DRUID Working Paper No. 08-02

Polarization of the Swedish University Sector: Structural Characteristics and Positioning

By

Daniel Ljungberg, Mattias Johansson and Maureen McKelvey

Danish Research Unit for Industrial Dynamics

www.druid.dk

Polarization of the Swedish University Sector: Structural Characteristics and Positioning

Daniel Ljungberg
Chalmers University of Technology
Department of Technology Management & Economics
SE- 412 96 Göteborg, Sweden
Corresponding author: Tel.; +46(0)31 772 1201
daniel.ljungberg@chalmers.se

Mattias Johansson
Chalmers University of Technology
Department of Technology Management & Economics
SE- 412 96 Göteborg, Sweden

Maureen McKelvey
University of Gothenburg
School of Business, Economics and Law
P.O. box 610 SE-405 30 Göteborg, Sweden
maureen.mckelvey@handels.gu.se

Abstract:
Universities have increasingly been facing a focus on competition for research resources, not the least for external funding. This paper studies structural characteristics of the Swedish university sector and these characteristics relation to the propensity of universities to attract external research funding. The findings show a clear polarization of the sector into 'Larger research and teaching intensive' universities, accessing the lion's share of external research funding, and 'Smaller education dependent' higher education institutions. Following from this, the paper discusses specialization and division of labor among universities, in relation to the ability to gain critical mass and excellence in research.

Jel codes: O32; I28

ISBN 978- 87-7873-256-9

Polarization of the Swedish University Sector: Structural Characteristics and Positioning*

Daniel Ljungberg¨, Mattias Johansson^ & Maureen McKelvey~

¨ Chalmers University of Technology
^Oslo University
~Göteborg University, School of Business, Economics and Law

1 Introduction

European universities are facing major transitions, including increasing numbers of students, decreasing research funding per faculty and new types of commitments to society (Lawton Smith, 2006; McKelvey & Holmén, forthcoming, 2008). A number of societal debates are on-going, such as how universities can obtain external research funding and why some are relatively more successful at it than others. Due to major changes in public policy in the past twenty years and high quality micro-level data, Sweden provides an interesting case of transition, new entrants and dynamic competition within the university sector. This paper provides empirical data about polarization within Sweden, as well as tentative explanations of which structural characteristics of individual universities help explain their positioning and access to resources for research. The 'university sector' is here defined as the total population and constituent elements of organizations providing both research and higher education within an economy. This population of higher education institutes (HEIs) include university colleges, institutes of technology and universities.

Like much of Europe, Swedish universities are moving from being state-regulated institutions providing a public good towards a more Anglo-Saxon model, where universities more explicitly compete for resources. In contrast to the USA, where such tendencies have been visible for many years, European countries have only during the last decades begun to introduce more competitive mechanisms for resource allocation, within the university sector (Geuna 2001, Vincent-Lacrin, 2006). Literature about Europe shows a diversity of the overall European university population, in regards to certain character-

*Research for this paper has been supported primarily by SISTER (www.sister.nu), in a collaborative project about Swedish universities as knowledge environments for the future. The researchers have been part of the RIDE research network (www.chalmers.se/ride). We are gratefully to comments from many individuals involved in the SISTER workshops and in the DRUID summer 2007 conference. This paper has in previous versions been referred to as "Does structure matter for science?: The Matthew effect in the Swedish university sector". Corresponding author: daniel.ljungberg@chalmers.se

istics, which enhance polarization into winners and losers in this new competitive regime (Geuna, 1998; Geuna, 1999).

Our paper can be put in context of the changing national institutions for education, research and growth. Major changes in Swedish research policy during the 1970s, then again in the 1990s, led to the starting-up of new colleges and universities, explicitly designed to stimulate regional economic growth and teaching, as well as to become new research centres (Sörlin & Törnqvist, 2000; Schilling, 2005). More recently, national debates and public policy initiatives have turned attention to the importance of critical mass and quality in research as well as how to design the external research funding system to become more competitive (Brändström, 2007). There are no existing studies asking whether colleges and universities with specific characteristics tend to receive above average research funding from councils, foundations and firms.

This paper contributes to these debates, firstly by describing structural characteristics, such as size and 'R&D intensity', of the population of Swedish universities and colleges and secondly by focusing on whether these affect the success of specific universities in obtaining external research grants. External research grants here include research money from research councils, foundations and the like as well as from companies located in Sweden and abroad. This paper thereby analyzes whether the relative success at obtaining external research funding can be related to specific structural characteristics, namely density of research personnel, research productivity as well as size and research intensity.

