism is viewed as the most appropriate explanation.

The second limitation is that based on the measure that was developed we are limited to each individuals subjective perception of their academic freedom. As such, individuals that objectively have the same level of academic freedom based on the initial definition but they experience their academic freedom differently (NOU 2006: 19, p. 7). However, it is also difficult to create an objective measures of academic freedom without introducing subjective judgment. A potential remedy to this problem to select or create indicators that are less dependent on subjective

judgment.

The third limitation is that even though we find that the variables in the regression analysis of the organizational dimension have explanatory power for the variation we find. There seems to be potential for other variables that are not included in the analysis to also have explanatory power because of the somewhat low R^2 in tabel 4.13.

The fourth and final limitation is related to the data. Because of the type of the data we have there is a potential for sample bias (Blair, 2014, p. 89). The presence of bias was considered previously and led to the conclusions that it is an uncertainty that needs to be taken into account when we consider generalization.

6.4 Implications Beyond this Case

Based on the previous section we see that there are limitations to the findings of this thesis that has the potential to decrease the internal validity and thereby decrease external validity, which relates to the possibility for generalization (Gerring, 2016, p. 195).

Our explanation of findings is closely related to the development within Norwegian higher education institutions. Consequently, it is difficult generalize the explanation and our conclusion of an ongoing isomorphic process to the population as whole. Even so, we find a relation between publication rate and the level of perceived academic freedom at the individual level. Others have also found that publication indicators have the potential to affect individual behavior (Aagaard, 2015). Consequently, this finding seems to have a more established foundation and based on the strategy used for case selection we believe that probability for finding a similar relation within other cases of the population is heightened (Gerring, 2007, p. 116).

6.5 Further Research

A potential avenue for further research is to apply a similar measure for perceived academic freedom to other data sources. This would enable a further development of the quantitative measure for perceived academic freedom. Additionally, it could potentially provide further support or challenge the findings of this thesis.

Furthermore, there is potential for further exploration of how organizational actors influence the level of perceived academic freedom. As the variables included in our regression on this dimension did not seem to capture all possible explanatory variables.

A study of the level of perceived academic freedom over time would be especially interesting because this enables us to follow the development and potentially determine causality.

Finally, there are also large potential for systematic qualitative studies which that can contribute to a better the understanding of potential relations between public management reform, the specific measures implemented and the level of perceived academic freedom.

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Appendix A

R-Quest Survey Response Analysis

R-QUEST survey – Response analysis

20 Dec 2018, Reymert, Langfeldt, Aksnes

Contents

1 About the survey

This survey has been developed by the R-Quest project. The questions have been designed by the research group with participants from all R-QUEST countries, with the aim of covering the overall research questions of R-Quest. The survey has been managed from Norway/NIFU, using SurveyXACT as a survey-tool for data collection. The questionnaire consists of 29 questions. Most of the questions are multiple choice, while there are some open-ended questions. The questionnaire is in English, while the invitations and reminders to participate in the survey is both in English and the local language.

2 Anonymity, data protection and NSD

The project is registered at the Norwegian Centre for Science Research Data (NSD)/the Data Protection Official for Research, and conducted according to the Norwegian Personal Data Act, as project "54988 R-QUEST cross national researcher survey". The NSD notification outlining the terms is stored in the Core Project dropbox folder.

In the invitation to participate in the survey, the terms were explained to respondents as follows:

> *By submitting the form you give consent to participating in the study. Your participation is voluntary and you may withdraw at any time. To compose the survey sample, we used publicly available publication data for the relevant fields of research. This, and public data on research funding, will be used to analyse the funding, publication and collaboration profile of the researchers responding to the survey, and reduce the time it takes you to complete the*

survey. All personal information gathered in the survey will be handled confidentially. It will only be applied for statistical analysis, and not shared with anyone outside the R-QUEST research group. When the analysis of the data is completed (December 2023) all replies will be anonymised. Publications from the project will not include information that could identify individuals or research groups.

3 Collection of email addresses

In our pragmatic approach we combine journal classification and organisational units in delimiting samples. We started with bibliometric analysis (Web of Science - WoS), using journal categories to identify key institutions and included those with a minimum number of articles in the respective journal category (WoS categories included: 'Physics'; 'Economics' 'Cardiac & cardiovascular systems'). We then searched the institutions' web sites for relevant organisational units to include in the survey.

We used available information on the units' web-pages to make lists of researchers to include in the survey. We collected data on the name, position and e-mail of the researchers. We included personnel in relevant scientific/academic positions (staff members, post docs and researchers but not PhD students, adjunct positions, guest researchers or administrative and technical personnel). Some departments also had research groups in other disciplines than the one selected. In these cases, we removed the personnel in the non-relevant groups.

In addition, we based on WoS-data, added people (at the selected institutions) prevailing with a minimum number of WoS publications in the field, regardless of which department/unit they are affiliated with. For economics, a limit of at least 5 WoS publications in the period included in the data (2011-2016) was used. For cardiology and physics, where the publication frequency (and co-authorship) is higher, a minimum of 10 publications was used.

In total (including the supplement survey), 6260 people (59%) were identified from staff lists and 4273 additional people from WoS-data (41%). However, it should be noted that many people on the staff lists also appeared in the WoS-data. When identifying the sample, staff lists were given priority and the WoS-data was used for supplementary purposes, only. This means that when one person appeared in both samples, i.e. the institute list and in the WoS list, we used the institute list, including the e-mail address appearing on the institute's web page.

As the two sampling sources target partly different groups – departing from the organisational units we get the full scope of researchers within a department/division; departing from WoS categories we get all who publish in the field – we get the most comprehensive sample by combining the two strategies.

4 The data collection

The survey has been organised in three rounds, see table 1.1. In October 2017 the survey was sent to Norwegian researchers in Physics, Economics and Cardiology as a pilot survey. This survey was closed in February 2018. The pilot survey showed good result with a high response rate and a relative low response duration.

In March 2018 the survey the was sent to Denmark (Physics and Economics), Sweden (Cardiology and Economics), UK (Physics and Economics) and The Netherlands (Physics and Cardiology). This survey was closed in august 2018. The response rate was not as high as in Norway, but relative high in Denmark, Sweden and the Netherlands. However, the UK survey turned out with low response rate.

To gather more responses, we sent an extra survey to the reminding researchers in Sweden and the Netherlands in October 2018, but not to the UK and the cardiologist in Denmark due to the low response rate in the second round in these groups. This survey was closed in December 2018.

Table 1.1 Overview of the survey dates

	Physics	*Cardiology*	*Economics*
Norway	*10 Oct 17 → 19 Feb 18*	*10 Oct 17 → 19 Feb 18*	*10 Oct 17 → 19 Feb 18*
Denmark	*22 March → 30 Aug 18*	*x*	*22 March → 30 Aug 18*
Sweden	*1 Oct 18 →*	*22 March → 30 Aug 18*	*22 March → 30 Aug 18*
UK	*22 March → 30 Aug 18*	*x*	*22 March → 30 Aug 18*
The Netherlands	*22 March → 30 Aug 18*	*22 March → 30 Aug 18*	*1 Oct 18 →*
N countries	*4 (5)*	*3*	*4 (5)*

Reminders

The Norwegian survey was launched the 10th of October 2017. Five reminders were sent by email, and one by regular mail. The reminders and invitation were written in both Norwegian and English.

The main survey was launched the 22nd of March 2018, with five reminders all sent by email. The last reminder was sent in the name of the local representative, with a personal message from the local representative. We also sent a reminder by ordinary mail to two institutions in the UK, but due to the low effect of these reminders we did not send further reminders by ordinary mail because of economic costs.

The supplement survey was launched the 1st of October 2018. Four reminders were sent, and the survey was closed the 9th of December.

We saw a clear pattern that the most respondents answer the same day that they got the invitation or a reminder or the following day.

Table 1.2 History of action for the test survey (Norway)

Type of action	**Date**	**Type of correspondence**	**Number of respondents**
Invitation	10th of October 2017	Email	1258
Reminder	17th of October 2017	Email	1084
Reminder	2nd – 6th of October 2017	Regular mail	847
Reminder	16th of November 2017	Email	900
Reminder	5th of December 2017	Email	821
Reminder	12th of February 2018	Email	686
Reminder	15th of February 2018	Email	653
Closing of the survey	19th of February 2018		

Table 1.3a History of action for the main survey (Sweden, Denmark, UK and the Netherlands)

Activity	Date
Launched	22nd of March
1st reminder	3rd of April
2nd reminder	26th of April
3rd reminder	22nd of May
4rd reminder	5th of June
5th reminder	8th of August
Closing of the survey	30th of October

Table 1.3b History of action for the extra survey (Sweden and the Netherlands)

Activity	Date
Launched	1st of October
1st reminder	11th of October
2nd reminder	8th of November
3rd reminder	19th of November
4rd reminder	3rd of December
Closing of the survey	9th of December

Response duration 14-16 minutes

On average the respondents used 34 hours to take the survey. However, this measured is flawed by extreme outliers. One respondent used the lot of 34 hours to take the survey, 104 respondents used more than 4 hours and only 256 (10 percent) used more than 45 minutes. These are respondent that probably took a large break while they took the survey and including them when analysing the mean makes no sense. The quickest respondent used less than a second and 10 percent used less than three minutes. As we see in the figure below we see that most people used between seven and 25 minutes.

To analysis the duration time we thus calculate the median a maximum duration time for the respondents using more than three but less than 45 minutes. Among these respondents the average (mean) was 16 minutes and median 14 minutes, we thus conclude that it took between 14 and 16 minutes to complete the survey.

