Systemic Rejection:
political pressures seen from the science system

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1. Introduction

The relationship between the science system and the political system is crucially important for understanding how excellent science comes about. Policymakers, through the logic of the knowledge-based economy, have conceptualized science as a key to promoting competitiveness, economic growth, and solutions to societies' problems. The consequent importance and relevance of science has led them to focus more closely on ways to control, steer, and try to improve the science system. Their attempts to govern knowledge imply a vertical conceptualization of the relationship between the political and science systems, that is, one in which the policymakers have power to steer and control science; we argue in this article that a horizontal model better characterizes what is actually occurring. The science system, while being pressured by political initiatives, nevertheless maintains independence as a functionally distinct system that reacts to the political system's pressures but retains self-steering capacity.

We argue that on the micro-level it is possible to create conditions for excellence and breakthroughs regardless of the political mode of governance because the horizontal relationship between the systems allows the science system to shield itself from political pressures. Our starting point is the observation that over the past decade there has been a critical refinement in the logic of science policy in Europe: whereas in the 1990s and early 2000s the logic was to support and create the ideal conditions out of which excellent research would emerge, by the mid 2000s, policymaking objectives had shifted towards a logic of outputs, specifically the overarching objective of efficiently engineering excellent research and breakthroughs (Sørensen et al 2015). Both terms, excellence and breakthroughs, have authentic roots in the scientific discourse that legitimate them and create an illusion of common ground between policymakers and scientists; however, below the surface, it is far less clear that these concepts function similarly within their respective systems. Working through these terms allows us to explore a fundamental question: despite the appearance of shared overall objectives, are policymakers and scientists in fact operating with conflicting logics and models?

Using evidence from interviews in high performing research groups in Denmark and Sweden, we examine the interplay between the science system and the political system. We investigate the way researchers implicitly accept or reject the agenda set by policymakers through indicator-based measures and instruments for funding and evaluation: How have political efforts to promote scientific excellence and breakthroughs influenced researcher behavior?

This approach allows us to explore empirically how the science system responds to steering pressures from the political system. Münch (2014) argues that competitive funding, university rankings and the focus on measures of research performance have changed the rules of the game, resulting in an “economized academic world” (p. 63), and preventing precisely what they aimed for, namely, the increase of new knowledge and breakthroughs (p. 125). Traditional scientific norms place the focus on all researchers contributing to the collective generation of knowledge, which means that all have a motive to pursue creativity and breakthroughs. However, Münch argues that competitive funding and performance measures lead researchers to think and act strategically, which may lead them to pursue incremental change instead of originality. The increased emphasis on measures and indicators

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of excellence have constitutive effects (Dahler-Larsen 2009, 2014, Espeland and Sauder 2007) on both how excellence is defined and on research behavior. It creates a risk that researchers will be more preoccupied with their performance as measured by indicators, for example the number of publications and where their publications are published, and less with their substantive contribution to their research field. There is a complex story behind politically driven attempts at steering that is neither linear nor direct, but rather involves a strategic acceptance or rejection of the steering attempt from within the system itself. For this reason, the systems theory of Niklas Luhmann shapes our approach by providing a justification for understanding the science and political systems as operationally closed systems that cannot directly interfere with each other, but only communicate through structural couplings, observations and irritations. According to his theory, it is within the science system that the decision is made to accept or reject the steering attempts of the political system.

Luhmann's theory forces us to consider the political system and the science system in a horizontal configuration. Too often the relationship is conceptualized as a vertical one; even in more detached theories of governance in which steering occurs at a distance (Rhodes 1996) or via metagovernance (Jessop 2004), a vertical assumption still exists: the government is seen to be acting on something within its purview.

In the next section we outline how Luhmann's systems theory provides a useful framework for understanding how political measures can impact the science system, researcher behavior and attitudes towards risk and competition, and ultimately the pursuit of excellence and breakthroughs. In order to bring a more concrete operationalization of the acceptance or rejection of steering attempts we turn to organizational theory and adapt a typology of strategic responses based on Oliver (1991) and Gornitzka (2013). Thereafter, we describe our methodology and case selection and present and analyze the results of the empirical study of researchers in Denmark and Sweden. The final section discusses these results and their implications for the main questions in our analysis.

2. Systemic rejection

Our analytical point of departure in this paper is the systems theory of German sociologist Niklas Luhmann. According to Luhmann's theory society consist of a number of autopoietic, functionally differentiated systems (Luhmann 1997). To Luhmann these systems are communication systems operatively closed around a specific binary code (Seidl 2004). The law system is for example only concerned with justice/injustice and the economic system with payment/non-payment. If we view the science system in the light of Luhmann's theory, it operates through the medium truth and consists of communication about what is true and untrue.

