

The Perceived Impact of Eight Systemic Factors on Scientific Capital Accumulation

Introduction

For the last decades, multiple scholars (e.g. Schulze-Cleven, Reitz, Maesse and Angermuller 2017; Slaughter and Rhoades 2004) have examined the commodification, marketization, liberalization and financialization of higher education systems (HES), four phenomena linked by the global pressure to accumulate material capital. With the global knowledge society and the emergence of international university rankings, an equally transformative phenomenon is reshaping HES. Referred to as the “academic world order” by Hazelkorn (2013), this transformation appears as the strengthening and widening of a deeply rooted tradition in academia of competing for prestige based on research output. Individuals, institutions and countries compete locally, nationally and internationally for the accumulation of scientific capital (e.g. publications) and the symbolic power (e.g. rankings and prizes) it carries (Münch 2014).

Relying on bibliometric measures and rankings, various researchers (e.g. Aghion Dewatripont, Hoxby, Mas-Colell and Sapir 2009; Marginson 2006; Salmi 2009) suggested that HES located in liberal political-economic structures dominated this academic world order. In fact, of the 20 top-ranked universities in the ARWU, 17 are American and 2 are British, and the US remains the largest producer of scientific publications (Royal Society, 2011). However, although Benner (2011) observed a transnational convergence towards the emulation of the American model of research governance, Schulze-Cleven et al. (2017) “challenge[d] hegemonic discourses about the current transformation of higher education” (p. 796) and called for a political-economic analysis of the multiple adaptations and resistance paths followed by HES in response to this global struggle.

Following Pestre’s (2003) argument that “there is no obvious hegemony of one mode of production (of knowledge) over another, and [that] the questions remain largely of a political nature” (p. 255), this article relies on the varieties of academic capitalism approach (VoAC) to assess, from the perspective of HES actors, systemic factors contributing to the comparative advantage of HES located in a specific political-economic context, the Nordic social-democratic regimes.

Scientific capital in the varieties of academic capitalism (VoAC) approach

This article is based on a robust theoretical approach that we slightly refined to focus on scientific capital accumulation and better circumscribe the particularities of social-democratic regimes. Capitalism is an economic system where private entities own the means of production and operate to maximize their profits (Rosser and Rosser, 2018), which represents an increase in capital and capacity to generate further profits. Noticing how market-based reforms and the global knowledge society were generating structural changes to the American universities, Slaughter and Leslie (1997), and Slaughter and Rhoades (2004) developed a theory of academic capitalism conceptualizing the embeddedness of profit-oriented activities into the academy, and the internal reorganization of higher education institutions to create new circuits of knowledge and, ultimately, generate external revenues. Analyzing various cases of the shift from a “public good regime” to an “academic capitalist regime,” the authors noted the growing presence

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of interstitial organizations connecting researchers to external actors, and intermediate organizations spanning the boundaries between public, non-profit and profit institutions. Capitalism would consequently be applied to the analysis of academic systems on the basis of their contribution to economies' means of production and revenue generation. In a renewed interest for state-university relations, Schulze-Cleven and Olson (2017) also used academic capitalism to capture public authorities' influence on the growth of performance criteria structuring market competitions between universities; and like Slaughter and Rhoades before them, they stressed the need to better understand divergences across national political-economic regimes, therefore supporting the argument for varieties of academic capitalism.

The varieties of capitalism (VoC) approach emerged as a framework conceptualizing the factors that condition the adjustment paths of organizations located in specific political economies in the face of macro-economic challenges (Hall and Soskice 2004). The framework suggests that different political economies may achieve a similar performance, but that the institutions influencing actors' behaviors and performance might differ significantly from one structure to another. The VoC approach is a firm-centered approach that analyzes the role of institutions (as socializing, power-granting, incentivizing interaction-inducing agencies) in coordinating actors' behaviors. There would be two broad types of capitalist economies: liberal market economies (LMEs) and coordinated market economies (CMEs), which would include Nordic economies, though compared to Continental European countries, coordination in Nordic countries would be based more on cooperation than hierarchies. In the former, coordination would be achieved via competitive market arrangements while, in the latter, it would be achieved through non-market relationships, such as incomplete contracting, network monitoring and collaboration. Hall and Soskice (2004) finally use the concept of "comparative advantage" to understand how the institutional structures of political economies provided organizations with advantages for engaging in a specific type of activity.

Applying the VoC approach to academia requires to consider universities as entrepreneurial (Clark, 1998), capable of strategic behaviors and controlling means of production to generate (material or immaterial) profits. Olson and Slaughter (2014) first proposed that the VoC approach be applied to academic capitalism. Comparing the cases of the United States and Germany, the authors suggested that LMEs were characterized by open HES, state intervention restricted to protecting free markets, free trade and private property rights. In CMEs, academic capitalism would entail a more scripted transition coordinated by the State, and the rhetoric of excellence would take the form of channeled competition. Schulze-Cleven et al. (2017) argued that it could "theorize how academic capitalism has differed between diverse economies and welfare regimes" (p. 799).

In this first conceptualization, Nordic countries were grouped with their Continental European counterparts. However, Schulze-Cleven and Olson (2017) followed Kauppinen and Kaidesoja's (2014) suggestion to those subcategories of CMEs and replaced the LME-CME dichotomy by Esping-Andersen's (1990, 1999) typology of welfare regimes (i.e. liberal, conservative and social democratic). For the authors, welfare states did reinforce the competition mechanisms inherent to academic capitalism, but differed in crucial dimensions such as funding mechanisms, institutional strategies and professional oligarchies.