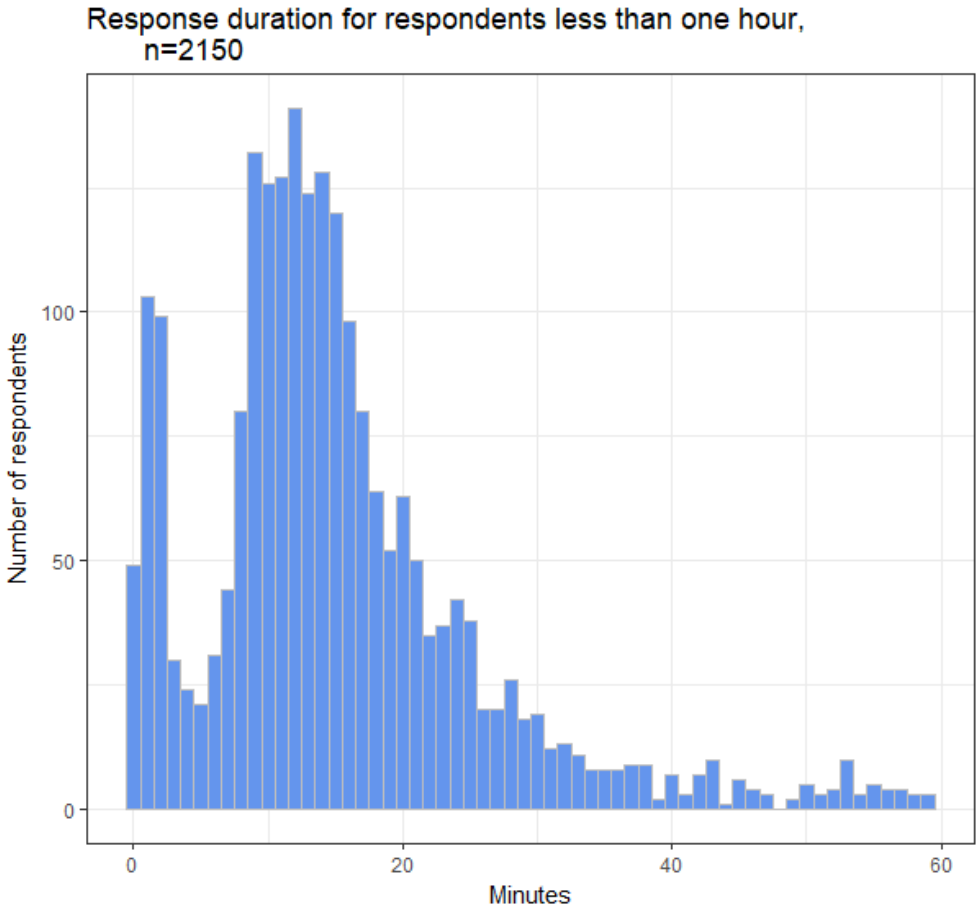

Figure 1.1 Distribution of time used to complete the survey among the respondents

Response rates

The survey was sent out to 10.514 respondents. Of these 1418 were exuded from the survey because they had non-working email addresses or answered that they were outside the target groups, many of them being retired for many years. Of the remaining, 2587 completed or partly completed the questionnaire, giving us a survey rate of 28.6 percent.

The survey rates varied between the countries. Norway got the highest response rate of 51.3 percent, followed by Sweden with a response rate of 38.6 percent and Denmark with a response rate of 32.3 percent. The Netherlands got a response rate of 19.6 percent and in the UK response the response rate was 13.4 percent (Table 1.4).

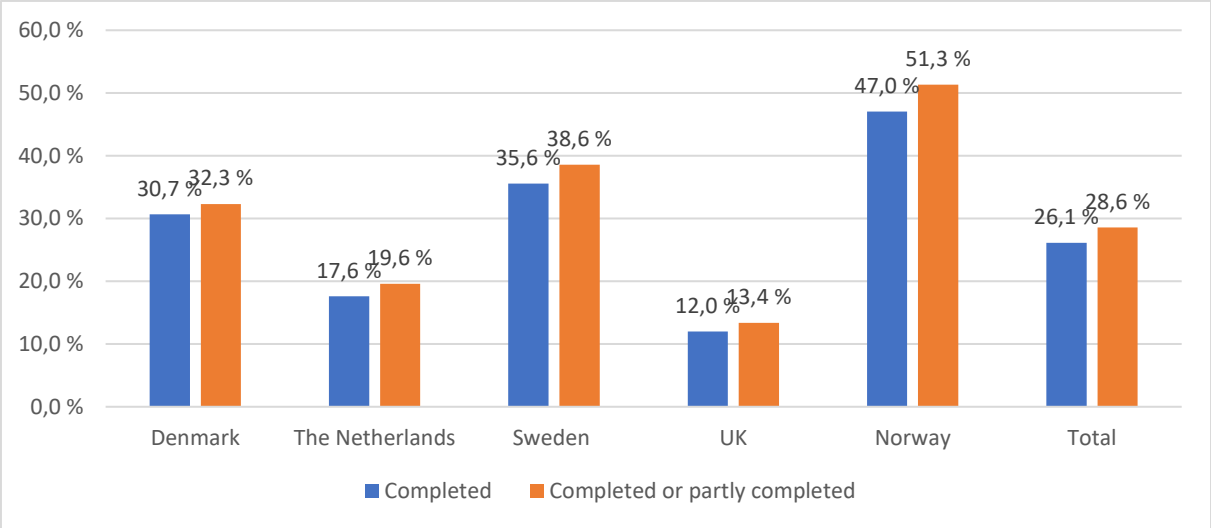

Figure 1.2 Response rate by country

Table 1.4 Calculation of response rates by country, details.

	Denmark	The Netherlands	Sweden	UK	Norway	Total
a) Initial total sample	**909**	3170	2809	**2368**	**1258**	10514
b) Excluded from the sample (c, d and e)	129	*529*	*357*	371	98	1484
c) Not delivered/invalid email, no research activity retired/died → Outside target group	122	*511*	*335*	365	85	1418
d) Not willing to answer/asked to be deleted from the sample	3	*9*	*10*	5	3	30
e) Filtered out in the survey (page 2 and 3) → outside target group*	4	*9*	*12*	1	10	36
f) Excluded from calculation of survey rates (c+e)**	126	*520*	*347*	366	95	1454
Updated total sample	783	2650	2462	2002	1163	**9060**
No answers	527	*2122*	*1502*	1729	563	6443
Some answers/partly completed questionnaire	13	*53*	*74*	28	50	218
Completed questionnaire	240	*466*	*876*	240	547	2369
Response rate based on completed questionnaire	30.7 %	17.6 %	35.6 %	12.0 %	47.0 %	26.1 %
Response rate some answers and completed	**32.3 %**	**19.6 %**	**38.6 %**	**13.4 %**	**51.3 %**	**28.6 %**

** These are respondents who replied that they are not involved in research/are not a researcher.*

*** In the following figures/response rates calculated by field and identification method, also category d is excluded from the total sample.*

In the following analysis of response rates, 30 respondents who rejected to answer/to be deleted (category d in Table 1.4) are excluded from the updated total sample. Data on these were deleted from the survey and we do not have information on e.g. field of research for these (but know figures by country as shown in Table 1.4). This implies that the response rates are calculated from a total sample of 9030 (rather than 9060 as in Table 1.4), which has only marginally impact on the figures.

- *Response rate by field*

The response rate also varies among the academic fields, from 26 percent in cardiology to 27 percent in economics and 30 percent in physics.

Table 1.5 Response rate by academic field

Field	No reply	Replied	N
Cardiology	74,0 %	26,0 %	1713
Economics	73,0 %	27,0 %	2307
Physics	69,7 %	30,3 %	5010
Total	**71,4 %**	**28,6 %**	**9030**

- *Response rate by sampling strategy*

Most non-working emails were from the WoS-sample. The response rate is also lower among the working emails from the WoS-sample than from the sample based on the collected staff lists (24.3% compared to 30.9%, Table 1.6). There are some notable differences between countries: The Dutch sample has a much higher share of WoS email addresses that what the other countries, and a lower response rate in this group compared to staff list sample (16.6% vs. 22.4%). Denmark on the other hand, has a small WoS sample (compared to its staff list sample), and is the only country with a higher response rate among those on the WoS list than those on the staff list. [can we see any reason for these differences in WoS sample size?]

Table 1.6 Response rate by sample source/identification method and country

		Sample source		
Country		**Staff lists**	**Web of Science**	**Total**
Denmark	Response rate	30,9 %	37,4 %	32,4 %
	N	598	182	780
Netherlands	Response rate	22,4 %	16,6 %	19,7 %
	N	1386	1255	2641
Norway	Response rate	51,9 %	50,3 %	51,5 %
	N	862	298	1160
Sweden	Response rate	40,0 %	35,4 %	38,7 %
	N	1785	667	2452
UK	Response rate	13,7 %	12,8 %	13,4 %
	N	1312	685	1997
Total	**Response rate**	**30,9 %**	**24,3 %**	**28,6 %**
	N	5943	3087	9030

N=adjusted total sample, not including 20 invited researchers who did not want to participate/asked to be deleted.

- *Response rate by field and country*

Investigating the response rate by country and field we see that the Norwegian economics are the ones with the highest response rate and the UK economics with the lowest response rate (see figure 1.3). However, the Swedish physicians are the largest group by number followed by the Dutch physicians). The UK economist are also the smallest group.