The autonomous and autopoietic character of the functional systems means that no system can steer the operations of another system directly (Andersen & Loftager 2014). It is thus not possible for e.g. the political or the economic system to steer the operations of the science system. Only the science system determines what is true or untrue. This, on the other hand, does not mean that the science system is totally uncoupled from the other systems in society. All functional systems are linked to each other (Heinze 2009: p. 69), i.e. interactionally open to other systems (Seidl 2004: p. 3). All the other functional systems in this way make up the environment in which a given system operates; an environment that the system continually observes and takes into account.

The only way one system can influence another system is thus through irritations, which emerge in two ways: through *structural couplings* and via *second order observations*. As examples of structural couplings between the science system and other subsystems, scientific journals (part of the economic system if they are owned by commercial publishing houses) and funding schemes (part of the political system) could be mentioned. Through such structural couplings the political system can influence the science system by, for example, defining the agenda for the different funding bodies. It can decide whether a funding body should support applied research or fundamental research, if it should focus on specific research topics, etc. The political system cannot directly determine the outcome of the research projects that get funded, but by deciding to fund one kind of research instead of another kind of research, the political system causes an irritation in the science system: "The adaptation of an autopoietic system to environmental conditions is mediated by structural couplings that are only able to irritate the cognitive processes of the system, and not determine them" (Luhmann 2000: p. 373 [our translation]).

The other way in which the functionally differentiated subsystems influence each other is more indirect. The science system can e.g. be influenced by the political system via the irritations caused by the evaluations, bibliometric measurements, rankings etc. of the science system that the political system carries out. These measurements can in a systems theoretical perspective be described as one system's (political) observation of another system (science). These observations are also observed by the system that is itself being observed. This means that the science system can observe how it is being observed by the political system. This is what Luhmann calls second order observations (e.g. Luhmann 2000: p. 288).

We know very little about how the science system reacts to both kinds of irritations. In this paper we therefore want to look into the question of how current irritations such as for example changing trends in funding policies (Bloch and Sørensen 2015) and a new understanding of excellence within science (Sørensen et al. 2015) are influencing the science system. How does the science system communicate about these issues? How do the researchers talk about journals, funding, measurements etc.? And do they change their behavior because of these irritations? In other words, how do they accept or reject steering attempts?

The acceptance or rejection of steering attempts is often not explicit, and take on different forms. Organizational theorists, and particularly those of the "Scandinavian school", have long been occupied with the non-linear relation between policy and organizational responses, suggesting terms such as "translation", "editing", "organizational hypocrisy" to describe the processes in which ideas and policies travel into and through organizations (Brunsson 1989, Brunsson and Olsen 1993, Czarniawska and Sevón 2005, Sahlin and Wedlin 2008[4]). Christine Oliver has attempted to create a typology of strategic responses of organizations to institutional pressures (Oliver 1991), which has been recently used in the field of higher education and science studies to explain how global rankings steer national policy (Gornitzka 2013). Three main strategic responses of the national government were drawn out of Oliver's work by Gornitzka: *channeling*, *filtering* and *buffering*. While these three can effectively describe the vertical pressure from supranational rankings to national policy, they need some adjustment in order to describe the horizontal interactions between the political and science system. Inspired by cell biology and systems theory, we could say that each system, metaphorically speaking, has a membrane that shields it from external pressures, which means that political pressure as it hits that membrane needs either to be accepted from the inside or is by default rejected. The strategic responses enumerated by Oliver and Gornitzka describe the ways that acceptance can be characterized. Our interest in this paper is in those responses that have what we call shielding effects: mechanisms by which the science system protects itself against pressures. With the exception of *channeling*, the others all exhibit varying degrees of shielding.

Channeling can occur when pressures are tightly linked or are on the same path, to use a historical institutionalist concept (Pierson 2000). In these cases, because they share a context and vision the pressures are internalized as is, "acquiescence" in Oliver's terms. From a Luhmannesque perspective, this is extremely unlikely in the interaction between systems. Because the systems are independent of each other, there is little chance that they could be on the same path, though the two paths might intersect at times. Nevertheless, the concept of channeling is important for thinking about common terms like excellence and breakthroughs, as it highlights the unstated (but also unproven) assumption that common terms reflect a common path. We argue that though common terms may be superficially related, the meanings embedded in them differ according to the system in which they are used, i.e. excellence for politicians is not excellence for scientists (Sørensen et al 2015).

Filtering is used to describe what happens when there is no common path or context and the pressures slowly make their way from the supranational to the national level through processes of translation or layering: "pressures are sifted as they are selectively mixed and matched" (Gornitzka 2013: p.79). In the horizontal relationship between systems, filtering is perhaps the most likely means of acceptance. The science system, in our case, chooses which elements to take in. It filters and makes its own decisions about what to accept and how to incorporate it.