Our research questions arise, because the whole issue of whether structural characteristics of universities tend to influence the ability to obtain external funding becomes interesting when the individual organizations face a new, competitive regime. Hence, this study is exploratory, even if comprehensive in examining the total population of universities and colleges in Sweden.

The first research question is a descriptive one, intended to investigate the potential existence of a diverse Swedish university population and thereby to improve classifications.

1) *What categories can be generated based on specific characteristics, which are useful to classify different universities? Where do specific Swedish universities as organizations position themselves?*

Hence, the first research question is to categorize individual Swedish universities based on the identified characteristics, as well as to map the overall population of actors in the Swedish university sector.

The second research question is an analytical one, dealing with positive and negative effects of characteristics on obtaining external research resources.

2) *What are the positive and negative impacts of structural characteristics, relative to external research funding?*

Our study thus contributes to the emerging understanding of European universities, as found in Geuna (1998, 1999) and in Bonaccorsi and Daraio (2007). Section 2 provides

an overview of relevant literature on European universities, and structural characteristics in university-industry relations. Section 3 presents the research design and methodology. Section 4 presents the descriptive results, which shows the polarization of the Swedish higher education sector in terms of structural characteristics, and Section 5 provides analysis in terms of whether the ability to attract external research funding is related to this polarization. Section 6 presents the conclusions and implications.

2 Theoretical Overview

Existing literature about the ability of universities to obtain research grants in general and to obtain industrial funding for research in particular have often focused on explanatory factors such as the quality of the research performed, the impact of informal networks and the 'Matthew effect' for individual researchers.[1] While some of this literature is reviewed below, this paper also brings in relevant literature for analysing the relative position and specialization of specific organizations, within the overall university sector.

2.1 European Context and Sweden

European universities are in many ways a regulated sector, tightly coupled to public policy objectives and government financing and therefore often dependent upon national governments. Within Europe, government funding is still the largest overall source of income for university-based research (Geuna, 2001; Vincent-Lancrin, 2006).

European public policy has been modified in recent decades and increasingly stresses the usefulness of science to society and for competitiveness through innovation. At the end of the 20th century, Europe began to move away from the post-World War II dominant paradigm, with its linear model of innovation, which stressed basic science as the main driver. This move has in some aspects been towards a model of applied research as a mechanism to create national wealth (e.g. Geuna, 2001; Lawton Smith, 2006). This suggests that governments are moving from 'automatic' flows of financing for universities, towards competitive research funding and thereby universities have to compete more amongst themselves.

Moreover, a decrease in the relative share of government funding has taken place during the last few decades in the European countries, leading to an increase in the share of external funding (Geuna, 2001; Vincent-Lancrin, 2006).[2] Hence, a transition in funding is underway, giving us cause to focus on external funding.

Despite the current focus on the economic impact of universities, we should remember that firms do not seem particularly keen on directly finance research activities at the

[1] Merton (1968) describes the Matthew effect as a cumulative advantage that operates in science, so that researchers with recognition, rewards and 'visibility' of scientific contributions tend to receive more additional recognition and resources, than researchers lacking them but making comparable contributions to science.

[2] According to OECD classification, there are two categories of government funding: general university funds (GUF), i.e. 'block funding'/general grants, and direct government funds (DGF), e.g. contract research and earmarked funds (see e.g. Geuna, 2001).

universities. As Geuna (2001) points out, the proportion of university research that is financed by industry is low everywhere, usually less than 10 percent. OECD figures show that the average of industry funded higher education expenditure on R&D (HERD) in the EU-25 in 2001 was 6,7 percent. This is slightly higher than in USA the same year and substantially higher than in Japan (Dosi et al., 2006). Data from Statistics Sweden show that Sweden is similar to the rest of Europe, with approximately six percent of the university research funding provided by Swedish and foreign firms in 2006 (Swedish National Agency for Higher Education's annual report 2007).

The population of organizations within the European university sector has been shown to be diverse. In his work on the topic, Geuna (1998, 1999) points to a polarization of the sector, in regards to a number of (structural) characteristics, into two main clusters. On the one hand, there are the pre-WW II (research) universities, which generally are large organizations with high research productivity and research orientation. These universities attract the majority of the research resources. On the other hand, there are the post-WW II (education) universities, which are mostly small in size and low in research productivity and orientation

From this, we draw a first assumption: *The Swedish university sector should display a polarization amongst HEIs in terms of size, R&D orientation, and R&D productivity, as well as the ability to attract (external) research funding, similar to the rest of Europe.*