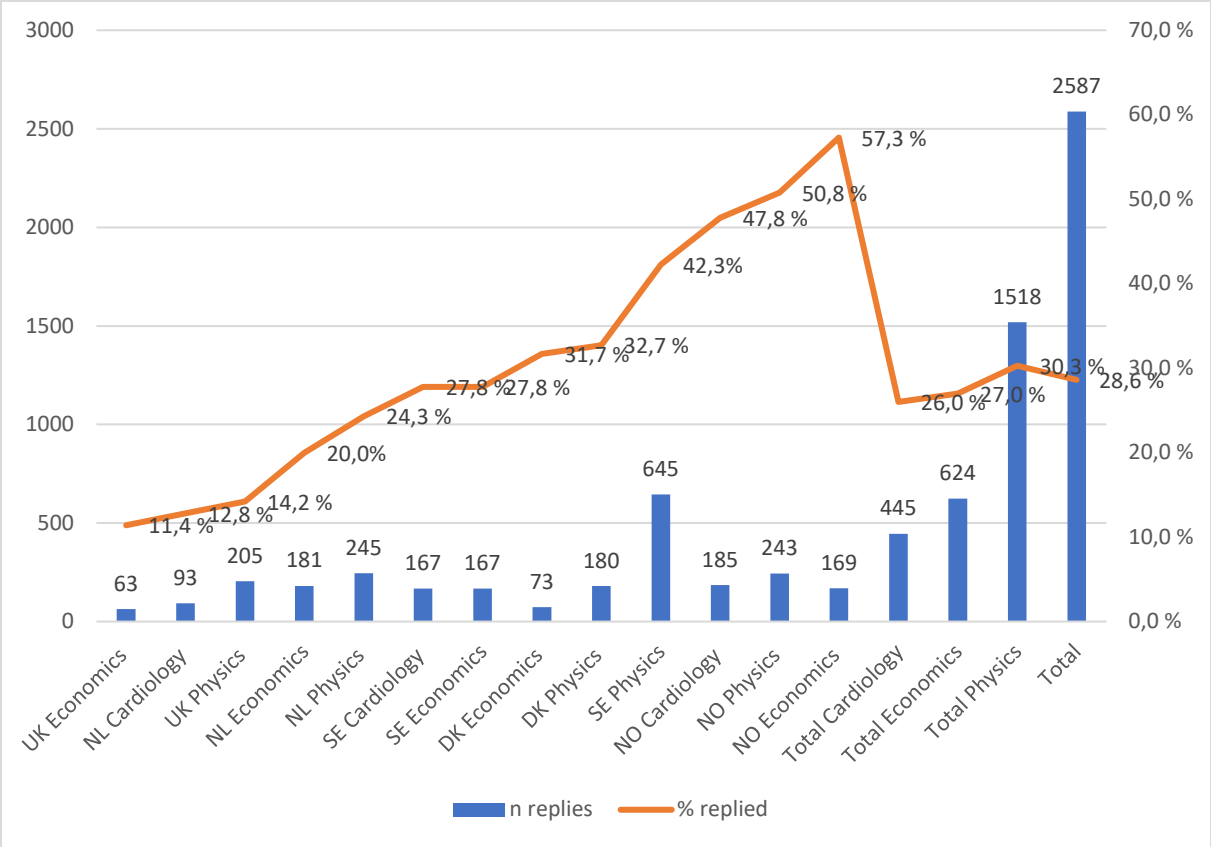

Figure 1.3 Responses and response rate by research field and country

5 Representation by background variables

Table 2.1 Respondents by field of research

Field of research	Frequency	Percent
Cardiac/cardiovascular	344	13,3
Economics	566	21,9
Physics	1253	48,4
Other medicine (including biomedicine and health sciences)	138	5,3
Other social sciences and humanities	55	2,1
Other natural sciences and technology (including mathematics)	231	8,9
Total	**2587**	**100**

*Based on answers to question 4. Astronomy/astrophysics reclassified under physics. Some have not answered Q4. These have been classified under the original survey field (B2). 'Others' are separated in three categories based on the survey text field.

Table 2.2 Respondents by position

Position	Frequency	Percent
Leader of institution/faculty/dept	138	5,3
Full professor	802	31,0
Associate professor	638	24,7
Medical position	65	2,5
Assistant professor	689	26,6
PhD student	14	0,5
Other, please specify	70	2,7
Retired/emeritus	156	6,0
Missing	15	0,6
Total	**2587**	**100**

*Type of position based on answer to question 2a. Retired/emeritus has been added as a new category (based on information in the text field). In addition, a few changes were made when the respondents' answers did not correspond with the information in the survey text field.

Table 2.3 Respondents by gender

Gender	Frequency	Percent
Male	1786	69,0
Female	501	19,4
Other/prefer not to say	34	1,3
Missing	266	10,3
Total	**2587**	**100**

Table 2.4 Respondents by age

Age	Frequency	Percent
< 30 years	34	1,3
30-34 years	260	10,1
35-39 years	320	12,4
40-44 years	278	10,7
45-49 years	282	10,9
50-54 years	290	11,2
55-59 years	251	9,7
60-64 years	214	8,3
65-69 years	165	6,4
70+ years	212	8,2
Missing	281	10,9
Total	**2587**	**100**

Table 2.5 Respondents by age

Year since (first) doctorate/Ph.D.	Frequency	Percent
1-4 years since PhD	342	13,2
5-9 years since PhD	359	13,9
10-14 years since PhD	264	10,2
15-19 years since PhD	313	12,1
20-24 years since PhD	287	11,1
25-29 years since PhD	237	9,2
30-34 years since PhD	161	6,2
35-39 years since PhD	124	4,8
40-44 years since PhD	94	3,6
45+ years since PhD	86	3,3
Missing	320	12,4
Total	**2587**	**100**

Table 2.6 Respondents by gender and field of research

*Field of research	Male	Female	Other/prefer not to say	N
Cardiac/cardiovascular	65,1 %	34,2 %	0,7 %	295
Economics	74,7 %	23,6 %	1,8 %	505
Physics	80,4 %	18,0 %	1,6 %	1135
Other medicine (including biomedicine and health sciences)	65,6 %	34,4 %	0,0 %	125
Other social sciences and humanities	82,4 %	17,6 %	0,0 %	51
Other natural sciences and technology (including mathematics)	85,7 %	11,9 %	2,4 %	210
Total	**76,9 %**	**21,6 %**	**1,5 %**	**2321**

*Based on answers to question 4, as explained in note to table 2.1.

Table 2.7 Respondents by position and field of research

*Position	Cardiac/ cardiovascular	Economics	Physics	Other	Total
Leader of institution/faculty/dept	7,0 %	5,9 %	3,5 %	8,7 %	5,4 %
Full professor	25,6 %	33,0 %	29,0 %	39,6 %	31,2 %
Associate professor	25,3 %	27,3 %	25,0 %	20,5 %	24,8 %
Medical position	14,2 %	0,0 %	0,1 %	3,5 %	2,5 %
Assistant professor	14,5 %	25,7 %	34,3 %	16,3 %	26,8 %
PhD student	1,5 %	0,7 %	0,4 %	0,0 %	0,5 %
Other, please specify	5,2 %	2,8 %	1,6 %	3,8 %	2,7 %
Retired/emeritus	6,7 %	4,6 %	6,0 %	7,5 %	6,1 %
N	**344**	**564**	**1240**	**424**	**2572**

*Type of position based on answer to question 2a, as explained in note to Table 2.2.

Table 2.8 Respondents by country, age and gender

Age	Gender	DK	NL	NO	SE	UK	Total
< 30 years	Male	71,4 %	100,0 %	100,0 %	22,2 %	77,8 %	67,6 %
	Female	28,6 %	0,0 %	0,0 %	66,7 %	22,2 %	29,4 %
	Other/pnts	0,0 %	0,0 %	0,0 %	11,1 %	0,0 %	2,9 %
	N	7	8	1	9	9	34
30-39 years	Male	77,6 %	58,7 %	66,0 %	70,0 %	77,0 %	68,5 %
	Female	20,9 %	41,3 %	32,1 %	29,1 %	23,0 %	30,6 %
	Other/pnts	1,5 %	0,0 %	1,9 %	0,9 %	0,0 %	0,9 %
	N	67	121	106	220	61	575
40-49 years	Male	78,1 %	74,3 %	70,9 %	76,5 %	62,5 %	73,9 %
	Female	21,9 %	23,9 %	28,4 %	21,6 %	30,0 %	24,3 %
	Other/pnts	0,0 %	1,8 %	0,7 %	2,0 %	7,5 %	1,8 %
	N	64	113	134	204	40	555
50-59 years	Male	80,4 %	87,9 %	75,5 %	78,9 %	82,0 %	80,1 %
	Female	19,6 %	12,1 %	23,7 %	18,9 %	16,0 %	18,7 %
	Other/pnts	0,0 %	0,0 %	0,7 %	2,1 %	2,0 %	1,1 %
	N	56	99	139	190	50	534
60-69 years	Male	92,3 %	89,2 %	81,4 %	84,4 %	83,3 %	85,0 %
	Female	3,8 %	10,8 %	18,6 %	15,6 %	16,7 %	14,7 %
	Other/pnts	3,8 %	0,0 %	0,0 %	0,0 %	0,0 %	0,3 %
	N	26	74	97	141	36	374
70+ years	Male	81,3 %	100,0 %	97,9 %	90,5 %	89,7 %	92,7 %
	Female	12,5 %	0,0 %	2,1 %	9,5 %	6,9 %	6,3 %
	Other/pnts	6,3 %	0,0 %	0,0 %	0,0 %	3,4 %	1,0 %
	N	16	28	48	84	29	205
Total	Male	80,1 %	77,7 %	75,6 %	77,5 %	78,2 %	77,4 %
	Female	18,6 %	21,9 %	23,6 %	21,2 %	19,6 %	21,5 %
	Other/pnts	1,3 %	0,5 %	0,8 %	1,3 %	2,2 %	1,1 %
	N	**236**	**443**	**525**	**848**	**225**	**2277**

*pnto = prefer not to say

Table 2.9 Number of respondents by type of organisation, country and field of research

Type of institution	Country	*Cardiac/ cardiovascular	Economics	Physics	Other	Total
Universities including hospitals	DK	0	66	150	37	253
	NL	65	133	208	88	494
	NO	152	105	170	81	508
	SE	124	122	542	152	940
	UK	0	57	144	45	246
	Total	341	483	1214	403	2441
Research institutes	NL	0	24	0	1	25
	NO	3	50	25	11	89
	SE	0	9	0	1	10
	UK	0	0	14	8	22
	Total	3	83	39	21	146
Total	DK	0	66	150	37	253
	NL	65	157	208	89	519
	NO	155	155	195	92	597
	SE	124	131	542	153	950
	UK	0	57	158	53	268
	Total	**344**	**566**	**1253**	**424**	**2587**

*Cardiac/ cardiovascular research was not included in the DK and UK surveys.

Table 2.10 Number of respondents by organisation and country

Organisation	DK	NL	NO	SE	UK	Total
a	110	39	24	103	22	
b	59	47	89	87	60	
c	57	45	30	50	42	
d		76	41	90	32	
e		94	64	61	80	
f		61	183	205		
g		28	50	109		
h		52		55		
i				137		
Org. with < 20 respondents	27	77	116	53	32	305
Total	**253**	**519**	**597**	**950**	**268**	**2587**

Appendix B

R-Quest Survey Questionnaire

The Questionnaire

R-QUEST survey. Text From final online version (3 Oct 2017), variable names added.

Page 1 The quality and conditions of research

This survey invites your views on the conditions and quality of research.
Your answers will help to explore the varying conditions and notions of research quality, and inform policymakers about how they best can support research.