When *buffering* occurs, it means that the pressures are being thwarted. This is one of the ways in which Oliver describes "avoidance" (Oliver 1991: p. 154). There is a decoupling of the pressures and their effects from the

[4] For an example of an analysis of how ideas travel into and through higher education institutions, see Degn (2014).

actual practices of academic work so the rejection is somewhat concealed. Avoidance in this way differs from "defiance", which according to Oliver is a more explicit rejection of pressures either by openly ignoring them or actively acting or arguing against them. While buffering is important to our study, the concept of defiance is one that we will not explore in detail because the ideas and concepts that we are interested in, excellence and breakthroughs, are not ones that the science system ignores or defies.

Oliver also describes another category with a shielding effect, namely "manipulation", which represents an attempt to "actively change or exert power over the content of the expectations themselves or the sources that seek to express or enforce them. Manipulation can be defined as the purposeful and opportunistic attempt to co-opt, influence, or control institutional pressures and evaluations (Oliver 1991: p.157)." In terms of the relations between systems, this is another important category of strategic response. There is a struggle to inject particularistic systemic meaning into the key concepts. We see this in the political system's attempt to co-opt scientific concepts like excellence and embed them with new meanings. How does the science system respond? Does it manipulate in return?

3. Case selection

The cases chosen are two high performing research units, one large research group in Denmark and one department, with several high performing research groups in Sweden. More details are provided in sections four and five. By high performing, we mean that both units publish intensively, have some of the most highly cited researchers within these fields, and are successful in generating significant external funding. In this sense both of the units can be classified as 'high resource' types (Rosinger et al 2016) meaning that they are dependent on external research funding and derive prestige from their success in that endeavor, rather than depending on university based distributions of funds which tend to be student/teaching based.

These high performing units can be said to meet the conditions of both the political and science systems. The differences in the Danish and Swedish context as described below, suggest that they are high performing despite, not because of, the policy context in which they are embedded. We seek to demonstrate that in many ways these units actively shield themselves from policy pressures in ways that are similar regardless of the national context. The design of our study does not allow us to determine to what extent the previous success of these units (i.e. Matthew effects) assists in them maintaining ongoing funding advantages over other units. Whether low performing units could 'get away' with shielding is beyond the scope of this paper. However, previous studies (Whitley 2014) suggest that institutional change such as changing funding patterns and changes in ‘authority relationships’ (e.g. increased state steering) in general reduce the ‘protected space’ of researchers, and in particular reduces it for those who are not able to get a tenured post or obtain funding with a long time horizon that allows them to experiment, take risks, develop new skills and techniques, etc. The high performing groups all benefit from 'slack resources' (Taylor 2016), which can be used to shield and create protected spaces for high performing groups that are simply not available in low performance environments, and which lead to increasing stratification within the system.

The two cases differ on a number of parameters: size, organization (one large group vs. several smaller groups in one department), and not least discipline (Natural sciences vs. Social science). They are thereby part of different organizational systems within the scientific system (see e.g. Knudsen 2007 for a discussion of the couplings between organizational and function systems) and their respective disciplines are subject to varying levels of prestige (see Rosinger et al 2016) making comparisons imperfect. We argue, however, that since these cases are used primarily as illustrative cases of how these systems allow themselves to be irritated, and to what extent their decisions are based on these irritations, the differences between the cases are of less importance. If anything the differences bolster the argument that there are common epistemic conditions, created by shielding, that allow excellent research to emerge.

Sweden and Denmark provide a contextual background of active government policymaking in the area of science. A key commonality is that both Sweden (Carlsson 2009, Young 2015) and Denmark (Wright 2014) have

developed comprehensive national systems that distribute funds according to bibliometric outputs, but they also demonstrate significant differences in their national approaches. Recent research, through an analysis of measures and indicators, claims that the national structural differences account for a difference in ability to generate breakthrough research (Öquist and Benner 2012, Karlsson and Persson 2012, Öquist and Benner 2015). Denmark's research performance has been growing steadily for many years and when measured bibliometrically, on e.g. top cited papers, Denmark belongs to the top 3-5 best performing countries in the world. Sweden, on the other hand, seems to have lost pace and its previously held position among the world's leading research nations (measured by their proportional share of highly cited papers). Öquist and Benner argue that these differences are due to national priority settings, conflicting aims of relevance and excellence, the governance and leadership of universities, the constellation of funding actors, and the mechanisms for funding distribution (Öquist and Benner 2015, cf. also Aagaard and Schneider 2013). Their reliance on a structural understanding of politically designed steering mechanisms results in the science system's role and influence not being sufficiently addressed.

By looking at high performing teams in both countries we attempt to show that the contingency of government steering and precariousness of funding are not decisive factors in research excellence and breakthroughs. That is, the high performers behave similarly under different conditions by shielding themselves from pressures that could undermine their performance.