About one hundred years ago, Sweden already had the universities of Lund, Uppsala, Gothenburg and Stockholm, as well as one specialized in medical subject (Karolinska Institute), two specialized in engineering and technical subjects (Royal Institute of Technology and Chalmers University of Technology) and a private university specialized in business and economics (Stockholm School of Economics). Then, during the 1960s and 1970s, the first regional colleges were founded as filials of existing universities. The filials were placed in the next tier of cities such as Linköping, mainly for reasons of regional politics. The main task of these colleges were at that time considered to be to attract more of the 'reserve of talent' into higher education, in order to provide the regional industry with workers. Later on, many of these organizations expanded and also became independent. Additional university colleges have been started in the 1990s, to stimulate economic growth and diffuse higher education to other groups in society.[3]

In the 1990s, Sweden underwent major changes in research policy. The underlying mechanisms include a recession, accompanied by a new belief in universities as driving economic growth. More recently, these public policy initiatives have led to debates about whether commercialization and academic entrepreneurship are effective, or not, within the Swedish context (Henrekson & Rosenberg, 2001; Granberg & Jacobsson, 2006).

For this paper, one of the most interesting outcomes of the 1990 reform was that new regional organizations were started not only for education of undergraduates but also for research and training of PhD students. Since 1997, all universities and university colleges are given research funding from the government, which was not the case before. Another

[3] Where not otherwise stated, this presentation draws especially upon the book "Knowledge for prosperity" by Sverker Sörlin and Gunnar Törnqvist . Authors' translation (original title: "Kunskap för välstånd")

outcome was a shift in Swedish science policy towards competitive research funding, but also towards explicit initiatives to stimulate high quality research at these new university colleges. This more competitive environment and restructuring of public authorities were also facilitated by the introduction of new public research foundations. They were based on the so-called wager earners' funds and these research foundations were intended to stimulate strategic research and to enhance co-operation and interaction with industry (Schilling, 2005). Although these reforms led to more HEIs conducting research, the overall Swedish public research funding was not enlarged, but rather spread out more thinly amongst more actors. Similar to the general trend in Europe, there has been a decrease in the relative share of government funding during the last few decades in Sweden (Heyman & Lundberg, 2002; Hällsten & Sandström, 2002). This empirical fact, together with the mentioned policy changes, indicates that in Sweden, as in Europe, we can observe an increasing importance of external research funding and a more competitive environment regarding research funding. This has given rise to some public debates, such as the difficulties of conducting high-quality research in this 'boot-strapped' environment and the need for 'critical mass' and the necessary size of research groups in order to be able to conduct 'good research' (Benner & Sörlin, forthcoming 2008).

2.2 Structural Characteristics Influencing University-Industry Interaction

The traditional rationale for government financing of universities, science and basic research are often attributed to an economic view of the contributions of research institutes to society (e.g. Bush, 1945). In other words, universities have a particular role, because science and education have been seen as public goods. As such, the university provides public goods in terms especially of education, teaching and commercialization to deliver what are now called externalities, general-purpose technologies and knowledge spillovers. These benefits are seen to promote societal development, solve societal problems and stimulate economic growth.

Universities are known to impact society more broadly. Studies have been made on the impact of university research and science on economic growth (e.g. Salter & Martin, 2001) and on the different mechanisms and channels for knowledge transfer, across different industries (e.g. Cohen et al., 2002). Salter and Martin (2001) identify six major mechanisms for diffusion of university research to industry: increasing the stock of useful knowledge; educating skilled graduates; developing new scientific instrumentation/methodologies; shaping networks and stimulating social interaction; enhancing the capacity for scientific and technological problem-solving; and creating new firms. Similar lists can be found in many other references. Cohen et al. (2002) show that the key channels for university research to impact industry are publications, public conferences and meetings, consulting and informal information exchange.

However, recent debates have swung to stress that universities should more directly contribute to economic growth (Salter & Martin, 2001). The literature has exploded on topics such as academic entrepreneurship, commercialization of research results and university-industry interaction. For example, *Research Policy* published 43 articles using

one or more of the words 'academic entrepreneurship', 'commercialization' and 'university-industry' in abstract, title or/and keywords in 2000-2005 (authors' search). The majority of these studies use patents, licenses and start-up companies as the empirical data, to demonstrate how universities influence society.

One topic of debate has been what quality of university research is required to stimulate university-industry interactions. Using biotechnology in the USA, Zucker & Darby (1996) put forth the 'star scientist' hypothesis. Based on data of scientists, they could show that prominent scientists were also prominent commercializers of science and thereby able to individually benefit from their human capital. Hence, one might expect that the researchers and fields with the most external research grants to also be most active in patenting, start-up companies and possibly, accessing research grants from companies.