Information about the partners and purpose of our project can be found at www.r-quest.no.

Your answers will be automatically saved as you proceed through the questionnaire. You may return to the questionnaire whenever you want.

Page 2 Your fields of activity

To what extent has your work the last five years* involved the following activities?
**You may disregard periods you have been on leave or not affiliated with a research organisation.*

	Not at all	To some extent	To a large extent	Cannot say
[Q1a] Research	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q1b] Teaching/Supervision	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q1c] Managing a research group/Research management	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q1d] Clinical work	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q1e] Research collaboration with actors outside science (e.g. industry/private sector, government organisation, municipality, NGO)	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q1f] Interaction/consultancy outside science (with e.g. industry/private sector, government organisation, municipality, NGO)	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q1g] Informing the public/public debate	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q1h] Commercialisation of research (patents, licenses, spin-offs)	(1) ❑	(2) ❑	(3) ❑	(4) ❑

Page 3 Your position

[Q2a] **What is your current (main) position?**

(1) ❑ Leader of institution, faculty/school or department (Rector/Pro-rector, Dean/Vice-dean, Director/Deputy director of institute, Head of department or similar)
(2) ❑ Full professor/Research professor/Research director or similar
(3) ❑ Associate professor/Senior researcher or similar
(4) ❑ Medical position/physician or similar
(5) ❑ Assistant professor/Postdoc/Researcher or similar
(6) ❑ PhD student
(7) ❑ Technician/assistant
(8) ❑ Other, please specify _[Q2b]____

[Q3] **Please indicate whether this is a temporary or permanent position:**

(1) ❑ Permanent/tenured position
(2) ❑ Temporary position

[message to those who are filtered out]

You replied that you are not involved in research/are not a researcher, and are hence outside the target group of this survey.

Thank you for letting us know!
Please contact us if you have any questions:
Questions regarding the survey: Ingvild Reymert, Researcher, NIFU. ingvild.reymert@nifu.no
Questions regarding R-QUEST: Liv Langfeldt, Research professor, NIFU. liv.langfeldt@nifu.no
www.r-quest.no

Page 4 Your field of research

[Q4a] **Please indicate your field of research:**

(2) ❑ Cardiac/cardiovascular systems/diseases
(3) ❑ Economics
(4) ❑ Physics
(5) ❑ Other, please specify* __[Q4b]___

**The sample for this survey was drawn to cover the three fields above and the interdisciplinary research and fields relating to them. If none of the fields listed are your main field of research, we appreciate that you use the "other" category to specify your main field.*

Page 5 Your research activity

How has your research been funded the last five* years? Please answer for research activity you spend your time on or/and are in charge of.
**You may disregard periods you have been on leave or not affiliated with a research organisation.*

	No source	Minor source	Moderate source	Major source
[Q5a] My position/research time funded by my institution	(1) ❑	(4) ❑	(2) ❑	(3) ❑
[Q5b] Grants from my institution (include all funding from own institution except your research time)	(1) ❑	(4) ❑	(2) ❑	(3) ❑
[Q5c] Competitive grants from external public sources (e.g. National funding agencies, EU framework programmes/ERC, Regional Health Trusts)	(1) ❑	(4) ❑	(2) ❑	(3) ❑
[Q5d] Other public sources	(1) ❑	(4) ❑	(2) ❑	(3) ❑
[Q5e] Business firms/industry	(1) ❑	(4) ❑	(2) ❑	(3) ❑
[Q5f] Private not-for-profit foundations/organisations	(1) ❑	(4) ❑	(2) ❑	(3) ❑
[Q5b] Other sources, please specify [Q5bCom]	(1) ❑	(4) ❑	(2) ❑	(3) ❑

Page 6 Your research activity

Please tell us whether the following statements describe your main research activities:

	Yes	Partly	No	Not relevant/ cannot say
[Q6a] I do most of my research alone	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q6b] My research relies on a small research team	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q6c] My research relies on a large research team	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q6d] My research relies on teams located in multiple research organisations	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q6e] My research relies on insights from many different disciplinary areas	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q6f] I can do most of my research with just a standard computer	(1) ❑	(2) ❑	(3) ❑	(4) ❑

	Yes	Partly	No	Not relevant/ cannot say
[Q6g] My research relies on research equipment, materials or laboratories primarily inside my organisation	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q6h] My research relies on research equipment, materials or laboratories located outside my organisation (e.g. national or transnational research facilities)	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q6i] My research relies on involvement of users from public and/or private organisations	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q6j] Other (please specify) [Q6jCom]	(1) ❑	(2) ❑	(3) ❑	(4) ❑

Page 7 Your research activity

Which of the following motivates/inspires you to do research?

	1 Not important	2	3	4	5 Very important	Cannot say
[Q7a] Curiosity/scientific discovery/understanding the world	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
[Q7b] Application/practical aims/creating a better society	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
[Q7c] Progress in my career (e.g. tenure/permanent position, higher salary, more interesting/independent work)	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
[Q7d] This is what I do for a living/the job I am most competent for	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
[Q7e] Contribute to the standing of my research unit/group	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
[Q7f] Inspiration from my colleagues (locally and/or internationally)	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
[Q7g] Inspiration from users (outside science)	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
[Q7h] Inspiration from students/young talents	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
[Q7i] Other, please specify: [Q7iCom]	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑

Page 8 Your research environment and factors influencing your research

What would you need to make significant progress in your research?

Local conditions/resources	Already in place	No need/ not relevant	May make a difference	Would really make a difference	Cannot say
[Q8a] More (local) senior colleagues working in my specific research field/speciality	(1) ❑	(2) ❑	(3) ❑	(5) ❑	(4) ❑
[Q8b] Flexibility and resources to recruit staff to my group/unit	(1) ❑	(2) ❑	(3) ❑	(5) ❑	(4) ❑
[Q8c] Flexibility and resources to retain staff in my group/unit	(1) ❑	(2) ❑	(3) ❑	(5) ❑	(4) ❑
[Q8d] More (of my) time dedicated to research	(1) ❑	(2) ❑	(3) ❑	(5) ❑	(4) ❑

Local conditions/resources	**Already in place**	**No need/ not relevant**	**May make a difference**	**Would really make a difference**	**Cannot say**
[Q8e] Long-term security of basic level funding	(1) ❑	(2) ❑	(3) ❑	(5) ❑	(4) ❑
[Q8f] A generous working climate, encouraging unconventional ideas	(1) ❑	(2) ❑	(3) ❑	(5) ❑	(4) ❑

Infrastructure/assistance	**Already in place**	**No need/ not relevant**	**May make a difference**	**Would really make a difference**	**Cannot say**
[Q8g] Access to cutting edge facilities (labs/infrastructures)	(1) ❑	(2) ❑	(3) ❑	(5) ❑	(4) ❑
[Q8h] Access to relevant data registries/biobanks/similar	(1) ❑	(2) ❑	(3) ❑	(5) ❑	(4) ❑
[Q8i] Access to relevant library facilities/journal repositories	(1) ❑	(2) ❑	(3) ❑	(5) ❑	(4) ❑
[Q8j] Sufficient technical staff/research support service	(1) ❑	(2) ❑	(3) ❑	(5) ❑	(4) ❑
[Q8k] Dedicated administrative help to develop grant proposals (e.g. ERC/EU grants, other large grants)	(1) ❑	(2) ❑	(3) ❑	(5) ❑	(4) ❑

Collaboration	**Already in place**	**No need/ not relevant**	**May make a difference**	**Would really make a difference**	**Cannot say**
[Q8m] Good collaboration within my group/unit	(1) ❑	(2) ❑	(3) ❑	(5) ❑	(4) ❑
[Q8n] Leadership of my unit/department that is positive towards my research topic(s)	(1) ❑	(2) ❑	(3) ❑	(5) ❑	(4) ❑
[Q8o] Opportunity to work with internationally leading academic groups in my field	(1) ❑	(2) ❑	(3) ❑	(5) ❑	(4) ❑
[Q8p] Opportunity to work with leading industry/user partners in the field	(1) ❑	(2) ❑	(3) ❑	(5) ❑	(4) ❑
[Q8q Opportunity to participate in Horizon 2020 projects	(1) ❑	(2) ❑	(3) ❑	(5) ❑	(4) ❑
[Q8r] Other important conditions, please specify: [Q8rCom]	(1) ❑	(2) ❑	(3) ❑	(5) ❑	(4) ❑

Page 9 Factors influencing your research

How do the following influence your research activity?

	No influence	Negative influence	Positive influence	Cannot say/Not relevant
[Q9a] National reviews/evaluations of my research unit/department (e.g. evaluations of research fields, Research Assessment Exercises)	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q9b] Reviews/evaluations of the performance of my research group/unit organised by my institution	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q9c] Bibliometric performance indicators (e.g. performance-based funding indicators)	(1) ❑	(2) ❑	(3) ❑	(4) ❑

Survey in Norway: "tellekanter" was added in the Q9c brackets.

[Q9d] **Please enter any comments on how these kinds of reviews/evaluations/indicators have influenced your research (or more generally your research unit/department) negatively or positively:**

_

Page 10 Actors influencing your research unit

In this question, and in the following questions about your unit/department, please answer for the level of your organisation (e.g. group/section/department) you find most relevant/can most easily answer for.

To what extent do the following actors influence what research topics you focus on in your research unit?

	No influence	Moderate influence	High influence	Cannot say/Not relevant
[Q10a] You	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q10b] Ordinary research staff	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q10c] Research group leaders	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q10d] Deans/department heads/leaders of academic units	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q10e] Organisational leaders (Rectorate/president team or equivalent)	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q10f] Organisations (private or public) for which you do contract research	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q10g] Topics prioritised by funding agencies/foundations/public authorities/Horizon 2020/similar	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q10h] Other external stakeholders, please specify: [Q10hCom]	(1) ❑	(2) ❑	(3) ❑	(4) ❑

Page 11 Your research environment and factors influencing your research

Which are the most pressing barriers in recruiting the best researchers to your unit/department? Please select the one or two barriers which are most important

[Q11a] ❑ The salary level at my institution
[Q11b] ❑ The limited international prestige of my institution
[Q11c] ❑ Competition from industry/non-academic organisations for the same candidates
[Q11d] ❑ High demands/work pressure at my institution
[Q11e] ❑ Career development opportunities at my institution
[Q11f] ❑ My unit is not allowed to recruit new permanent staff
[Q11g] ❑ Rigid/slow hiring process at my institution

[Q11h] ❑ Other barrier, please specify: __[Q11hCom] ___
[Q11i] ❑ My unit has not met barriers in recruiting the best researchers/candidates
[Q11j] ❑ Cannot say

Page 12 The best research in your field

Think about the research you consider to be the best in your specific field/speciality.* Why do you consider this the best research? You may select more than one option.