The case studies pay particular attention to two key areas related to the interactions between science and policy: risk-taking and competition. Both of these can be tied to broader neoliberal governance concepts of New Public Management (NPM) and academic capitalism (see Slaughter and Taylor 2016 for a recent discussion). NPM-type reforms have become highly influential within the research sector. While it would be a mistake to characterize these as a blueprint that policymakers follow precisely, many elements have been incorporated across European countries and policy areas (Pollitt et al 2009). A range of elements are seen to characterize NPM (Hood 1991, Pollitt and Bouckaert 2011), but our interests in this paper focus on two in particular. First, policies seeking market-based solutions which are rooted in competition and can be enacted through quasimarkets even when real markets do not exist. For example, the network of research funding councils function as a quasimarket in which researchers compete for funding; the points systems for publications and citations which are linked to funding also have a market-like character. Second, the use of metrics, benchmarking, and quantified measures for enhancing productivity and efficiency. The shift to metrics provides the rationale and ability for non-experts (policymakers) to make judgments on activities that are otherwise outside their scope of understanding (scientific research). They are further justified by the belief that numerical discourse and audits are indicative of trustworthiness and accountability (Porter 1996, Power 1997). In our cases, we are interested in the metrification of publication success as measured by impact factors and citation indices which have been co-opted by policymakers for funding purposes. Further, and often in coordination with these new metric tools, there has been a shift from focusing on 'scientific' to 'research' excellence (Sørensen et al. 2015). Scientific excellence is defined by the scientific community; it is a self-referential conception of quality, one that is uncovered by peer review. On the other hand, research excellence is a politically grounded concept based on metrics that supersede peer expertise.

Risk-taking is a necessary element for exploration and discovery. An underlying hypothesis, and one built into the EU's notion of frontier research, is that revolutionary results as opposed to incremental ones come from research that takes risks. However, increased risk also means the increased potential for failure and from a policymaking perspective, threatens the ability to *efficiently* engineer breakthroughs. We look at how the science system observes and responds to the political system's conceptions of risk, particularly those hidden in the way project proposals are funded.

Competition can be said to be the panacea of NPM reforms, but some types of competition have been deeply embedded in the academic environment since long before that term was coined. A central element of traditional scientific norms is competition for recognition and priority of discovery. However, new policies introduce new forms of competition: competition for funding, competition in university rankings, and competition in other forms of standardized measures such as citation impact. There is also competition at different levels: internally among colleagues and departments, and externally between universities and the global community. A key question is

whether these new forms of competition influence the pursuit of breakthroughs. We look at how high performing environments deal with competition.

4. Perspectives from a high performing Danish research group

The first case to be considered here draws on results from interviews with members of a high performing research group in Denmark that has a proven record of making breakthrough research. Measured by the number of articles, citations and other bibliometric indicators, this group is performing in the world elite within its field. The group works within the field of chemistry and was established in the late 1980s at a Danish University. The group consists of about 30 people (BA, MA and PhD-students as well as post docs). Our interviews consist of four focus group interviews with members of this research group and an interview with the leader and founder of the research group. The interviews took place in December 2014 and January 2015.

Some of the characteristics of this group are a great enthusiasm for chemistry among the members, a friendly work environment and flexibility in the organization of the research process and daily work. Ideas are continually developed and researched in ad hoc formed subgroups that evolve around research ideas and dissolve when the ideas have been researched and the publications made. Crucial to the work process in the group is also an almost 24/7 availability of the research leader as well as a general open door policy. Researchers in the group also enjoy a far-reaching freedom to pursue research ideas of their own. As one of the younger researchers express it:

> *You can just do crazy stuff, whatever you want to. After some time X* [the group leader] *came around and he just said like, if you have ten crazy ideas just try all of them and if just one of them works, we have a nice publication that is cool. That is kind of his philosophy so you can try whatever you want and then later also build up a little team of people helping you.* (PhD student)

A post doc working in the group also appreciates this freedom and according to her this freedom primarily has to do with having an adequate amount of funding:

> *I like that; that here we can just think, and if we have an idea we can just try it […] I like this kind of freedom where you can more or less do whatever you want. But I think something that helps a lot is having money [...]* (Post doc)

The group leader confirmed in an interview that money is in fact no problem. He has enough funding and takes sole responsibility for always having funding for his group of 30 people. Asked about funding and the fact that none of the researchers in the group seem to worry about having sufficient funding, he says: "It's not their problem, it's mine". He further says: "There are no limitations. They know that as long as they make good chemistry [research], there is money."

However, even though the research leader in this way can buffer the researchers from possible negative effects of the interdependency (structural couplings) between the science system and its surrounding environment – because he does not want to let funding issues and worries disturb the research process – irritations caused by second order observations cannot be avoided completely. The researchers in the group are all in the beginning of their careers – PhD students and post docs – and they are very aware of how they are judged (observed) by the surrounding societal systems as well as by the research system itself. They paint an identical picture of how they think they are judged and measured: by the amount and quality of what they publish. For example, one of the post docs says, when asked about her motivations for joining this group:

> *I was looking for a group where they published a lot of course, which is very important for a post doc […]"* and she also says: "*[…] it was an important group in this field, they published a lot, and the good thing is that not only X* [the group leader]*, the professor, publishes a lot, but also their PhDs and everybody has a lot of work done, so I liked this. So that's why I chose it.* (Post doc)