The 'quality' of firm knowledge has been less prevalent in the debate, with the exception of 'absorptive capabilities' of firms (Cohen et al 2002). Some papers have examined the importance of having high quality of science, from the perspective of firms and different industries. Mansfield (1995) surveyed industrial technology managers in the USA, finding that the university research perceived as most important was often directly related to the quality of the faculty in relevant departments and to the size of R&D expenditures in relevant fields. High-quality science thus seems to attract more industrial interaction with universities, so that again, we would expect that high levels of external funding for research (from any source) should be correlated with high measures of university-industry interaction. However, this does not mean that lower quality or lower prestige universities do not interact with firms. Mansfield (1995) also found that in several industries, the relationship between faculty rating and their contribution to industrial innovation was very weak. Hence, in some industries and research fields, many modestly ranked departments play as large a role as some of the most highly ranked departments. Similarly, in the UK, it was found that the research quality of the departments did not impact the probability to engage in various mechanisms to interact with firms. Departments in applied fields rated as low quality appeared to have a higher likelihood of engaging in a variety of mechanisms for transfer (D'Este & Patel, 2007). One explanation could be that less prestigious departments may be more willing to focus on firms' immediate problems, rather than long term research (Mansfield & Lee, 1996). If the latter is correct, then the researchers and universities should be able to substitute research grants for external company monies.

Other literature focuses upon firms, using a rich description of structural characteristics such as the size, age and R&D intensity of those firms, in order to help explain why these firms interact with universities. It appears that firm size is positively related to interactions (e.g. Beise & Stahl, 1999; Laursen & Salter, 2004), but not to contract or collaborative research (e.g. Cohen et al., 2002; Santoro & Chakrabarti, 2002; Schartinger et al., 2002). R&D intensity has been found to be positively related to interaction, in studies using different proxies such as R&D expenditures over sales and number of scientist in a firm, (e.g. Laursen & Salter 2004), but not be related to contract or joint research specifically (e.g. Mohnen & Hoareau, 2003). Several studies have found that

intensity and types of interactions differ between industries, where industries ranked as most prone to interact with universities include pharmaceuticals, semiconductors and other manufacturing industries (e.g. Cohen et al. 2002; Klevorick et al., 1995). The age of firms is found in some studies to be related to interaction, but this is not as well researched and the results are somewhat inconclusive (Meyer-Krahmer & Schmoch, 1998; Schartinger et al., 2001; Laursen & Salter, 2004).

Given that the industrial side is well researched, an interesting question for this paper is whether literature deals with structural characteristics of the individual universities and of populations of universities. To the extent they are studied, these usually refer more to the university support structure for handling patenting and spin-off activities.

There are nonetheless a few studies specifically concerned with structural characteristics of universities, when they interact with industry. Looking at department levels rather than disciplines in Austria, Schartinger et al. (2001) found that department size had a significantly positive impact on industry interaction. They also attempted to capture the effects of departments' R&D intensity on interaction, but they found no significant impact on interaction in general. Similarly to industry differences for firms, some research suggests that the intensity and type of interaction vary among research orientations and scientific fields (see e.g. Meyer-Krahmer & Schmoch, 1998; Schartinger et al., 2002).

We propose to apply the structural characteristics found to influence firms' propensity to interact with academia also on universities engaging in such, and other external, relationships. We do so due to a perceived lack of such studies in the current literature. From this and the earlier discussion, we draw our second assumption: *HEIs in Sweden that are larger, more R&D intensive and with a higher research productivity should display a higher propensity to obtain external research funding in general, and industry funding in particular, as well as a higher relative importance of such funding, relative to others.*

3 Methodology and Data

In the following section, we present the method and data used for this study.

3.1 Data and Methods

The method used here is primarily descriptive, using quantitative data to explore the research questions identified above. Since the first descriptive question addresses the categorization of the university sector, the use of factor- or cluster-analysis could be appropriate. However, the range of data and number of observations is rather limited, mainly due to the small number of HEIs located in Sweden, and so we have concentrated on a descriptive analysis.

The data for the analysis is to a large extent drawn from a Swedish national database on universities (the NU-database: (http://www.hsv.se/statistik/statistikomhogskolan). The database is run by the Swedish National Agency for Higher Education, and uses data that the agency collects directly from all Swedish HEIs as well as from other sources on a yearly basis.

The database contains data on students, personnel, and finances. Information on personnel is retrieved from Statistics Sweden. They in turn collect the information from respective higher education institution for the short-term salary statistics. Financial data is collected by the Swedish National Agency for Higher Education (HSV) from respective HEI on a yearly basis. This can include figures from annual reports, and more detailed data on specific issues like different sources of funding. This data is obtained at the university level and cannot be broken down on different research subjects at the respective HEI.[4]

This paper uses the averages over the period 2001-2005, for all the variables analyzed here, except for publications that use the average for 2001-2004. There are several reasons for this. Firstly, 2001 represents a break in the reporting of some of the data-series. The database goes back to the fiscal year 1993/1994, for some data of interest, such as the number of employees. However, the statistical sources were changed in 2001, making it hard to combine data from the recent years with data from before that. Secondly, some variables fluctuate wildly, for reasons that may have to do with reporting routines rather than representing actual changes in data. Hence, the average over the period is used as in particular the amount of grants and funding can vary considerably from year to year.