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Schulze-Cleven and Olson (2017) compared academic capitalism in the American, German and Norwegian contexts. In Germany, channeled competition meant that authorities selected institutions based on their status and research output to receive larger support and direct mass education towards vocational training. In the US, academic capitalism was marked by the deregulation of social protection arrangements, the reinforcement of intellectual property laws and the financialization of higher education. Finally, in Norway, academic capitalism would take the form of an embedded flexibilization, meaning that individuals and institutions would compete within institutional arrangements to ensure equality of condition and opportunity for individuals and citizens.

The authors proposed a convincing framework but, although Schulze et al. (2017) called upon researchers to analyze processes of non-monetary competition in HES, the literature on the VoAC approach remains mostly focused on contrasting trajectories of market-making institutional changes. As we argued in the introduction, there is a different yet intersecting logic transforming academia and its analysis implies a different understanding of capital and capitalism. For Bourdieu (1988), capital represents the accumulated labor that enables actors to appropriate social energy, with the potential of converting it into material or immaterial profit. Articles, books, papers, patents and other means of dissemination recognized by the scientific community would represent an objectified form of scientific capital, which is a subtype of cultural capital.

Building upon Bourdieu, Münch (2014) analyzed the struggle for excellence in the academic field and noted that pillars and corollaries of academic capitalism – such as new public management (NPM), entrepreneurial universities, market competition, isomorphism commercialization and hierarchies – could also be used to describe universities' struggle for the accumulation of scientific capital and its resulting symbolic power. By analogy, it means that capitalism would apply to academic systems not only on the basis of universities' revenue generation capacity, rather on the basis that (private or public) academic organizations own the (material, social and cultural) means of production and operate strategically to maximize the symbolic profits (in the forms of citations, prizes, rankings, etc.) attached to research production. According this framework, academic capitalism would transform the academic field and favour the heteronomous pole, characterized by the competition for funds and influence, over the autonomous pole, which encourages the pursuit of knowledge and peer recognition from academic peers. Like Slaughter and Leslie (1999), Münch considers that the economic thought has seized the academic field, not only in the material sense, but also in a symbolic sense where, capital accumulation strategies are used to gain symbolic power from scientific capital.

Like for Slaughter and Rhoades' (2004) version of academic capitalism, Münch's (2014) bourdieusian depiction of this global phenomenon calls for a political-economic analysis of national trajectories. Benner (2011) has identified three research governance models: the Anglo-Saxon model would encourage market competition, hierarchies, mobility of scientists and integrative mechanisms between entrepreneurs and academics; the Continental European would be characterized by research institutes, rigid career structures, industrial strongholds and excellence initiatives; and the Nordic model would include strong public support, block grants to universities, mergers between universities and institutes and horizontal differentiation between institutions. Performing a correspondence analysis based on Esping-Andersen's (1990) typology, Bégin-Caouette,

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Askvik and Cui (2016) found that liberal and social-democratic regimes could be distinguished on a dimension named “academic centrality”, which included variables related to HERD, general university funding, doctoral graduation rates and co-publications.

In a nutshell, the VoAC approach builds upon political economy and sociology, and conceptualizes the institutional *configurations* that welfare regimes provide governments, universities and researchers to foster their *comparative advantage* in accumulating scientific capital and generating symbolic power in the global academic field. The strategies of capital accumulation and conversion are therefore conditioned by societies’ welfare regimes, including their historical trajectory and culture, social policies, welfare mixes, coordination mechanisms and institutional stratification.

At this stage, the literature suggests that the institutional configurations structuring the accumulation of scientific capital differ from one political economy to the other, but no study has linked the level of scientific capital any the specific configurations. In fact, most studies that have looked at “academic excellence” have taken for granted that the factors observed in liberal regimes, such as the dominance of English, abundant resources, competitive funding and institutional autonomy, applied to all contexts (Aghion et al. 2009; Marginson 2006; Salmi 2009). The institutional configurations in Nordic social-democratic regimes, however, appear different, but not less performing, since it produces more articles per capita and articles that are more cited than in the US (SCImago Journal & Country Rank 2013; ISI Web of Knowledge 2013). Moreover, on a per capita basis, Denmark and Sweden count more world-class universities than the UK or the US (ARWU 2018).

This paper thus follows the VoAC approach to frame the institutional configurations providing HES in social-democratic context with a comparative advantage in engaging the accumulation of scientific capital. At the confluence of the literature on the VoAC approach and research production in Nordic HES, we identified eight systemic factors (see below) and our objective is to assess the influence of those systemic factors on the level of scientific capital accumulation. *More precisely, the research question is: what are the systemic factors perceived as contributing the most to scientific capital accumulation by key system actors located at different levels of the Danish, Finnish, Norwegian and Swedish HES?* The aim is not to examine whether or why Nordic countries perform better than other countries, nor to explain variations between them, but to tentatively consider the four countries as part of the same political-economic ideal type, and to explore interplays between social-democratic contexts and scientific capital accumulation.

Systemic factors in a social-democratic context

To understand scientific capital accumulation, one can focus on individual, institutional or systemic factors. Systemic factors emerge from macro-level analyses and correspond to the institutionalized features of a HES. Following Clark (1983) and DiMaggio and Powell (1983), HES are here defined as the aggregation of organizations that constitute a recognized area of institutional life and are structured by the social function of controlling and contributing to the advancement and dissemination of knowledge and technique.