**If you do research in multiple fields, select the one you can most easily answer for.*

[Q12a] ❑ Has answered/solved key questions/challenges in the field
[Q12b] ❑ Has changed the way research is done in the field (e.g. methodological breakthrough)
[Q12c] ❑ Has enabled researchers in the field to produce more reliable or precise research results
[Q12d] ❑ Has changed the key theoretical framework of the field
[Q12e] ❑ Was published in a journal with a high impact factor
[Q12f] ❑Has attracted many citations
[Q12g] ❑ Has been a centre of discussion in the research field
[Q12h] ❑ Has drawn much attention in the larger society
[Q12i] ❑ Has benefited society (e.g. in terms of application in industry, new clinical practices, informed public policy)
[Q12j] ❑ Is what all students/prospective researchers need to read
[Q12k] ❑ Other, please specify: __[Q12kCom] ___
[Q12l] ❑ Cannot say

Page 13 Your best research

Think about what you consider your best research achievements. What characterises this research? You may select more than one option.

My best research ...

[Q13a] ❑ was funded primarily by internal resources at my institution
[Q13b] ❑ was funded primarily by national funding agencies
[Q13c] ❑ was funded primarily by European/international sources
[Q13d] ❑ was funded primarily by users/industry
[Q13e] ❑ was funded by multiple sources
[Q13f] ❑was done in collaboration with users/industry
[Q13g] ❑ was interdisciplinary
[Q13h] ❑ was published in high impact journals
[Q13i] ❑is more frequently cited than my other research
[Q13j] ❑has had importance for subsequent research on the topic outside my group (e.g. the formulation of research problems, development of methods or theory)
[Q13k] ❑ has had importance outside science (e.g. used in industry/professional practice/policy-making)
[Q13l] ❑got me promoted/helped my career
[Q13m] ❑ Other, please specify: _[Q13mCom] ____
[Q13n] ❑ Cannot say

Page 14 The best research group/unit in your field

Think about the research group/unit you consider to be the best in your field.* What characterises this group/unit? You may select more than one option.

**If you do research in multiple fields, select the one you can most easily answer for.*

[Q14a] ❑ It has many highly talented researchers
[Q14b] ❑ The group/unit head is one of the most respected researchers in the field (internationally)
[Q14c] ❑ It has the right mix of competences
[Q14d] ❑ It has excellent working conditions in terms of funding/facilities/capacity/time for research
[Q14e] ❑ It has a very fruitful collaboration with users/industry
[Q14f] ❑It is very interdisciplinary
[Q14g] ❑ Other, please specify:__[Q14gCom] ___
[Q14h] ❑Cannot say

Page 15 Reviewing research

How do you generally perceive the ability of the following people to evaluate the quality of your research?

	Very low ability	Low ability	Medium ability	High ability	Very high ability	Not relevant/ cannot say
[Q15a] Myself	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
[Q15b] Colleagues in my research group/unit	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
[Q15c] The head of my department/unit	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
[Q15d] My scholarly network outside my department	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
[Q15e] Reviewers of papers I have submitted to journals in my fields	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
[Q15f] Panels that have evaluated my unit/department (e.g. for national or institutional reviews)	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
[Q15g] The reviewers of my research proposals to my main national funding source	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
[Q15h] The reviewers of my proposals to the European Research Council (ERC)	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
[Q15i] The reviewers of my proposals to the Horizon 2020 (apart from ERC)	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
[Q15j] My partners outside academia (user partners/industry)	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
[Q15k] Others, please specify: [Q15kCom]	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑

Page 16 Reviewing research

Please indicate which of the following activities you have participated in during the last 12 months

[Q16a]❑ Assessed candidates for positions in your department/group
[Q16b]❑ Reviewed papers for publication (for scientific journals, proceedings or books)
[Q16c]❑ Served on one or more editorial boards of scientific journals
[Q16d]❑ Reviewed grant proposals (remote, for funding agencies)
[Q16e]❑ Served on one or more panels reviewing grant proposals
[Q16f] ❑ None of these

Page 17 Review for funding agencies

[Q17a] **Thinking of the last time you reviewed grant proposals, please indicate the kind of funding scheme/call you reviewed for:**

(1) ❑ Strategic/targeted research (applications to calls addressing thematic priorities)
(2) ❑ Independent researcher-initiated research (applications to calls open to all research questions)
(4) ❑ Do not remember/cannot answer
(5) ❑ Other, please specify __[Q17b]___

[Q18a] **Please indicate the kind of grant you reviewed**

(1) ❑ Research project
(2) ❑ Fellowship

(3) ❑ Large grant/centre
(5) ❑ Do not remember/cannot answer
(6) ❑ Other, please specify __[Q18b] ___

Thinking of what you found to be the best proposal, please indicate what was important for your assessment.
You may answer more generally if you find it difficult to remember one particular proposal.

	Not important	Somewhat important	Highly important	Do not remember/can not answer
[Q19a] Project description: research question/problem selection	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q19b] Project description: methods/research plan	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q19c] Track record of the research team: number of publications/productivity	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q19d] Track record of the research team: citation impact of past publications	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q19e] Track record of the research team: important prior contributions in the relevant research field (assessed independently of citation scores and source of publication)	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q19f] Track record of the research team: experience with risk-taking research	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q19g] The research environment: resources and facilities for performing the proposed research	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q19h] Communication/dissemination plan for scientific publications	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q19i] Communication/dissemination plan addressing user groups outside academia	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q19j] Other, please specify: [Q19jCom]	(1) ❑	(2) ❑	(3) ❑	(4) ❑

[Q19k] **Please enter a few keywords on the main positive characteristics of what you found to be the best proposal (e.g. what made the project description or the team the best):**

_____
_____

Page 18 **Positions in your research group/department**

[Q20a] **Thinking of the last time you assessed candidates for research/academic positions. Please indicate the kind of candidates you assessed:**

(1) ❑ Junior/early career
(2) ❑ Senior/tenure
(5) ❑ Other, please specify __[Q20b] ___
(4) ❑ Do not remember/cannot answer

Thinking of the candidate you found to be the best, please indicate the aspects that were important for your assessments.
You may answer more generally if you find it difficult to remember one particular candidate.

	Not important	Somewhat important	Highly important	Do not remember/can not answer
[Q21a] Matching field/expertise to the needs of the group/unit/project	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q21b] Research achievements: number of publications/productivity	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q21c] Research achievements: citation impact of past publications	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q21d] Research achievements: important prior research contributions (assessed independently of citation scores and source of publication)	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q21e] Teaching experience/achievements (including supervision of students)	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q21f] Experience/achievements from work outside science, e.g. professional/clinical practice, industry or public administration	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q21g] Experience in interacting with the public/users/industry	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q21h] Standing of the unit/group where the candidate is/has been working/trained	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q21i] The potential for future achievements	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q21j] Communication and language skills	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q21k] Ability to compete for research grants	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q21l] Ensure diversity in the group/department (e.g. gender, ethnicity, age)	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q21m] General impression from interview with candidate	(1) ❑	(2) ❑	(3) ❑	(4) ❑
[Q21n] Other, please specify: [Q21nCom]	(1) ❑	(2) ❑	(3) ❑	(4) ❑

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[Q22] **Below are the aspects for which you selected "highly emphasised" in your previous answer. Please indicate which one of these was the most important aspect in your assessment.**

(1) ❑ Matching field/expertise to the needs of the group/unit/project
(2) ❑ Research achievements: number of publications/productivity
(3) ❑ Research achievements: citation impact of past publications
(4) ❑ Research achievements: important prior research contributions (assessed independently of citation scores and source of publication)
(5) ❑ Teaching experience/achievements (including supervision of students)
(6) ❑ Experience/achievements from work outside science, e.g. professional/clinical practice, industry or public administration
(7) ❑ Experience in interacting with the public/users/industry
(8) ❑ Standing of the unit/group where the candidate is/has been working/trained
(9) ❑ The potential for future achievements
(10) ❑ Communication and language skills
(11) ❑ Ability to compete for research grants
(13) ❑ Ensure diversity in the group/department (e.g. gender, ethnicity, age)
(14) ❑ General impression from interview with candidate

(12) ❑ {text entered/specified}

[Q23] **Please enter a few keywords on the main positive characteristics of what you found the best candidate/the last candidate you recommended for a position (e.g. what made his/her past achievements or competences the best):**

_____

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[BQ1] **Your gender**

(2) ❑ Female
(1) ❑ Male
(3) ❑ Other/prefer not to say

[BQ2] **Your year of birth (4 digits) ___**

[BQ3] **In what year did you obtain your (first) doctorate/Ph.D.?**
*Enter 4 digits, leave open if you do not hold a doctorate/Ph.D.*___

Concluding comment

[Q24] **Below you may add any additional comments on what is important to facilitate high quality research in your field, or what limits your ability to make progress in your research.**

_____
_____
_____

Thank you for participating
Please contact us if you have any questions:
Questions regarding the survey: Ingvild Reymert, Researcher, NIFU
ingvild.reymert@nifu.no
Questions regarding R-QUEST: Liv Langfeldt, Research professor, NIFU
liv.langfeldt@nifu.no

www.r-quest.no

Appendix C

Methods, Data and Operationalization

	nat_eval	insti_eval	biblio_ind	you_inf	staff_inf	gleaders_inf	deans_inf	orglead_inf	orgcon_inf	topicp_inf
nat_eval	1.00	0.69	0.38	0.04	-0.03	-0.13	0.03	0.05	-0.04	0.01
insti_eval	0.69	1.00	0.54	-0.02	-0.10	-0.04	0.11	0.11	0.01	0.04
biblio_ind	0.38	0.54	1.00	-0.14	-0.02	-0.01	0.06	-0.04	-0.02	-0.03
you_inf	0.04	-0.02	-0.14	1.00	0.09	-0.27	-0.12	0.02	-0.07	-0.10
staff_inf	-0.03	-0.10	-0.02	0.09	1.00	0.35	0.16	0.15	0.17	0.14
gleaders_inf	-0.13	-0.04	-0.01	-0.27	0.35	1.00	0.36	0.28	0.16	0.28
deans_inf	0.03	0.11	0.06	-0.12	0.16	0.36	1.00	0.66	0.36	0.26
orglead_inf	0.05	0.11	-0.04	0.02	0.15	0.28	0.66	1.00	0.36	0.32
orgcon_inf	-0.04	0.01	-0.02	-0.07	0.17	0.16	0.36	0.36	1.00	0.44
topicp_inf	0.01	0.04	-0.03	-0.10	0.14	0.28	0.26	0.32	0.44	1.00