To complement and check data in the NU-database we have used many other sources of data, such as the web-sites and annual reports of respective HEI, to obtain data on e.g. the age of the institutions. Publications were gathered from the Science Citation Index (SCI) and the Social Science Citation Index (SSCI).

3.2 Variables and metrics

Based on the literature review and research questions, we have identified a series of variables as relevant to the analysis namely external research funding (of different types), size, research intensity, age, density of researchers and productivity (of science). For each, we have identified a metric where data can be gathered. Table 1 summarizes the variables and metrics, and includes details of the specific information gathered and the sources. Each variable and metric is discussed in turn below.

External research funding: We take a broad definition of external research funding, but only including funding for which universities and research groups have to compete. This excludes general university funds (i.e. block funding and similar) and internal funds. In the analysis, we compare different types of external funding to income generated from undergraduate (including Masters) education. Thereby, we can differentiate universities that access resources through research from those that access resources through education.

To make a more detailed analysis, external research funding is broken down into eight categories. Seven categories have been constructed for the Swedish situation in previous literature and the categories are thereby possible to extract from the database

[4] 'Research subject' here refer to the lowest level of division of research in the Swedish system (4-digit level). Authors' translation (Swedish: 'Forskningsämne'). There are ca 254 research subjects (4-digit), 55 'research subject groups' (3-digit) and 12 'research areas' (2-digit). Note that due to the constraints of the database some of the smallest research subjects are grouped together in the calculation.

Table 1: Summarizing the variables, metrics and data collection

	Metric	Specific information	Source
Competitive (external) research funding	Research funding	All research funding except general university funds and internal funds (in absolute number or per researcher)	NU
Funding for undergraduate education	Income from undergraduate education		NU
Size	Research personnel	Number, in FTE, of research assistants, research students, lecturers, other researching personnel and professors	NU
Research intensity	Research orientation	Students per professors	NU
Age	Foundation year		University web sites, annual reports
Density	Research personnel	Number, in FTE, of research personnel broken down per research subject	NU
Quality (Research productivity)	Publications	Normalized # of publications per researcher in a HEI	SCI, SSCI

(Sandström, 1997; Hällsten & Sandström, 2002). Earlier critic of the NU-database has suggested that it is difficult to differentiate between the grants and contract research obtained from Swedish and foreign firms (Hällsten & Sandström, 2002). In response to this problem the two categories were merged into one category, representing industry-funded research.

The categories for external research resources used are:

- *Research councils* (RC): the Swedish Research Council (Vetenskapsrådet)
- *New foundations* (NF): Comprising all public foundations, such as the Knowledge foundation (KK-stiftelsen) and the Foundation for Strategic Research (SSF).
- *Foundations* (F): Private or semi-public foundations, such as the Wallenberg foundation, The Bank of Sweden Tercentenary Foundation (Riksbankens Jubileumsfond) and the Swedish Cancer Society. University foundations are not included, since it is considered to be internal funds.
- *Government institutions & EU* (G & EU): Funding from the government through institutions such as VINNOVA, local authorities, county councils and EU.
- *Industry* (I): contract research and grants from Swedish and foreign firms.
- *Contract research (non-industry)* (CR): Contract research from all different financers, except from industry.
- *Other external funding* (O): grants from Swedish and foreign non-profit organizations, as well as "other" incomes.

The other data has to do with metrics applied to the structural characteristics of universities and HEIs:

University size may affect the resources available for R&D projects aside from day-to-day tasks and has been shown as important to explain R&D in firms. As an indicator for university size, we use number of research personnel, since employees is commonly used to denote firm size (e.g. Laursen & Salter, 2004; Cohen et al., 2002) as well as occasionally university size (Schartinger et al., 2001). In the Swedish database, personnel categories do not easily distinguish those employees who are researching from those who are only teaching. Moreover, in Sweden, PhD students are usually university employees, actually undertaking much of the research. Out of the personnel categories available in the NU database, this paper therefore includes Professors (Chair, Full), Senior Lecturers (e.g. Associate Professors), Research Assistants (e.g. post-docs, Junior Lecturers), other researching and teaching personnel and PhD students.