From the interviews it is also clear that publications and pressure are two things that are closely connected by the respondents. As one of the PhD students in the research group said:

> *I already have some publications, so I don't feel so much pressure. I just, I mean I have to sort of make my own publication before I finish my Ph.D. and I think this is completely realistic that I will achieve this at some point.* (PhD student)

According to the research group leader the publication pressure can from time to time cause tensions among the researchers within the group. Although the general picture is that people get along well and almost feel that the group is their second family, there have been examples of group members quarreling over the authorship of papers. In one instance the group leader explains how he made a choice regarding the environment over publication points:

> *It caused a little bit of turbulence in the house. Because when I tell my people that the paper will end up in the garbage can if they cannot agree, it tells a bit about how the environment of the group can be. But to me it was more important to calm down the internal tensions in the group than to publish one more paper. The environment in the group was more important to me than the paper.* (Group leader)

Also when it comes to taking risks in the research process there seems in this group to be more room for making mistakes – but also to aim higher – as this dialogue from one of the focus group interviews illustrate:

> *The reason that we can operate like this as a group is because* [the group leader] *is already successful. A new professor cannot work like this, it's simply not possible, because you don't have the funding or the money to buy the chemicals. You can't risk a project not working.* (Master student)

> *You are right with this,* [in my prior group] *we couldn't risk projects not working. We had to go to safer things, and that was a very huge problem for us, because we sometimes had good ideas, we could not work on them.* (Post doc)

> *[...] and this also leads to higher impact publications, the fact that you can do more risky things, simply because these are usually more exciting, but there is also the risk that it just doesn't work.* (Master student)

The fact that the group and the group leader are so well-established apparently allows them to take more risks than not so well-established groups. Despite a growing interest in the science system from the surrounding environment – and the experience of increasing pressure for publishing – there is clearly still a lot of room in this group for taking risks and aiming for breakthroughs in the scientific sense of the word.

5. Perspectives from a high performing Swedish department

The second case examines a high performing department in the faculty of social sciences in a leading Swedish research university. Interviews were conducted with 15 researchers and administrators at various career stages. Within the department there are several prominent research groups that researchers can choose to join. These groups function in much the same way as in the Danish case, where researchers come together to form various constellations for publication. As described by a member of one group, the leaders "[…] have been very consciously working on creating a group with collaborations rather than individuals writing single pieces and just thinking of their own career in that sense." (Associate professor). In addition to providing a platform for collaboration, the group and its projects also provide a shielded source of funding: "[…] so far I have prioritized writing papers instead [of writing grant applications]. It takes a while to find funding and so I think as long as I can get funding anyway [i.e. through the group] and write things that I'd like to, I'll go for that option" (Associate professor).

The circular nature of funding and publications, is very much embedded in the thinking of researchers in the department, and the critical importance of having funding shapes researchers' outlook and behavior: "You've got to get funded all the time so you can buy yourself freedom to research" (Professor). But as one administrator

described, this requires constant success, failure is simply not an option. This leads to a more conservative approach to research:

> *I think you should be able to take risks, but I don't think the system is really generating that because of the demands for publications; and you have to do those otherwise you won't get more research money or the permanent position you want to get. It really drives you to safer projects.* (Post doc)

Competition appears in many forms and at different levels. There is a general understanding that the whole academic environment is set up in a competitive manner:

> *It's survival of the fittest in some sense you could say. I thought about it in that sense and that does not mean that I like it, but there is not much you can do. There are some good sides to it as well. I would not like to see people just sitting on their chair year after year doing nothing of importance, that's not my dream scenario either.* (Researcher)

Others characterize it somewhat jestingly in sporting terms "[...] and the citation... the whole citation index gives you the quantitative assessment; it's like the long jump. Here's the yardstick we've been waiting for for so many years to tell objectively who can jump the longest. Yeah!" (Professor 2). There is a strong interest and identification with these metrics, however, for the most part this competitive spirit does not seem to undermine the collegial environment. The attitude towards others' success is positive: "[...] so if you're thinking something like there would be some envy, some bad feelings and so on, [no], I think there is often a celebration when someone has published a paper, comes out with a book, things like that - there is always a celebration" (Professor 3).