As Bleiklie and Kogan (2007) noted, competitive logics are counterbalanced by institutionalized systemic factors. To expand the applicability of the VoAC approach, we believed it was necessary to review the broader literature on HES, inductively list potential

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explanations for Nordic HES' level of scientific capital and integrate those explanations within the VoAC framework. We reviewed more than 200 documents, identified 39 acknowledged explanations for countries' performance and grouped those explanations into eight macro-level factors. It is worth noting that, once the data was collected, an exploratory factor analysis (see Appendix 1) further supported the following eight-factor structure ($\alpha = 0.89$). The following factors are not necessarily specific to social-democratic regimes, but they emerge from the literature as potential contributors to social-democratic regimes' comparative advantage and, as such, became hypotheses to be tested.

Societal beliefs

The VoC approach emphasizes the role of culture and, for Hall and Soskice (2001), “repeated historical experience builds up a set of common expectations that allows the actors to coordinate effectively with each other” (p. 13). In this case, culture was subdivided into two factors: societal beliefs (outside academia) and academic traditions (within academia). As Jessop (2017) noted, the knowledge-based society imaginary has powerful effects on capital accumulation. The imaginary in social-democratic regimes would be characterized by a concern for equality (Aareva, Dobson and Elander 2009), a belief in economic modernization (Gregersen and Rasmussen 2011) and a trust in academics (Välismaa 2005). First, although they have entered the global academic capitalist race, the “public good” rhetoric remains dominant in social-democratic regimes (Kauppinen and Kaidesoja 2014) and is used to defend major reforms in higher education. This “public good” rhetoric is also supported by citizens of social-democratic regimes having more positive experiences of public institutions and favouring collective solutions more than in other regimes (Schulze-Cleven and Olson 2017). Those beliefs contribute to universities and academic symbolic power insofar as they are perceived as trustworthy and legitimate (Bourdieu 1988). Maesse (2017) described the elitism dispositive through which universities responded to the social demand for legitimacy in exchange for a symbolic power that could be converted into capital in the media, politics and the economy.

Academic traditions

Actors within organizations learn to follow a set of informal rules by virtue of experience with other actors that have a shared understanding about what strategies are appropriate (Hall and Soskice, 2001). Like Slaughter and Rhoades (2004), Münch (2014) suggested, for instance, that NPM, commodification and socially constructed hierarchies have eroded sets of shared understanding within academic communities. Seized by the economic thought, the heteronomous pole of the academic field transformed what we call here “traditions.” Münch, however, noted that, in some countries, Humboldtian ideals were still pervasive and created a sort of hybrid. Nordic universities still follow a Nordic adaptation of Humboldtian ideals, such as the integration of research and teaching, academic freedom, collegiality and public funding (Askling 2012; Välismaa 2005). New to the Nordic context, the tradition of institutional autonomy would have been reinforced by recent reforms turning universities into strategically oriented and competing actors (Kauppinen and Kaidesoja 2014; Münch, 2014).

Institutional differentiation

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Both political economy and sociology are interested in the processes of stratification and differentiation (Bourdieu 1988; Esping-Andersen 1999). The social construction of excellence functions by reducing the complexity of regulations, programs and research expertise into a set of abilities that define actors and stabilize the image of the field (Bloch and Mitterle 2017; Münch 2014). In the social-democratic regimes, the complexity reducing effect would have taken the form of a horizontal departmentalization rather than a vertical hierarchy between institutions (Maese 2017), according to which, within the university sector, all the units would be both “research universities” and “national teaching institutions” (Aarrevaara & Pekkola 2010), offering PhD programs albeit mostly in their specific field of expertise (Benner 2011). Nordic governments also proceeded to mergers between universities, university colleges and even research institutes (Pinheiro, Geschwind and Aarrevaara, 2016), thus contributing to a magnification process (Maesse, 2017).

Academic work

In Münch’s (2014) academic capitalism, the most pronounced change is the industrialization of research within universities, where lots of research assistants work under the direction of one professor and have little opportunity to ascend to the professorship. The (chair) professor becomes more of a manager, continuously applies for funding, coordinates team and has little time to conduct research. The *Changing Academic Profession* survey confirmed that full-time faculty members in Finland and Norway, who applied for grants and manage research teams, spent less time doing research than their junior counterparts (Aarrevaara and Pekkola 2010). What is particular to social-democratic regimes is that, following a principle of “productivism” (Esping-Andersen 1999), they have attained the highest doctoral graduation rates (OECD, 2013), and thus can rely on a large pool of researchers. At the same time, the academic profession in those countries is characterized by a homogeneous academic valuation system (Angermuller 2017), in which doctoral students, postdoctoral fellows and contract researchers’ capacity to obtain a permanent position remains limited (Öquist and Benner 2015).

Governance

This factor relates to the distribution of authority, power and control across the levels of HES (Clark 1983). Schulze-Clever and Olson’s (2017) observed that, all regimes tended to encourage competition and accountability, the path dependence of national adjustments were the result of institutional configurations. Social-democratic regimes followed an embedded flexibilization, which increases the scope of competition while ensuring that it serves broader social goals and minimizes negative side effects. States in social-democratic regimes have strong influence on policies, funding (Perez Vico and Jacobson 2012), state-initiated mergers (Aareva et al. 2009), development contracts (Kvil 2004) and quality assurance measures. The recent reforms – such as the 2003 Quality Reform in Norway – has, however, increased local autonomy, while shifting authority from departments to institutions and from institutions to intermediary bodies, such as the Norwegian Agency for Quality Assurance (NOKUT) or the Swedish Authority for Higher Education (UKÄ). It is nonetheless interesting to note that those organizations include representatives from academic communities and benefit from their trust, as well as from the trust of governments (Stensaker 2014).