In studies of firms, *R&D intensity* is usually measured in terms of R&D expenditure over sales (e.g. Mohnen & Hoareau, 2003). However, due to the nature of the university 'business' and some difficulties with this data in the NU-database, because of changed reporting during the studied period, a corresponding metric cannot be used directly. Instead, we propose that R&D intensity can be seen as research intensity or research orientation.

Our argument is based on the main businesses of the universities. Universities can be seen as having two main tasks, namely education and research (McKelvey and Holmén forthcoming 2008). Therefore it seems feasible to construct indicators that measure the relation between these two tasks, in order to capture research intensity. Geuna (1999) uses researchers per student as an indicator, the rationale being that the higher the indicator is the higher "the propensity of the institution to carry out research". Hence, the detailed level of data on personnel per research field may be used to classify the universities and the university colleges in terms of being more or less science-based. Thus, what is measured here is the intensity of research as compared to education, or in other words the level of research orientation. Rather than research personnel (which is a broad category), we focus on chair professors (full professors), as they can be claimed to play a central role in research activities. Since our analysis is descriptive in nature, we use students per professor, in order to get a more easily comparable indicator of research orientation.

Age is used here mainly as a complementary variable. It is not included in the NU-database but founding year was obtained from other sources. The age in the Swedish university sector is rather skewed, ranging from a couple of very old institutions to most being fairly young. Here, the variable is mostly useful in developing categories.

Density refers to high number of researchers within specific subjects, and can also be seen as an indicator of specialization. The density of research personnel in the different research subjects reveals to some extent the intensity of the research conducted at a particular university. Here we study the share of research subjects with more than a certain number of researchers active in them. This relates to the debates about "critical mass" and overall research intensity.

A common indicator of *quality* has been publications. A more cautious way to handle this indicator is to call it *scientific productivity* instead of quality, as has been done by Geuna (1999). Rather than analyzing total publications (which would demonstrate overall research output), we want to analyze publications per researcher. First of all, we normalized publications per author. This means that a paper with e.g. three authors from the same HEI would be counted as one paper for that institution. Each author is assigned a percentage of the paper. Then the numbers were aggregate on the university level. We then averaged the normalized number of publications per HEI, by dividing by the total number of researchers at that HEI.

4 Descriptive Characteristics of the Swedish Universities

This section focuses on the relative position of individual organizations, and the total population, in the Swedish university sector, as defined in the first research question and the first assumption drawn from literature.

4.1 Overview of the Swedish University Sector

This paper uses the term 'university sector' broadly, yet there are differences amongst the HEIs. In Sweden, university status relates to the so-called 'right' to examine research students in all science areas; i.e. within Medicine, Natural sciences, Humanistic and Social sciences and Technical sciences.[5] University colleges on the other hand can only examine research student within scientific areas that they are specifically granted. As of 2007, the Swedish higher education sector consists in total of 14 universities and 22 state controlled university colleges. In addition, there are three private HEIs with the right to examine research students.[6] We are here interested in the HEIs performing research in a wider sense and therefore we do not study the colleges devoted to arts, pedagogic and the like. This leaves us with 30 Swedish HEIs.

Our first research question is related to which characteristics are useful to define categories, as well as to position specific HEIs within these classifications. First we analyze the population in terms of age (Year of establishment), number of undergraduate and Masters students (Students), number of chair or full professors (Prof.), number of PhD students (PhD), income from undergraduate education (Income education), total income and cost from research and research education (Income research and Research expenditure). The variables for education and research include all scientific, engineering, humanities and social science disciplines. Table 2 presents the 30 chosen Swedish HEIs, ranked according to their aggregated absolute size in these variables in 2005.

Table 2 can in way ways be interpreted as reflecting Swedish science and educational policy in the 19th and 20th centuries, especially the waves of HEI establishment in the

[5] Science areas are a classification used for the government authorities' resource allocation for research and research education. To be granted a 'science area' means that the HEI has the right to examine research students within that particular area. Authors' translation [Swedish: 'Vetenskapsområde'].

[6] Chalmers UT, Jönköping UC and Stockholm SE

Table 2: Overview of the Swedish HEIs, 2005 [1000 SEK]