Pressures for competition internally are couched in a supportive environment. While the leaders in the department set the tone, they do it more by example than by exerting any sort of direct pressure: "He's not very controlling; he is very constructive and very inspiring" (Post doc), or as another person describes it, "The head of the institute to start with, what he appreciates is international publications, but I mean, except for that I don't think that he is pushing us in a very direct sense. The whole institute, we are pushing each other" (Associate professor). The desire for international publications and recognition is not just coming from external pressures or motivations, but is an internal drive:

> *Today you live in the globalized world and you have to do your research in another way. So it's a bit of a change, and the change is not all that managed... it's come from the research community as well. It's not all politics and people plotting to do it. It's sort of an urge: that you need to be part of the international research community, and you want to be part of the international research community.* (Department administrator and Researcher)

The competitive environment within the department is based on respect among colleagues and this can trump external pressures: "for me it is more important how my closer colleagues think. That's been more important than pressure from the university" (Professor 4). Or as another researcher puts it, "I guess they [the central administration] are encouraging that sort of perspective from the researchers, but I would do it anyway, regardless of their visions..." (Associate professor 2). This shielding also can be seen in attitudes towards journal ranking indexes, as can be seen in this brief justification by an associate professor for why he would be proud to publish in a particular journal despite it's not being top ranked: "I think that they, in my world, are better than what the citation factor would indicate" (Associate professor).

External pressures caused by structural couplings between the science system and the political system in the form of different funding schemes are often experienced as quite extreme, particularly by early to mid career researchers whose base contracts only contain ten per cent research time. In order for them to actually conduct research, they must obtain grants and buy themselves out of teaching. This can be done by either applying for grants or taking part in already existing grants as described above. Those applying for grants often face extreme odds:

> *Funding is of course crucial, and I think it deteriorates for every year. As it is now, all resources are going to young post docs, preferably methodologically very skilled, and excellent groups around professors. I calculated after the last results from the science councils [...] that the chances for me to get*

> *research funding is approximately five per cent ... which I think is absurd, illegitimate.* (Associate professor 3)

Grants tend to follow the Matthew effect, going to groups around excellent professors and obtaining them becomes part of the role of the professor:

> *As a professor you have this sort of pressure to write applications, that's what you are supposed to do... you are supposed to bring external money to the department; you are supposed to be a kind of motor driving things. So I think that I make more applications than I actually have to and in one way I was more successful last year than I had hoped for or expected to be.* (Professor 4)

This buffering activity allows those who have not succeeded in obtaining funds themselves the opportunity to work on projects for which others have received funding.

The university itself also works to at least partially shield researchers from the political system. The national funding system allocates a percentage of institutional funding based on performance results (Carlsson 2009). However, the funding from that instrument, once received by the university, is redistributed at the university's discretion. This is the first level of shielding. The university distributes funds internally according to different criteria than the state system: "We have our own distribution system and the state has their distribution system [...] the state system, it's very much natural science technological science and medicine [oriented], and that would not fit our university" (Central administrator). This does not mean that bibliometrics doesn't matter, rather the different faculties select different bibliometric systems by which to measure themselves. The university then uses these to determine internal funding. Here a different sort of sports metaphor is used: "It's like they [each faculty] have their own golf handicap. They have a level which is their starting level and they can improve or go the other way. That actually has an impact on the resources they obtain" (Central administrator). This metaphor implies that the competition is not among faculties but rather internalized within faculties. They are competing against their own past performance, but also against the performance of others in their field internationally as the bibliometric measures are grounded in international output results.

6. Discussion

This paper has examined the relationship between the science system and the political system by looking at high performing groups within the Danish and Swedish environment in order to provide a clearer picture of the effects that policy decisions have on research excellence and breakthroughs. The two case units are both successful in producing excellent research regardless of the national system that they operate in. Why? The evidence above suggests that the groups' success lies not in being steered by the policy system, but rather, by shielding itself from many of the main pressures that the political system creates. Where the two systems do align, such as publication in respected journals, the researchers in the high performing research groups we studied follow a different logic for rationalizing their preferences than that expected by the policymakers. This means that the high performing groups benefit from the system while at the same time buffering the effects the system has on them. In other words they succeed in both obtaining money/prestige and creating protected spaces (Whitley 2014), which allow them to pursue research according to the norms of the science system. However, this is not to argue that the political pressures do not have any effect. In both groups, the researchers were acutely aware of the ways in which the political system was observing them. The structural couplings used to distribute funding were particularly powerful in Sweden. In the areas in which the political system attempts to steer the science system, we find that the effects are stronger on the more junior researchers. The established professors are able to shield both themselves and those under them, at least to an extent, from the political steering influences, but in ways that do not appear to diminish the excellence of the research outputs.

It is highly likely that this observation would also apply to low performing groups which, like more junior researchers, lack the prestige and slack resources that would enable them to buffer political pressures. They are far more likely to have a simple choice between channeling (accepting and conforming to the politically steered

conditions) and rejecting. In line with Whitley (2014), our observations suggest that this would make them less likely to produce excellent science, because they would have difficulties generating the necessary 'protected space' and flexibility needed for creating breakthroughs.

A comparison of the Danish and Swedish case studies in the light of Luhmann's concepts of structural couplings and second order observations reveals a remarkable number of similarities despite the difference in the fields and organizations in which the groups are embedded. However, there are also significant differences. The evidence uncovered above suggests that the following points should be taken into account when trying to understand the relationship between the political system and the science system:

First, it is worth noticing that the political system cannot directly steer development in the science system. In both examined cases we observe that the science system shields itself off from the political system by rejecting some of the ways in which it is observed, for example in the understanding of the quality of particular journals in the Swedish case or the carving out of significant space for free exploration in the Danish case, and by finding ways around the structural couplings which reflect back on a more traditional understanding of breakthroughs in the science system.