Table C.1: Correlation Matrix for Possible Academic Freedom Variables

How do the following influence your research activity?	Factor 1	Factor 2
National reviews/evaluations of my research unit/department		0.708
Reviews/evaluations of the performance of my research group/unit organized by my institution		0.923
Bibliometric performance indicators		0.673
To what extent do the following actors influence what research topics you focus on in your research unit?		
You		
Ordinary research staff		
Research group leaders	0.407	
Deans/department heads/leaders of academic units	0.759	
Organizational leaders (Rectorate/president team or equivalent)	0.804	
Organizations (private or public) for which you do contract research	0.527	
Topics prioritized by funding agencies/foundations/public authorities/Horizon 2020/similar	0.460	

Table C.2: Factor Matrix Rotated using Oblimin Rotation.

How do the following influence your research activity?	Factor 1	Factor 2
National reviews/evaluations of my research unit/department	0.07	0.71
Reviews/evaluations of the performance of my research group/unit organized by my institution	0.036	0.92
Bibliometric performance indicators	-0.04	0.67
To what extent do the following actors influence what research topics you focus on in your research unit?		
You	0.02	-0.08
Ordinary research staff	0.31	0.01
Research group leaders	0.41	-0.07
Deans/department heads/leaders of academic units	0.76	0.17
Organizational leaders (Rectorate/president team or equivalent)	0.80	0.08
Organizations (private or public) for which you do contract research	0.53	-0.07
Topics prioritized by funding agencies/foundations/public authorities/Horizon 2020/similar	0.46	-0.06

Table C.3: Factor Loadings - Complete Matrix

Position Codes
Amanuensis (1010), Dosent (1532), Forsker (1108), Forsker (1109), Forsker (1110), Forsker (1183), Førsteamanuensis (1011), Førsteamanuensis II (8028), Høgskoledosent (1012), Høgskolelektor (1008), Postdoktor (1352), Professor (1013), Professor (1404), Professor II (9301), Professor II (8013), Stipendiat (1378), Stipendiat (1017), Undervisningsdosent (1483), Universitetslektor (1009), Universitetslektor II (8029).

Table C.4: Scientific Positions Included in Table 3.6

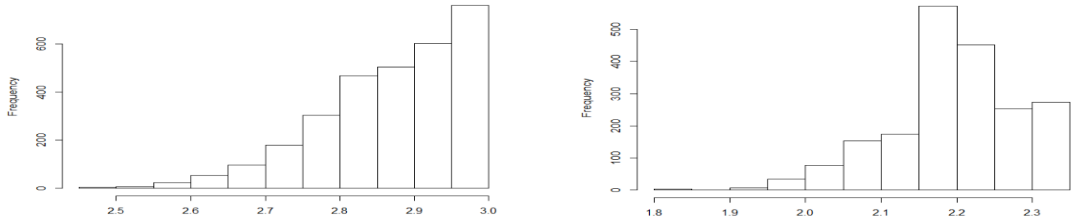
Category	SKO
Full Professor	Dosent (1532)
	Høgskoledosent (1012)
	Professor (1013)
	Professor (1404)
	Professor II (9301)
	Professor II (8013)
	Undervisningsdosent (1483)
Associate Professor	Førsteamanuensis (1011)
	Førsteamanuensis II (8028)
Assistant Professor	Amanuensis (1010)
	Høgskolelektor (1008)
	Universitetslektor (1009)
	Universitetslektor II (8029)
Medical Position	Assistenttannlege (1014)
	Avdelingstannlege (1260)
	Instruktørtannlege (1015)
	Instruktørtannlege (1353)
	Instruktørtannpleier (1032)
	Overlege (0782)
	Sjefpsykolog (0796)
	Spesialpsykolog (0795)
	Spesialtannlege (0787)
	Spesialtannlege (1016)

Table C.5: Positions Included in Each Category of Table 3.12

Appendix D

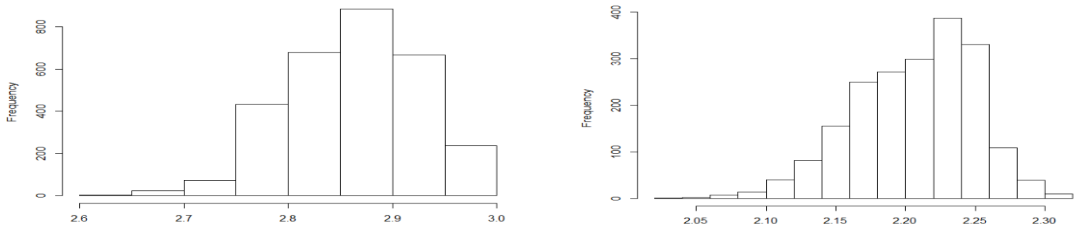
Analysis of Variation

Evaluations and Performance Measures



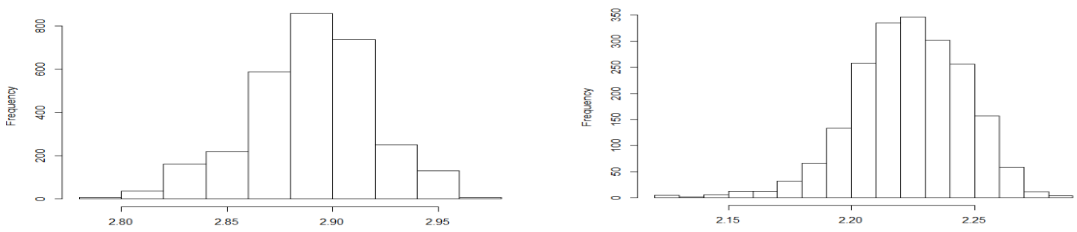
(a) Additive Index (b) Additive Index with Weights

Figure D.1: Business Schools.



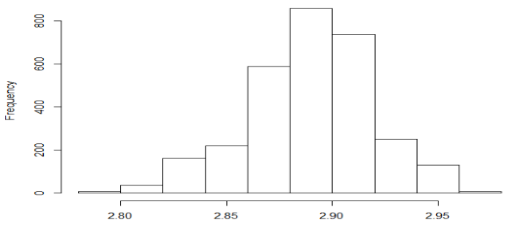
(a) Additive Index (b) Additive Index with Weights

Figure D.2: New Universities and University Colleges.

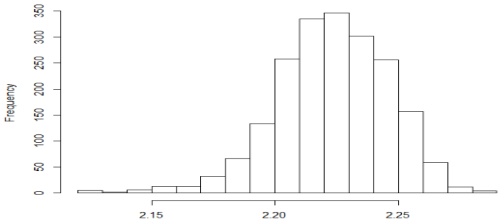


(a) Additive Index (b) Additive Index with Weights

Figure D.3: Old Universities.



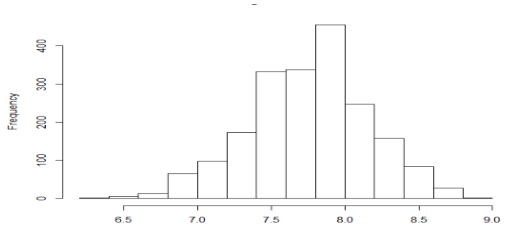
(a) Additive Index



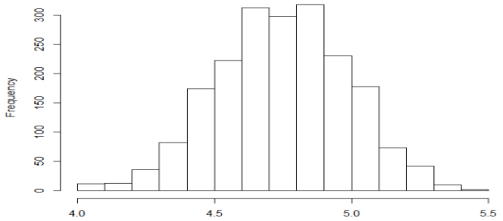
(b) Additive Index with Weights

Figure D.4: Old Universities.

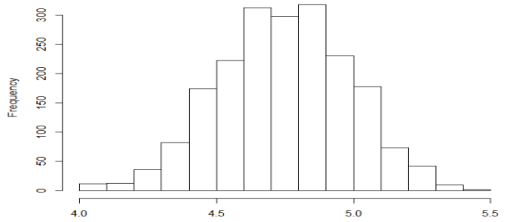
Organizational Actors



(a) Additive Index

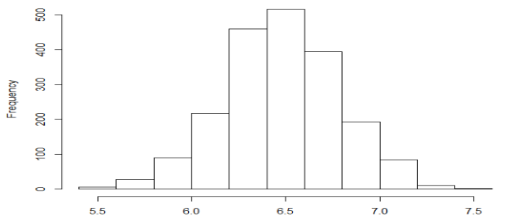


(b) Additive Index with Weights

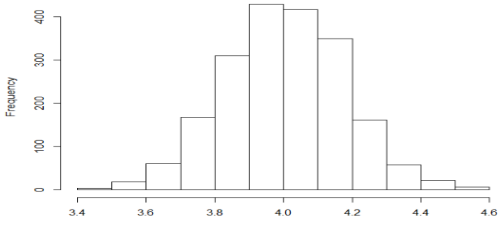


(c) Multiplicative Index

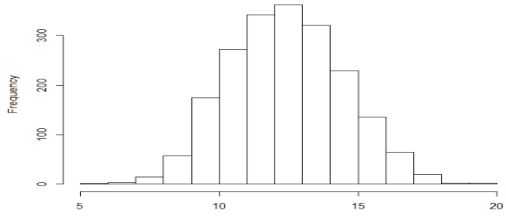
Figure D.5: Business Schools.