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Funding streams

Münch (2014) distinguishes three subfields within the academic field: academic research, evaluation and resource allocation; and the way those three subfields interact is captured by this sixth factor: funding streams, which refers to the funding flows (Lepori, Reale and Slipersaeter 2011) between those three subfields. This article recognizes four streams: basic funding (block grants to universities), competitive funding (grants allocated for one project by research councils), strategic funding (grants allocated in pre-defined areas of interest for the country) and excellence funding (initiatives where a limited number of units receive a bigger and more stable grant). Münch (2014) and Angermuller (2017) argue that academic capitalism has lowered guaranteed amounts per students and promoted the emergence of performance-based, competitive and excellence funding. The share of basic funding in Nordic countries has indeed decreased steadily since 2000 and is increasingly based on performance indicators (Virtanen, Silander and Pietilä 2014). Competitive grants remain important (Ahola, Hedmo, Thomsen and Vabø 2014) and contribute to a plural, open and regulated competition. But Bloch and Sørensen (2014) noted a trend towards greater concentration of excellence funding into fewer units. For Maesse (2017), if magnification creates large units, only concentration can transform those units into powerful locations. Finally, Potì and Reale (2007) had observed a transformation of traditional research councils into mission-oriented organizations providing larger sums in priority areas for governments.

Networking with non-academic actors

In its original formulation, academic capitalism entails a blurred demarcation between universities and businesses, and the embeddedness of profit-oriented activities in HES (Slaughter and Leslie 1999). Well-known in liberal regimes, the concept of universities' "third mission" (i.e. contributing to the society and the economy) was formally introduced in Nordic countries in the 1990s but is still met with resistance by large comprehensive institutions (Brundenius, Göransson and Ågren 2011). In Münch's (2014) theory, university-industry collaborations are not a symptom of merging between academia and the economy, but rather used by entrepreneurial universities and researchers in their struggle for powerful positions in the academic field. Mendoza (2009) has, for instance, observed that some faculty used contracts from the private sector to accumulate social and material capital then reconverted into scientific capital. At the national level, Denmark, Finland, Norway and Sweden have created innovation agencies and developed integrated innovation systems where universities play a crucial role, while obtaining more private funding (Välilmaa 2005), training PhDs in partnership with the workplace and developing revenue-generating spin-offs (Perez Vico and Jacobson 2012).

Internationalization

The last factor relates to relational systems established between academic actors across countries. In the Nordic context, internationalization takes place at three levels: Nordic (e.g. the Nordic Council of Ministers for Education and Research), European (e.g. European Research Council) and global. Research being a risky activity, international collaborations – as a form of social capital – can be used strategically as an insurance against risk (Kim 2017). International activities in the Nordic countries also include the recruitment of foreign scholars (SNAHE 2012), funded research stays for students

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(Stephan, Scellato, Franzoni 2015) and joint research projects. Academic capitalism postulates that this social capital can be converted into symbolic power through a closing effect where powerful units create an exclusive and prestigious network (Münch 2014).

Methodology

Systems being mostly immaterial, studies attempting to apprehend this component of social life must rely on proxies, which can be derived from individual, institutional or national data. Some studies have established relationship between researchers' publishing productivity and workforce characteristics (e.g. Aarrevaara and Pekkola 2010; Kwiek 2016) but they can seldom connect systems' characteristics to national research production. Other studies have attempted to establish relations between university characteristics across several countries and their ranking positions (e.g. Aghion et al. 2009; Salmi 2009). These studies are robust, but they fail to distinguish institutional from systemic factors and they often omit outliers. National case studies provide the groundwork for cross-cutting comparisons and hypotheses (e.g. Mårtensson, Roxå and Stensaker 2014); some hypotheses having contributed to the identification of the factors here tested. Finally, some studies correlate national characteristics with bibliometric data (e.g. Öquist and Benner 2015). Performance differences then appear undeniable, but explanations for those differences tend to remain at the stage of hypotheses.

Considering that very few countries fit the Nordic welfare regimes' ideal type, it was not possible to conduct large-scale quantitative studies based on country indicators. Studies relying on actors' perspectives regarding various systemic factors may combine a holistic view of the system with the possible identification of single components relevant to the analysis (e.g. Maassen et al. 2008). In the VoAC approach, Schulze-Cleven et al. (2017) suggested researchers could link political-economic structures to HES' dimensions by probing different policies based on the perspectives of collective, institutionally empowered actors (e.g.: governments, university management, business groups, unions) and individual actors (e.g.: students, academics). To assess the influence of the eight systemic factors presented above, this study is based on a multi-level problem approach to comparative education (Bleiklie and Kogan 2007; Holmes 1981) and relies on the aggregated perspectives of different groups of directly or indirectly involved in the research production process.

Data collection

This paper considered perspectives from actors located within 3 levels of authority (international, national and institutional) and 13 strata, each having first-hand perspective on research production: Nordic organizations, ministries of higher education, quality assurance agencies, research councils, innovation networks, university associations, academic staff unions, and within one case university per country, external board members, administrators, faculty members, doctoral students, contract researchers, and one non-university institution. The sampling design was purposeful and nested, meaning that organizations representing each stratum were purposely selected (non-probabilistic sampling), but all potential respondents within these institutions were contacted (probabilistic census-based sampling).