Second and related to the first point, while policy studies like e.g. Öquist and Benner (2015) provide insights that are valuable, particularly regarding the way funding affects research environments, we nevertheless feel that overall such studies are too linear and place too much confidence in the ability of policy to change the situation. As we have highlighted in this paper, and following ongoing research in organizational and individual responses to institutional pressures, several transformational processes are at work when policies attempt to create structural couplings between the political and the scientific systems. This paper has shown how various shielding responses are activated in our case groups, and our evidence thereby shows that it is necessary to get down to the shop floor level to see how people are affected by these policies and how they either accept or reject them (Rushforth and Rijcke, 2015, have already begun this work). We must also go down to this level in order to fully understand the tools and techniques researchers have at their disposal for doing this.

Finally, a more sophisticated and nuanced theory seems to be needed in order to be able to describe how the political system can affect changes in the science system. Luhmann provides grounding for such an approach. His understanding of the science system as an autopoietic societal system operating according to its own logic and codes seems to be a fruitful starting point for future research on complex solutions to research governance and the production of excellence.

References

Aagaard, K. and Schneider, J.W. (2013). Relationships between policy, funding and academic performance — Examination of a Danish success story. In Red. S. Hintze & A. Lottmann *(Eds.), TRANSLATIONAL TWISTS AND TURNS: SCIENCE AS A SOCIO-ECONOMIC ENDEAVOR: Proceedings of STI 2013 Berlin. 18th International Conference on Science and Technology Indicators*, pp. 19-28.

Andersen, S.C. and Loftager, J. (2014). Deliberative Democratic Governance. *Administrative Theory & Praxis*, 36(4): 510–529.

Bloch, C. and Sørensen, M.P. (2014). The size of research funding – trends and implications. *Science and Public Policy*. 42 (2015): 30–43.

Brunsson, N. (1989). *The Organization of Hypocrisy. Talk, decisions and actions in organizations*. Chichester: John Wiley & Sons.

Brunsson, N. and Olsen, J. (1993). *The Reforming Organization*. London: Routledge.

Carlsson, H. (2009) Allocation of Research Funds Using Bibliometric Indicators – Asset and Challenge to

Swedish Higher Education Sector. *Infotrend*, 64(4), 82-88.

Czarniawska-Joerges, B., & Sevón, G. (Eds.) (2005). *Global ideas: How ideas, objects and practices travel in the global economy*. Malmø: Liber and Copenhagen Business School Press.

Dahler-Larsen, P. (2009). *The Evaluation Society*. Stanford: Stanford University Press.

Dahler-Larsen, P. (2014). Constitutive effects of performance indicators - getting beyond unintended consequences. *Public Management Review*, 16(7): 969-986.

Degn, L. (2014). Translating Governance Ideas in Danish Higher Education. *Higher Education Policy*, 28: 295-313.

European Commission. (2013). *Innovation Union Competitiveness report*. Brussels.

European Union (2013). *Regulation (EU) No 1291/2013 of the European Parliament and of the Council establishing Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020)*, OJ L 347/104. Luxembourg: Publications Office of the European Union.

Espeland, W.N. and Sauder, M. (2007). Rankings and reactivity: how public measures recreate social worlds. *American Journal of Sociology*, 113(1):1-40.

Ferlie, E., Musselin, C. and Andresani, G. (2008). The steering of higher education systems: a public management perspective. *Higher Education*, 56(3): 325–348.

Gläser, J., & Laudel, G. (2007). The Social Construction of Bibliometric Evaluations. In R. Whitley & J. Gläser (Eds.), *The Changing Governance of the Sciences* (Vol. 26, pp. 101-123): Springer Netherlands.

Gornitzka, A. (2013). Channel, Filter or Buffer? National Policy Responses to Global Rankings. In Tero Erkkilä (Ed.), *Global University Rankings: Challenges for European Higher Education*, Houndmills: Palgrave Macmillan, pp. 75-91

Hagstrom, W.0. (1965). *The Scientific Community*. New York: Basic Books.

Heinze, T. (2009). Institutional Interfaces of the Science System and the Economic System. In G. Bechmann, V. Gorokhov and N. Stehr (Eds.), *The Social Integration of Science. Institutional and Epistemological Aspects of the Transformation of Knowledge in Modern Society*, 67-84. Berlin: edition sigma.

Hood, C. (1991). A Public Management for All Seasons?. *Public Administration*, 69(1): 3-19.

Jessop, B. (2004). Multi-level governance and multi-level metagovernance. In I. Bache and M. Flinders (Eds.), *Multi-level Governance*, Oxford: Oxford University Press.