(a) Additive Index

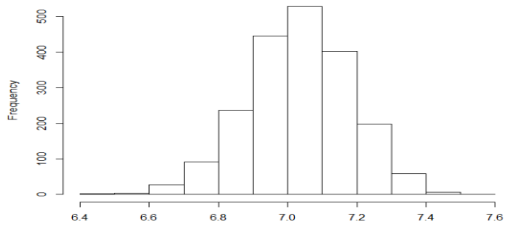


(b) Additive Index with Weights

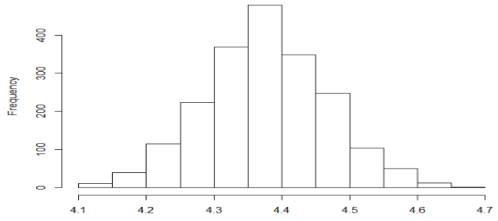


(c) Multiplicative Index

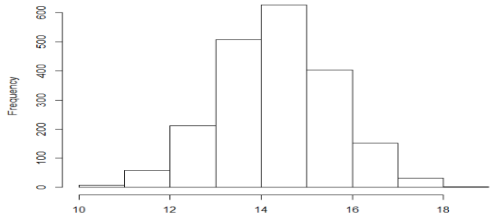
Figure D.6: New Universities and University Colleges.



(a) Additive Index

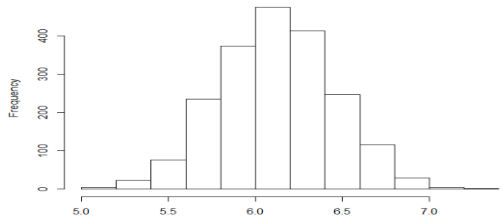


(b) Additive Index with Weights

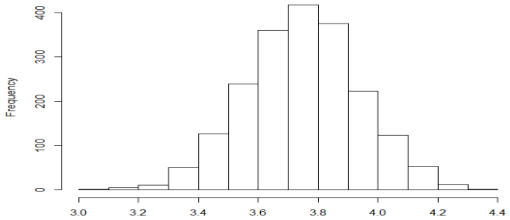


(c) Multiplicative Index

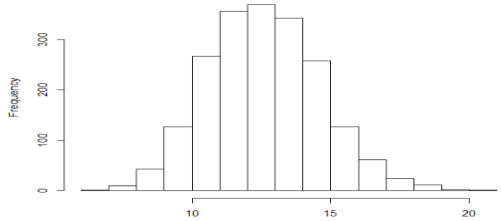
Figure D.7: Old Universities.



(a) Additive Index



(b) Additive Index with Weights

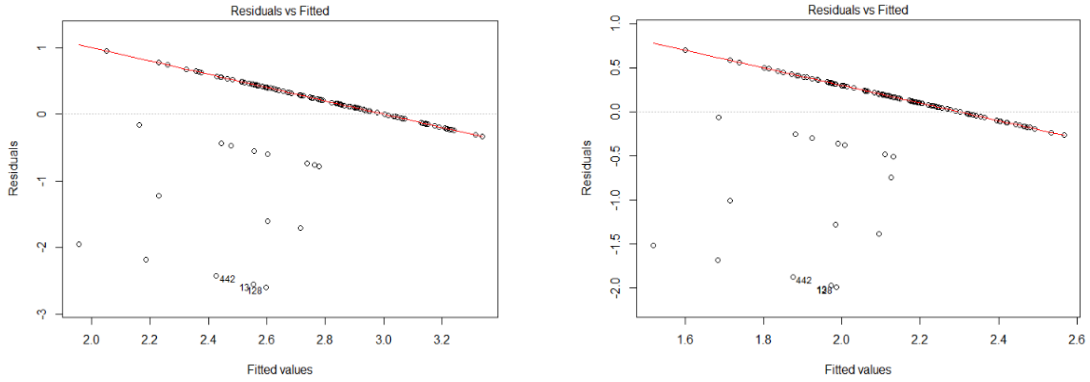


(c) Multiplicative Index

Figure D.8: Technical Universities.

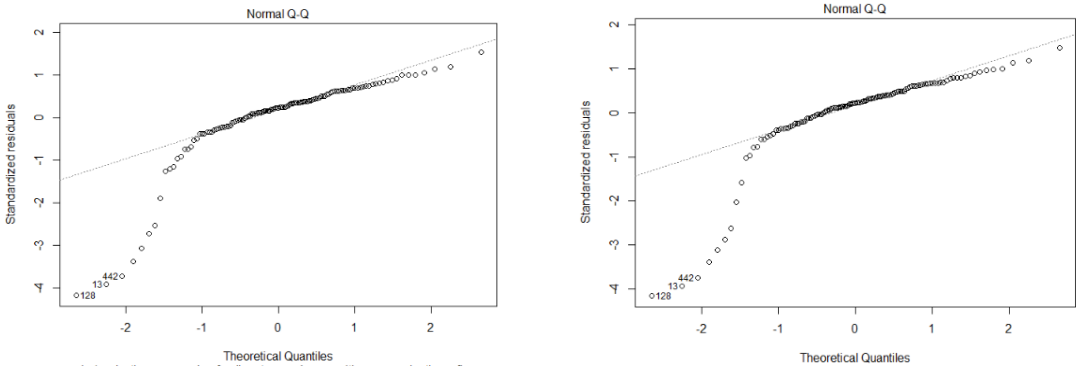
Appendix E

Evaluations and Performance Measures Regression Analysis



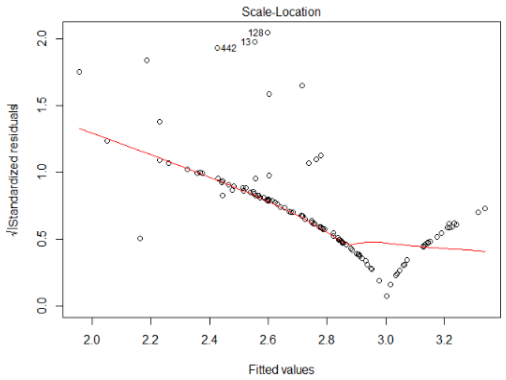
(a) Additive Index (b) Additive Index with Weights

Figure E.1: Residuals Versus Fitted Values.

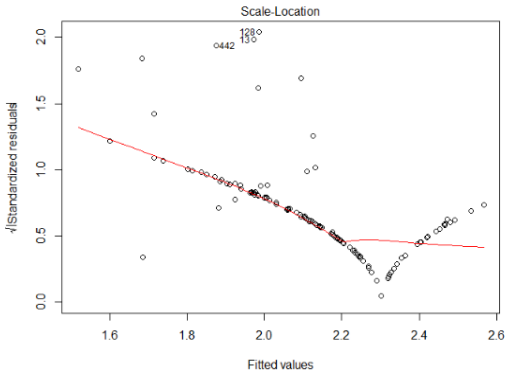


(a) Additive Index (b) Additive Index with Weights

Figure E.2: Normal QQ Plot.



(a) Additive Index



(b) Additive Index with Weights

Figure E.3: Scale-Location Plot.

Examples of Comments to Question 9d

(1) Working in a well known research group with extensive public communication is positive, as well as the evaluation of the university. The group fascilitates good research ideas, applications and thereby funding. We are also active in communicating results (media/social media).

(2) I have a very strong sense of independence and being able to pursue my own research goals, however, the bibliometric performance indicators incentivize me to get my research out and do more in a positive way. I would like to see a greater granularity in the bibliometric indicators, as they do not really distinguish well between journals of very varying quality.

(3) Feedback from national reviews has been very important and has helped me to build a good research environment. Institutional support in the form of strategic funding has also been instrumental. Bibliometric measures are difficult to judge. Sometimes they make us try to publish in higher ranking journals, but at the price of losing relevant readership. The administrative constraints regarding temporary employment and flexible use of grant resources are really counterproductive and force us to publish before a study has accumulated enough data to be of top quality.

(4) A poor (i.e. less than outstanding/excellent/very good) review can easily be demotivating rather than constructive and will easily result in difficulties in obtaining research funding for many years, and such reviews occur very infrequently, making this a big risk rather than a good opportunity. Similarly those who get a review of outstanding/excellent will typically boast about it for many years, sometimes not warranted. Bibliometric performance indicators are typically overinterpreted and misused, and the large emphasis on such indicators will negatively affect the funding opportunities in research areas typically publishing in journals of relatively lower impact (which varies quite a bit between different fields).

	Dependent variable:			
	Evaluations and Performance Measures			
	(1)	(2)	(3)	(4)
Publication	.492*	.449*	.574*	.998**
	(.209)	(.227)	(.244)	(.335)
External Funding	.365	.569	.608	.364
	(.544)	(.588)	(.598)	(.628)
Female		−.197	−.560	−.563
		(.672)	(.701)	(.740)
Assistant Professor		−.801	−.326	.739
		(.789)	(.842)	(1.018)
Associate Professor		−.047	−.174	.096
		(.681)	(.706)	(.763)
Medical Position		15.933	16.350	17.677
		(1,591.948)	(1,602.106)	(1,560.214)
Business Schools			1.714	.771
			(1.217)	(1.404)
New Universities and University Colleges			1.449*	1.540*
			(.695)	(.749)
Cardiology				−2.566*
				(1.161)
Physics				−1.784
				(1.013)
Constant	.555	.674	−.200	.304
	(.537)	(.752)	(.839)	(1.031)
Observations	123	123	123	123
Log Likelihood	−45.949	−44.172	−41.299	−38.464
Akaike Inf. Crit.	97.897	102.345	100.598	98.929
Note:	*p<0.05; **p<0.01; ***p<0.001			

Table E.1: Binomial Logistic Regression with the Alternative Organization Variable.

	Dependent variable:			
	Evaluations and Performance Measures			
	(1)	(2)	(3)	(4)
Publication	.459*	.429	.469	1.087**
	(.211)	(.227)	(.241)	(.383)
External Funding	−.156	.144	.196	.068
	(.645)	(.718)	(.729)	(.770)
Female		−.068	−.215	.105
		(.668)	(.749)	(.894)
Assistant Professor		−.799	−.394	.908
		(.833)	(.881)	(1.139)
Associate Professor		.024	−.220	−.025
		(.690)	(.726)	(.791)
Medical Position		15.988	18.128	20.215
		(1,751.048)	(4,557.385)	(4,363.638)
Business Schools			−.813	.780
			(1.284)	(1.598)
New Universities and University Colleges			−1.499	.476
			(1.217)	(1.635)
Technical Universities			16.619	19.034
			(2,168.295)	(1,979.031)
Cardiology				−4.203**
				(1.515)
Physics				−3.106*
				(1.339)
Constant	.792	.863	1.753	.950
	(.518)	(.715)	(1.221)	(1.276)
Observations	113	113	113	113
Log Likelihood	−43.514	−41.944	−37.588	−31.825
Akaike Inf. Crit.	93.028	97.888	95.176	87.650
Note:	*p<0.05; **p<0.01; ***p<0.001			

Table E.2: Binomial Logistic Regression with Conservative Source of Funding Variable.