To test the importance of systemic factors, those groups of actors were asked – through a survey and interviews – to what extent they perceived the above-mentioned factors had a positive, negative or no influence on academic research production in their country. Between September 2014 and March 2015, interviews were conducted with 56 senior officials and members of the 13 strata. Interviews were semi-structured and lasted around one hour. Validity was enhanced through expert reviews of the protocol, interviewees' approval of transcripts, peer verification of preliminary findings and a multi-level framework offsetting locus bias.

A survey was also disseminated to professors as well as representatives from governments, research councils, innovation networks, university associations and faculty unions. The survey relied on Likert-type scales and asked participants to indicate to what extent each item/explanation has a positive influence, negative or no influence on the level of research production in their country. Validity was enhanced through focus groups, cognitive interviews (Groves, Fowler, Couper, Lepkowski, Singer and Tourangeau 2009), expert reviews and pilot tests. Of the 3,435 online surveys disseminated, 456 (13%) were completed. Following the usual procedure of deleting all cases for which more than 5% of the questions would remain unanswered (Cleophas and Zwinderman 2012), the sample was reduced to 324 participants, of which 74 come from Denmark, 81 come from Finland, 85 come from Norway and 84 come from Sweden.

This paper assumes that actors' perspectives were based on an interpretation of their empirical reality and, since the targeted actors have direct and indirect knowledge of research production, their perspectives should reflect their actual work and not scholarly reflections (Becker, Geer and Hughes 2003). One could, however, doubt actors would be able to provide an informed perspective on a level of reality as diffused as systems. Although 84% of survey respondents were university professors, 16% were actors operating at the national level. Half of the interviews were also conducted with actors at the national level whose functions require them to consider systems as wholes, and there had to be a convergence between data sets as well as between the perspectives of actors at different levels for a factor to be considered as tentatively confirmed in one country.

Data analysis

First, a deductive thematic analysis was processed on transcripts. For Braun and Clarke, (2006), “a theme captures something important about the data in relation to the research question” (p.10). In this study, global themes were identified from the eighth a priori hypotheses, and the 39 explanations found in the literature became pre-defined organizing themes, i.e. abstracts concepts consistent with the data and the theory and useful in portraying patterned responses (Corbin and Strauss 2008). Saturation was used to assess the salience of factors, and was therefore considered at the stage of analysis when new information produced little change to the codebook (Guest, Bunce and Johnson 2006).

Second, 36 of the 39 survey items representing the individual explanations found in the literature were grouped into eight factors following an exploratory factor analysis with orthogonal rotation (varimax), though one factor (institutional differentiation) was removed from further analyses because of an unreliable alpha coefficient ($\alpha = .42$). Then, we calculated the means of items' score within each factor as a first indication of factors' perceived importance. Scores above 4.0 (on a 5-point scale) suggested that, in average, participants considered this factor to have a strong positive impact on scientific capital

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accumulation. Average scores cannot, however, indicate if one factor is perceived as significantly more important than the others. To examine significance, while avoiding Type-1 error (false positives), we used a one-way repeated-measure ANOVA, followed by post-hoc t tests for each pair of factors. In this design, we compared the average survey score each respondent gave to different factors. Factors were the independent variables and participants' responses to the items belonging to those factors was the dependent variable. The ANOVA calculates an F-ratio indicating if at least one factor is significantly different from at least one other. The pairwise t-tests were then calculated to identify which of those factors obtained significantly higher mean scores.

We then merged the qualitative and quantitative findings using a convergent and parallel mixed-method design (Creswell and Plano Clark 2011). Relying on convergence between statistically significant factors' average score and organizing themes that have reached a level of saturation forced us to focus on what appeared crucial across levels of authorities and countries.

Limitations

There are several limitations associated with this study. First, the sample was derived from a hypothetical population, which would represent all the actors involved directly or indirectly in the research production process. We could not, however, send the surveys to all system-level strata; and time and financial considerations forced us to select only one university per country and to send it only to all full professors. We cannot claim that our sample is representative of this undefined population. General claims about the four Nordic HES should be treated with caution regardless. Second, one could wonder if the aggregated perspectives of actors involved in the research production process constitute a satisfactory proxy to apprehend the real impact of the macro-level organization of science. We posit that perspectives, as a coordinated set of ideas and actions (Becker et al. 2003), were based on actors' interpretation of their empirical reality. Relying exclusively on perceptions and opinions nonetheless constitutes a major caveat, especially since we cannot correlate any factor's perceived impact to any measure of a national research output. Future studies (based on national statistics) will be needed to confirm the impact of those factors on actual research outputs.

Results

Quantitative and qualitative data were collected and analyzed independently, and considered of equal importance. However, due to space constraints, only the one-way repeated-measure ANOVA will be presented below and quotes from the thematic analysis will be presented in the discussion to promote a more nuanced understanding.

A one-way repeated-measure ANOVA was performed to detect if the variance in survey scores between factors was significantly higher than the variance in survey scores within factors. Mauchly's test indicated that the assumption of sphericity had been violated, $\chi^2(20) = 590.30$, $p = 0.00$, so the Huynh-Feldt estimate, in this case $\epsilon = 0.876$, was preferred to reduce Type-I error rate (Field 2013). There was a significant difference between factors' average score, multivariate test Wilks's lambda $F(0.29, 318) = 128.03$, $p = 0.00$. Since the F test rejected the null hypothesis (of no difference between factors' score), we

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ran post-hoc pairwise *t* tests – with the Bonferroni correction – between each pair of factors. Table 1 shows how the mean difference between factors' score, the standard error, the level of significance and the confidence interval.