HEI	Year of est.	Students	Prof.	PhDs	Incomes education	Incomes research	Research expenditures
Lund U	1666	26 884	572	1 196	1 713 812	3 282 072	3 295 967
Uppsala U	1477	21 852	472	1 117	1 350 335	2 761 855	2 758 065
Karolinska I	1810	5 603	308	568	813 718	3 021 736	2 990 967
Göteborg U	1891	25 823	433	582	1 781 269	2 441 777	2 439 510
Umeå U	1965	16 904	243	565	1 383 975	1 574 108	1 574 562
Stockholm U	1904	23 126	351	719	1 047 940	1 698 178	1 707 119
Royal IT	1826	12 443	242	772	978 333	1 703 328	1 710 099
Linköping U	1970	18 041	264	685	1 260 338	1 253 291	1 232 334
SLU	1977	3 418	190	388	475 486	1 607 385	1 559 843
Chalmers UT	1829	8 554	150	585	741 257	1 371 704	1 389 577
Luleå UT	1971	8 082	89	287	617 696	566 903	561 674
Malmö UC	1998	10 241	40	77	805 768	130 274	141 400
Örebro U	1965	9 483	56	139	576 416	250 354	250 615
MittUniversity	1993	8 202	37	130	514 433	279 391	261 199
Karlstad U	1977	8 183	45	113	505 667	262 048	264 364
Växjö U	1977	7 414	42	130	479 971	207 686	206 275
Mälardalen UC	1977	8 725	41	91	573 213	131 545	130 118
Kalmar UC	1977	6 023	32	72	463 024	126 690	133 909
Södertörn UC	1995	6 382	34	89	268 519	217 454	228 996
Jönköping U	1977	6 634	31	74	426 416	138 744	130 594
Gävle UC	1977	6 102	23	15	357 934	97 182	99 869
Borås UC	1977	5 002	19	43	374 544	56 316	62 610
Blekinge IT	1989	3 320	22	55	261 725	106 761	107 493
Dalarna UC	1977	5 125	16	30	335 252	66 521	67 258
Stockholm SE	1909	1 390	32	35	88 450	152 820	222 255
Halmstad UC	1983	5 398	21	28	280 325	72 962	71 906
Kristianstad UC	1977	5 239	14	13	319 100	42 803	47 986
Skövde UC	1977	4 183	12	55	266 662	45 314	52 815
Väst UC	1990	4 056	5	20	268 672	38 652	43 592
Gotland UC	1998	2 252	8	4	129 870	23 322	19 395

1970s and the 1990s. Table 2 indicates a clear size and age distribution, running the range from Lund University to Gotland college. Generally speaking, the oldest organizations are also the largest, as indicated in terms of incomes from research, research expenditures as well as number of professors, PhD students, and undergraduate students. Still, two of the HEIs started in the 1990s have grown larger than ones started in the 1970s, particularly MittUniversity and Malmö UC. These two lie close to two of the major metropolitan areas and population centres, located close to Stockholm-Uppsala respectively Malmö-Lund.

However, the size-age distribution has three noticeable exceptions, especially in terms of undergraduate students. Two, namely Karolinska Institute (KI) and the Swedish University of Agricultural Sciences (SLU), have considerably fewer students than other organizations of their size. The third exception is Malmö UC, which has a rather high share of students relative to its research effort, as compared to other organizations similar on the other size variables.

Hence, this first overview of the university sector suggests that most Swedish HEIs can be divided into larger-older and smaller-.younger categories, as defined by number of variables. The variables for size cover a range from students to professors and income streams, and most of the organizations appear to fall within similar size categories for all such variables.

4.2 Relative Orientation Towards Education or Research

To go further with our classification, we explore variables to identify HEIs' relative orientation towards either education or research, defined in terms of relative efforts. To some extent, the age-size variable will be discussed below.

Note that orientation here simply refers to relative emphasis on one of the two activities at the organization, and it does not show their relative 'share of market' within Sweden as a whole.

Figure 1 relates the overall size in terms of number of researchers, on the x-axis, to the research intensity related to education, in form of students per professor, on the Y-axis.[7] The different HEIs are in the figure labelled with the national so-called university code (see Table 9 in Appendix A).