Statistic		(1)	(2)	(3)	(4)
Psuedo R2	McFadden	0.056	0.090	0.184	0.310
	CoxSnell	0.045	0.071	0.140	0.223
	Nagelkerke	0.080	0.127	0.250	0.400
AUC		0.666	0.708	0.801	0.874
AIC		93.028	97.888	95.176	87.650
BIC		101.210	116.979	122.450	120.378
-2LL		-43.514	-41.944	-37.588	-31.825

Table E.3: Goodness of Fit Statistics for Step-Wise Inclusion of Variables in the Final Model.

Appendix F

Organizational Actors Regression Analysis

	Dependent variable:			
	Organizational Actors			
	(1)	(2)	(3)	(4)
Publication	−.133	−.112	−.125	.097
	(.110)	(.134)	(.141)	(.178)
External Funding	−.488	−.377	−.315	−.452
	(.289)	(.332)	(.323)	(.379)
Female		−.278	−.154	−.260
		(.381)	(.374)	(.427)
Assistant Professor		−.580	−.644	−.238
		(.454)	(.454)	(.572)
Associate Professor		.361	.427	.757
		(.439)	(.430)	(.483)
Medical Position		−.893	−1.066	−.854
		(.747)	(.744)	(.898)
Business Schools			.695	.299
			(.691)	(.825)
New Universities and University Colleges			−1.019*	−.708
			(.430)	(.512)
Technical Universities			−1.072**	−1.121*
			(.389)	(.442)
Cardiology				−.714
				(.676)
Physics				−.679
				(.628)
Constant	7.274***	7.307***	7.709***	7.534***
	(.360)	(.500)	(.573)	(.672)
Observations	224	191	191	154
R^2	.020	.043	.112	.125
Adjusted R^2	.011	.012	.068	.057
Note:	*p<0.05; **p<0.01; ***p<0.001			

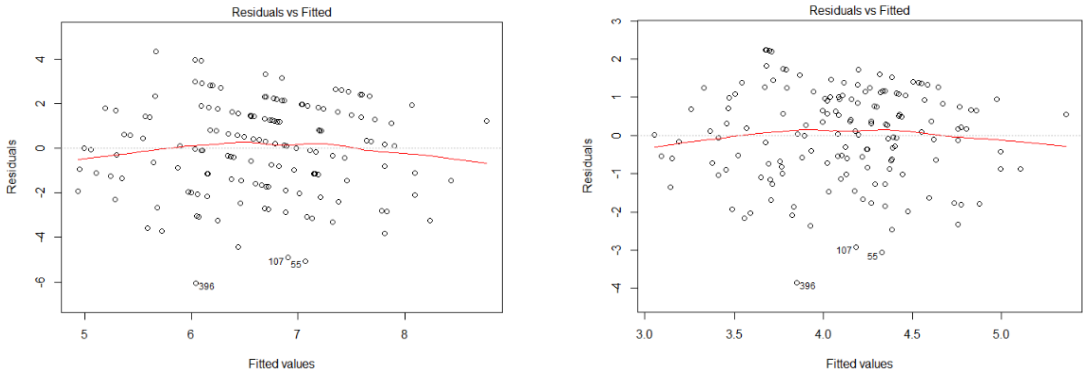
Table F.1: OLS-Regression wit the Additive Index as the Dependent Variable

	Dependent variable:			
	Organizational Actors			
	(1)	(2)	(3)	(4)
Publication	−.064	−.045	−.045	.076
	(.065)	(.079)	(.083)	(.105)
External Funding	−.183	−.159	−.123	−.194
	(.171)	(.197)	(.192)	(.223)
Female		−.210	−.138	−.200
		(.227)	(.221)	(.251)
Assistant Professor		−.200	−.225	−.025
		(.270)	(.269)	(.337)
Associate Professor		.200	.250	.434
		(.261)	(.255)	(.284)
Medical Position		−.534	−.619	−.529
		(.444)	(.441)	(.529)
Business Schools			−1.061*	−.721
			(.419)	(.486)
New Universities and University Colleges			−.483	−.308
			(.409)	(.486)
Technical Universities			−1.170**	−1.030*
			(.426)	(.519)
Cardiology				−.344
				(.398)
Physics				−.318
				(.370)
Constant	4.395***	4.396***	5.094***	4.790***
	(.214)	(.298)	(.414)	(.455)
Observations	224	191	191	154
R^2	.010	.029	.106	.122
Adjusted R^2	.001	−.002	.062	.054
Note:	*p<0.05; **p<0.01; ***p<0.001			

Table F.2: OLS-Regression with the Additive Index with Weights as the Dependent Variable.

	Dependent variable:			
	Organizational Actors			
	(1)	(2)	(3)	(4)
Publication	−.653	−.903	−.892	.211
	(.495)	(.596)	(.642)	(.799)
External Funding	−3.902**	−3.300*	−3.080*	−3.493*
	(1.297)	(1.478)	(1.476)	(1.699)
Female		−1.357	−1.071	−1.590
		(1.700)	(1.706)	(1.914)
Assistant Professor		−4.407*	−4.436*	−2.354
		(2.025)	(2.074)	(2.568)
Associate Professor		−.654	−.466	1.483
		(1.959)	(1.964)	(2.167)
Medical Position		−6.555	−6.830*	−3.447
		(3.332)	(3.396)	(4.030)
Business Schools			−6.028	−1.309
			(3.231)	(3.702)
New Universities and University Colleges			−3.301	−.513
			(3.152)	(3.703)
Technical Universities			−5.462	−2.459
			(3.285)	(3.950)
Cardiology				−4.356
				(3.031)
Physics				−3.400
				(2.818)
Constant	10.341***	12.641***	16.581***	12.830***
	(1.620)	(2.231)	(3.188)	(3.468)
Observations	224	191	191	154
R^2	.048	.082	.107	.115
Adjusted R^2	.039	.052	.063	.046
Note:	*p<0.05; **p<0.01; ***p<0.001			

Table F.3: OLS-Regression with the Multiplicative Index as the Dependent Variable.



(a) Additive Index (b) Additive Index with Weights

Figure F.1: Residuals Versus Fitted Values.

Figure F.2: Residuals versus Fitted Values for the Multiplicative Index.

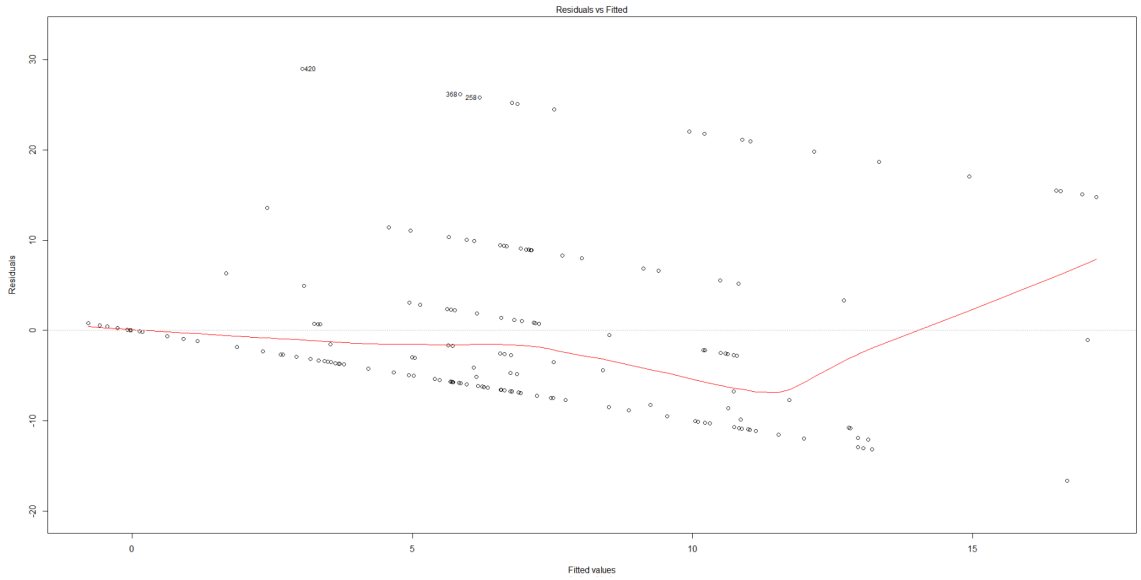


Figure F.3: Normal QQ Plot for the Multiplicative Index.

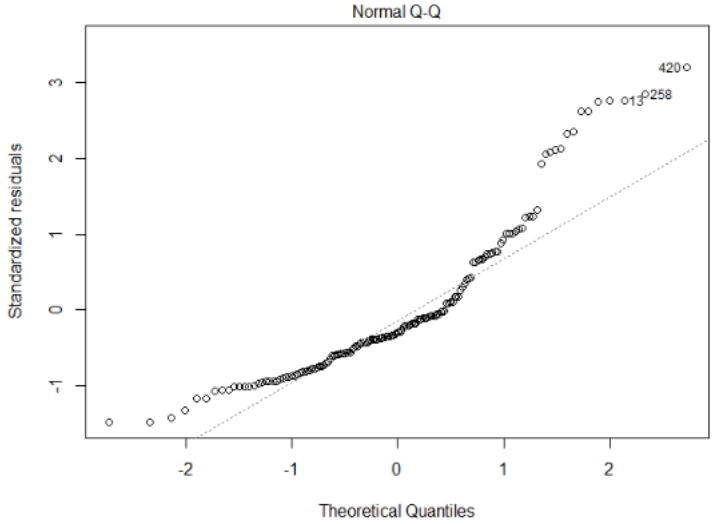


Figure F.4: Residual Plot of Log Transformed Additive Index with Weights.