[TABLE 1 HERE]

The mean score for “Academic traditions” is significantly higher than for “Public authorities” (I-J = 0.95, $p < 0.01$), “Networking” (I-J = 0.93, $p < 0.01$), “Early-career researchers” (I-J = 0.42, $p < 0.01$), “Funding streams” (I-J = 0.38, $p < 0.01$), and “Societal beliefs” (I-J = 0.34, $p < 0.01$). Similarly, “Internationalization” has a significantly higher average score than “Public authorities” (I-J = 0.90, $p < 0.01$), “Networking” (I-J = 0.89, $p < 0.01$), “Early-career researchers” (I-J = 0.37, $p < 0.01$), “Funding streams” (I-J = 0.34, $p < 0.01$), and “Societal beliefs” (I-J = 0.30, $p < 0.01$).

Although the complete thematic analysis is not presented here (see Bégin-Caouette 2017), it is worth mentioning convergence between saturated themes and significant factors. First, numerous organizing themes related to factors “Academic traditions” (e.g. academic freedom, public funding and university autonomy) and “Internationalization” (e.g. research collaborations, foreign scholars and European funding) achieved the level of saturation during the stage of analysis. Items similar to those organizing themes also obtained an average score above $M \geq 4.00$ in the survey. Convergence between quantitative results and qualitative findings makes it possible to reject the null hypothesis for these two factors.

The factors “Societal beliefs,” “Academic work” and “Funding streams” had respectively three, two and four saturated organizing themes, and respectively three, one and three items with an average score above $M \geq 4.00$ in the survey. Those factors' means were significantly higher than the means of the factors “Governance” and “Networking” while significantly lower than the means of “Academic traditions” and “Internationalization.” The null hypothesis for these three factors was therefore only partly refuted. Finally, although some organizing themes related to “Governance” and “Networking” saturated at the stage of the qualitative analysis, no item obtained an average score above $M \geq 4.00$ across countries, and the two factors obtained significantly lower means than all the other factors. Convergence prevents from rejecting the null hypothesis and these factors must be considered tentatively refuted.

Discussion

This paper attempted at answering the following research question: What are the systemic factors perceived as contributing the most to scientific capital accumulation by key system actors located at different levels of the Danish, Finish, Norwegian and Swedish HES? A convergent parallel mixed-method design allowed for the identification of points of convergence between factors with statistically significant higher means, survey items obtaining an average score above 4.0 and organizing themes achieving saturation in the deductive thematic analysis (see Appendix 2).

Academic traditions

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According to system actors, academic traditions – the Nordic adaptation of the Humboldtian model (Askling 2012) – appeared to be the most important factor in explaining scientific capital accumulation. For Münch (2014), if prestige relies on logic of distinction, renewal in science requires autonomy and a stable state funding. In the four countries, most actors perceived that academic freedom increased professors' dedication and was conducive to the scientific process. As one Danish professor explained: "When you are free to make your own choices concerning the area, theme and methodology, you become more dedicated to it." One university board member added that science's "self-governing capability and peer-review system really drives excellence." Another tradition is the prominence of public research funding. As the representative of a university association said, "I think public funding is important... We need a large fraction of free public research funding."

While academic capitalism postulates that the academic field has been seized by the economic thought (Münch 2014) and dominated by its heteronomous pole, our findings are to the effect that some institutional configurations of one variety of academic capitalism would, on the contrary, reinforce the autonomous pole (fuelled by an endogenous demand for knowledge). Bégin-Caouette et al. (2016) had already shown that social-democratic regimes – characterized the socialization of risk, productivism and a public welfare mix – scored high on a dimension named "academic centrality," which referred to the prominence of academia in the knowledge production process. The current study suggests that, in social-democratic regimes, actors perceived that the above-mentioned traditions interacted with and were protected by three institutional configurations: a public good rhetoric (Kauppinen and Kaidesoja 2014), egalitarian outcomes (Schulze-Cleven and Olson 2017) and public trust (Maesse, 2017).

First, trust – as a form of symbolic power (Bourdieu, 1988) – presents a key to understanding the balance between academic freedom and societal expectations. Academics' trustworthiness and legitimacy were manifest in citizens' confidence in their institutions and perception that and in the role played by academics in the development of social-democratic regimes. Trust was described by Fukuyama (1995) as conducive to economic prosperity in societies where the role of families is limited, such as in Sweden. Esping-Andersen (1999) showed that "familialism" was weaker in social democratic than in conservative regimes, and, accordingly, these citizens demonstrate greater trust in science than the EU-27 average (European Commission, 2010). Various interviewees argued that freedom for professors was perceived by citizens as a legitimate demand for recognition to better contribute to society. And, according to a national-level actor in Finland, trust emanated not only from the apparent selflessness of the scientific endeavour, but also from the perceived utility and accessibility of higher education:

Citizens trust and praise researchers a lot... There is a general idea that university education and science are important activities in the country... One reason for that is the "open access for all" to enter the scientific society. It is not a secret area or a place where people do very strange things.