Karlsson, S. and Persson, O. (2012). *The Swedish Production of Highly Cited Papers*. Stockholm: Vetenskapsradet.

Knudsen, M. (2007). Structural Couplings Between Organizations and Function Systems: Looking at Standards in Health Care. *Cybernetics & Human Knowing*, 14(2-3), 111-131.

Luhmann, N. (1997). *Die Gesellschaft der Gesellschaft*. 2 vol. Frankfurt am Main: Suhrkamp Verlag.

Luhmann, N. (2000). *Die Politik der Gesellschaft*. Published by A. Kieserling, Frankfurt am Main: Suhrkamp.

Merton, R.K. (1957). Priorities in Scientific Discovery: A Chapter in the Sociology of Science. *American Sociological Review*, 22(6): 635-659.

Merton, R.K. (1988). The Matthew Effect in science, II: Cumulative advantage and symbolism of intellectual

property. *Isis*, 79(4):606-623.

Merton, R.K. and Barber, E. (2004). *The Travels and Adventures of Serendipity: A Study in the Sociological Semantics and the Sociology of Science.* Princeton: Princeton University Press.

Münch, R. (2014). *Academic Capitalism: Universities in the Global Struggle for Excellence*. New York: Routledge Press.

Pierson P. (2000). Increasing Returns, Path Dependence, and the Study of Politics. *The American Political Science Review*, 94(2): 251-267

Pollitt, C. and Bouckaert, G. (2011). *Public Management Reform, 3rd ed.*. Oxford: Oxford University Press.

Pollitt, C., van Thiel, S., Homburg, V. (2007). *New Public Management in Europe: Adaptation and Alternatives*. Basingstoke: Palgrave.

Porter, T. (1996). *Trust in numbers: The pursuit of objectivity in science and public life*. Princeton: Princeton University Press.

Power, M. (1997). *The Audit Society*. Oxford: Oxford University Press.

Oliver C. (1991). Strategic Responses to Institutional Processes. *Academy of Management Review***,** 16(1): 145-179.

Öquist, G. and Benner, M. (2012). *Fostering breakthrough research: a comparative study*. Halmstad: The Royal Swedish Academy of Sciences.

Öquist, G. and Benner, M. (2015). Why Are Some Nations More Successful Than Others in Research Impact? A Comparison Between Denmark and Sweden. In I.M. Welpe et al (Eds.), *Incentives and Performance: Governance of Research Organizations*, Dordrecht: Springer.

Rhodes, R. (1996). The New Governance: Governing without Government. *Political Studies*, XLIV: 652-667.

Rosinger, K., Taylor, B. Coco, L. and Slaughter, S. (2016). Organizational Segmentation and the Prestige Economy: Deprofessionalization in High- and Low-Resource Departments. *Journal of Higher Education*, 87 (1), 27-54.

Rushforth, A. and Rijcke, S. (2015). Accounting for Impact? The Journal Impact Factor and the Making of Biomedical Research in the Netherlands. *Minerva* 53: 117–139.

Sahlin, K. and Wedlin, L. (2008). Circulating Ideas: Imitation, Translation and Editing. In R. Greenwood, C. Oliver, R. Suddaby, and K. Sahlin-Andersson (Eds.), *Handbook of Organizational Institutionalism* (pp. 218-242). Thousand Oaks: SAGE.

Seidl, D. (2004). Luhmann's theory of autopoietic social systems. *Müncher betriebswirtschaftliche Beiträge, Munich Business Research*, # 2004-2.

Slaughter, S. and Taylor, B. (2016). Conclusion. In Slaughter, S. and Taylor, B.J. (Eds), *Higher education, Stratification, and workforce development: Competitive advantage in Europe, the US, and Canada*, Dordrecht: Springer.

Sørensen, M. P.; Bloch, C. and Young, M. (2015). Excellence in the knowledge-based economy: from scientific to research excellence. *European Journal of Higher Education*, Published online.

Taylor, B. (2016). Field dynamics of stratification among US research universities: The expansion of federal support for academic research, 2000-2008. In Slaughter, S. and Taylor, B.J. (Eds), *Higher education,*

Stratification, and workforce development: Competitive advantage in Europe, the US, and Canada, Dordrecht: Springer

Whitley, R. (2014). How do institutional changes affect scientific innovations? The effects of shifts in authority relationships, protected space, and flexibility. In Whitley, R. and Gläser, J. (Eds). *Organizational Transformation and Scientific Change: The Impact of Institutional Restructuring on Universities and Intellectual Innovation*. Emerald Group Publishing.

Wright S. (2014). Knowledge that Counts: Points Systems and the Governance of Danish Universities. In A. Griffith and D. Smith (Eds.), *Under New Public Management: Institutional Ethnographies of Changing Front-Line Work*, University of Toronto Press.

Young, M. (2015). Competitive funding, citation regimes, and the diminishment of breakthrough research. *Higher Education*, 69(3): 421-434.