Trust also emanated from academics' role in the development of the welfare state. Despite a claim that academic capitalism would shift from trust to suspicion (Münch 2014), interviewees in the social-democratic VoAC reported that "there [was] an unusual high level of trust" and "open and supportive communications" between academics and public authorities. Those quotes only represent actors' perceptions of citizens' trust, but other

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authors (e.g. Arter 2008) have noted that, in Nordic democracies, experts had a strong influence in shaping bills before they are presented to parliaments. Taking the example of Sweden, Glimell (2004) had suggested that the emergence of the knowledge society was, in Nordic countries, placed under firm scientific control. Swedish scientists justified their influential occupations by their selfless devotion to academic work (Ahola et al. 2014) and became the ethical safeguards in the face of political and commercial intervention (Glimell 2004). In VoAC terms, one could infer that the autonomous pole has advocated for its consecrated authority in the public sphere (Münch 2014).

Second, trust could also be related to the societal belief that higher education contributes to the public good (Välilä 2005), economic development and welfare policies (Gregersen and Rasmussen 2011). As Kauppinen and Kaidesoja (2014) noted, the “public good” rhetoric is still salient in social-democratic regimes and shapes HES’ response to academic capitalism. One Finnish researcher actor reported that, since the end of the Cold War, “there was a common consensus in Finland that higher education would be the way to rise.” This expressed rhetoric would support public investments in research and, according to surveys and interviews, the prominence of public funding would contribute to the accumulation of scientific capital. Beyond the amount of funding, it is the public welfare mix (Esping-Andersen 1990) that would foster the comparative advantage. As demonstrated by Kim (2013), in economic downturns CMEs retain a skilled workforce and outsmart the market with counter-cyclical investments in research, consolidating their comparative advantage. A Swedish representative from a quality assurance agency gave the example of the 2008 economic crisis: “while most other countries were cutting in their research budget, Sweden was not; it was possible to keep up with the international competition in terms of citations or ERC grants”.

This “public good” rhetoric also seemed to intersect with broader egalitarian values. As Schulze-Cleve and Olson (2017) have observed, competition in social-democratic regimes happens within institutional arrangements to ensure equality. For instance, since students put fewer private resources to pursue higher education, they do not demand more private appropriation of higher education’s return (Schulze-Cleven and Weishaupt 2015) and support public investments. Participants also made connections between an equality of conditions between citizens (including professors), the apparent selflessness of academia and, consequently, its consecrated authority.

A third academic tradition obtained high average scores in the survey and saturated in our qualitative analyses: the concentration of resources into universities (rather than research institutes or businesses). Magnification and concentration are two critical strategies in constructing beacons of excellence in the global struggle for prestige (Münch 2014). Concentration of research activities and research funding in universities (visible in the high HERD levels) would contribute to “academic centrality” in social-democratic regimes (Bégin-Caouette et al. 2016) and further consecrate the autonomous pole. For interviewees, this concentration contributed to efficiency in a context of small populations. In Sweden, a quality assurance representative made a similar observation: “Universities perform better because they don’t spread out their funding. They are really emphasizing excellence, so they create really good environments.” It is, however, worth noting that, if the Swedish R&D system has long been characterized by a clear concentration of research funding into universities (Norden, 2014), Denmark and Finland possessed numerous governmental research institutes, some of which competing with universities for funds and

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researchers. To create performing and visible research environments, Denmark incorporated most of its governmental research institutes with universities, while Finland has followed a more incremental process of merging institutes together and then integrating some of them into university structures. The effect was to reinforce the central position of academia (Askling 2012) and construct excellence by increasing institutions' size (Münch 2014).

In sum, the comparative advantage of social-democratic regimes was explained by the symbolic capital inherent to trust protecting academic freedom and by the amount and stability of public support protecting HES' endogenous development. Interestingly, if the societal belief in the importance of higher education and the amount of public funding could result in government intrusion, the involvement of scientists in policy-making, the deliberation meta-structures (i.e., consensus-based democracies) and the delegation of public authority to intermediary organizations, which have academic legitimacy, seem to protect the autonomous pole.

Internationalization

Social-democratic regimes are open and export-dependending economies, and those international exchanges compensate for the small size of nations' population (Nordic Council of Ministers 2016). Similarly, it is not unusual in a smaller country to find few experts in any given sub-discipline, thus creating a need for international exchanges in science. As it was explained by a Nordic organization representative, "We are five small countries, so it is important to get new contacts and new networks because, when we do it together, it is easier and we have a greater impact." Internationalization would have a positive impact because it increases material, social, and cultural capital, which are then converted into scientific capital.

First, as observed by Münch (2014), building networks with international partners grants academics with symbolic power in the global academic field (i.e. the closing effect). A union representative said that, "Sweden will remain a small country... but we want to be part of the international research community and do research that other people will value." Not only this social capital increases the number of publications (Li, Liao and Yen 2013), a report from the Academy of Finland (2014) revealed that international co-publications had a greater impact than publications written only by Finnish researchers. One professor in the natural sciences said that "internationalization is essential; all my work is tied to international collaborations... it is known that people who have international collaborations publish more articles in better journals."

Second, internationalization serves to pool cultural capital such as ideas, knowledge, data and competences. Kyvik, Vabø and Alvsvag (2015) showed that informal research collaborations with partners abroad contributed to research environments and helped achieve the critical mass needed to conduct more demanding research projects. Internationalization would also increase Nordic HES' cultural capital through the recruitment of foreign scholars. International recruitment reached saturation in the interviews and obtained an average score above 4.27 in the four countries. For Kim (2017), transnational academic mobility creates possibilities for the creation of new kinds of knowledge. A representative from a Swedish granting organization explained "At times you need somebody who comes and tells you that there is a different way to do things. Of

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course, all the knowledge that ‘outsiders’ bring with themselves... stimulates research.” For Münch (2014), recruitment would also reinforce HES’ comparative because foreign scholars would trade their scientific capital in exchange for recognition from the institution (gift exchange), which they will later praise (Potlach effect). One Norwegian government representative explained the following: “So [international doctoral students] had full pay for four years and then they leave. But, when they do their PhD in Norway, they do research, they influence the research environment and, when they leave, they take our knowledge out in the world.” For Riis (2012), this recruitment also alleviated academic inbreeding, common in the Nordic countries until the mid-1990s.

Third, international social capital can be converted into material capital, such as equipment and funding. The Finnish Ministry of Education and Culture (2014) recognized that Finnish discoveries have benefited from such European facilities as the CERN, the European Organization for Nuclear Research and the Biobanking and Biomolecular Resources Research Infrastructure. On a smaller scale, a Danish professor of biochemistry reported that, twenty years ago, his not-yet-recognized field could not attract the necessary funding, so he had to “collaborate with a group in Germany and to have access to large facilities.” International networks are also mandatory to obtain European funding, which was perceived more positively than the “seed money” provided by NordForsk because it consisted in important sums for longer periods. For a national-level actor in Norway:

EU funding is attractive, and it is a tool for excellence. I would guess the EU funding has the most effect. All institutions are challenged to apply for ERC, Marie Curie, etc. In the future, EU funding will be a main driver for us because it is not just a question of being good in doing applications, it is a question of academic excellence because you are now competing on a European level.

To summarize, like in the economic field, the comparative advantage of social-democratic regimes in the academic field was related, for participants, to the open and internationally dependent character of their political economy. HES generate symbolic power in the global academic field through participating in international networks (closing effect); a symbolic power contributing to their capacity to accumulate material capital (in the form of European funding) then converted into scientific capital. Those HES would finally accumulate capital through the conversion of the cultural capital embodied in the recruited foreign scholars, namely through a gift-exchange process and a Potlach effect.

In sum, based on the aggregated actors’ aggregated perspectives compiled in the survey and interviews, the comparative advantage of HES located in social-democratic regimes seem to be fostered by the internationalization of research and the pervasiveness of a Nordic adaptation of Humboldtian traditions, namely academic freedom, public funding and funding concentration into universities. It is generally considered that, in the global academic capitalist race, the academic field is dominated by the heteronomous pole (Münch 2014). But competitive logics are also counterbalanced by institutionalized systemic factors (Bleiklie and Kogan 2007). In our study, survey respondents and interviewees seemed to suggest that, following a process of embedded flexibilization (Schulze-Cleven and Olson 2017), the social-democratic institutional configurations of a public good rhetoric, egalitarian outcomes and public trust interacted with academic traditions in protecting the autonomous pole of the field, contributed to the “academic centrality” (Bégin-Caouette et al. 2016) of HES and, ultimately, fostered the development

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of scientific research. Finally, it could also be hypothesized that locally prominent academic actors can build upon the internationally open structure of their country's political economy to generate symbolic power in the global academic field, accumulate material capital (in the form of international funding) and appropriate the scientific capital generated by internationally recruited scholars.

Conclusion

The objective of this paper was to assess the importance of eight systemic factors in contributing to the comparative advantage of social-democratic regimes in the global academic capitalist struggle. Considering that few countries belong to this regime, we relied on a multi-level problem approach and aggregated the perspectives of representatives from 13 strata purposefully sampled because they grouped organizations directly or indirectly in the research production process. Following a convergent-parallel mixed-method design, we considered as tentatively unrefuted the only two systemic factors (i.e. academic traditions and internationalization) that had significantly higher average survey scores and that achieved saturation in the thematic analyses.

Our interpretation of the findings is that three institutional configurations of social-democratic regimes (trust, public good rhetoric and egalitarian outcomes) protect the endogenous development of the academic field, and one other configuration (open economy) fostered its global influence; all of those structuring HES' comparative advantage. This study does not compare systems from different welfare regime types and does not confirm any claim about the distinctive character of a social-democratic VoAC. It nonetheless substantiates Kauppinen and Kaidesoja' (2014), Olson and Slaughter' (2014) and Schulze-Cleven and Olsons' (2017) claim that political-economic structures shape systems' adjustment paths and actors' response to the global pressure of academic capitalism. By depicting the interactions between political-economic structures and the accumulation of scientific capital, it also lays the ground for a future study comparing the impact of eight systemic factors on scientific capital accumulation in a set of liberal, conservative and social-democratic regimes.

The VoAC approach would allow for intra-category but, considering space limitations, we did not report differences between the four Nordic countries. Analyses have, however, shown, for instance, that the theme "funding concentration" had not reached saturation in Norway and that the factor "internationalization" obtained lower scores in Finland than in Denmark (see Bégin-Caouette 2017). The reader should also be aware of country differences both in terms of research production and in terms of HES' features such as the legal status of universities in Finland (Kauppinen and Kaidesoja 2014), the prominence of government research institutes in Norway (Kyvik et al. 2015), mergers in Denmark (Pinheiro et al. 2016) or career progression in Sweden (Öquist and Benner 2015). Future research exploring those differences might further our understanding of national responses to the global academic capitalist pressure.

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