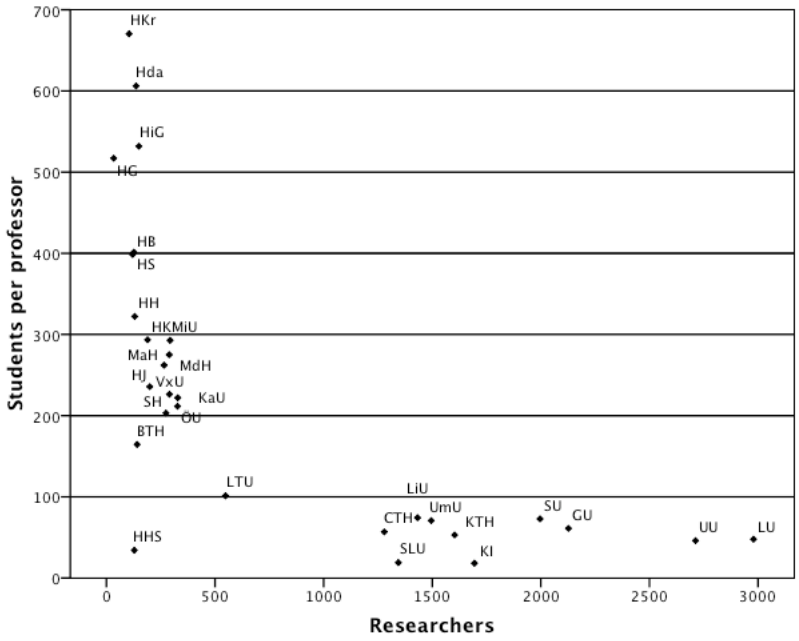

Figure 1: Research orientation

Figure 1 is striking, in that the data reveals two quite distinct groups of Swedish HEIs. The universities in the first group have a large number of researchers as well as high relative orientation towards research, in terms of students per professor. These ten institutions each have more than 1000 researchers. As can be seen in Table 6 in Appendix A, each also has more than 100 chair professors. Their overall low numbers of students per professor indicates an orientation less directly dependent on education and with more room for research. These HEIs all have university status and seven of them are the oldest

[7] For actual numbers, see Table 6 in Appendix A.

in Sweden.[8] The remaining three of these ten universities were founded about 1970 and they represent the largest of the younger universities.

As noted in Tables 2 and 4, however, these have large absolute numbers of students and educational financing, so they are combining research and teaching. The group will further on be referred to as the 'Larger (and older) Research and Teaching Intensive' universities. They are grouped along the x axis, and they are (from right to left on this axis): Lund University (LU), Uppsala University (UU), Göteborg University (GU), Stockholm University (SU), Karolinska Institute (KI), Royal Institute of Technology (KTH), Umeå University (UmU), Linköping University (LiU), the Swedish University of Agricultural Sciences (SLU), and Chalmers University of Technology (CTH).

Looking back, we can identify a few more detailed differences within this first group. One is that the age is generally, but not always, related to size. Chalmers is the exception here, in that it is relatively old compared to the population but it is also the smallest in this first group. The three younger universities in the group are all somewhat smaller than the older ones. Finally, of the three younger universities, one of them has almost the lowest student to professor ratio (SLU) whereas the other two have the highest student professor ratio in the group (Linköping U and Umeå U).

The second group has the inverse characteristics, differing on both dimensions from the first group. They have lower numbers of researchers, as well as many more students per professor. The group is composed of younger organizations, which are also smaller, as defined in terms of research. These are all regional HEIs, with the oldest founded in 1965 and the youngest being less than ten years old. As can be seen in both the figure and in the appendix table, most HEIs in this group have less than 300 researchers and less than 50 chair professors. These HEIs distinguish themselves not only by being smaller, but also by having significantly more students per professor than the universities in the first group. In fact, almost all of them have more than 200 students per professor, which is more than twice as much as in the first group.

This group will be referred to as the 'Smaller (and younger) Education Dependent' HEIs. They are grouped along the y-axis of Figure one and they are (descending order on that axis): Kristianstad (HKr), Dalarna (Hda), Gotland (HG), Gävle (HiG), Skövde (HS), Borås (HB), Halmstad (HH), MittUniversity (MiU), Malmö (MaH), Kalmar (HK), Mälardalen (MdH), Jönköping (HJ), Växjö University (VxU), Karlstad University (KaU), Södertörn (SH), Örebro University (ÖU) and Blekinge (BTH).

One organization, within this second group, has been left out in Figure 1, because it is an outlier when it comes to this specific characteristic. Väst UC (HV) is the second smallest HEI, even more specialized in education than the others, having a student per chair professor ratio that is extremely high (2301 students per professor).

One organization, Luleå UT, in some aspects lies close to the second group but also shares some characteristics of the first group. Luleå is considerably larger than the HEIs in the second group but also much smaller than most organizations in the first group. It also has a research orientation closer to those found in the first group. One interpretation is therefore that Luleå may be moving between the two groups.

[8] Stockholm SE is the only institution being over 100 years old that do not show up in this group

One organization does not follow the general pattern. Stockholm School of Economic (HHS) has one of the lowest students per professor ratio, but it combines its specialization in research with a small size. Moreover, it is among the oldest universities in the country but also private. They have obviously evolved, or chosen, a combination of research and teaching which differs significantly from the other Swedish organizations.

4.3 Density in Research Subjects

To pursue the idea of research intensity further, our next step is to identify whether the organizations have different numbers of research subjects in which they are active as well as whether they have different density of professors and researchers across research subjects, self-declared to the government.[9] In many ways, the idea of 'density' can be related to the issue of 'critical mass', in other words do universities have many or few researchers and professors within each specific subject?

Table 3 presents the Swedish HEIs according to the two groups, defined above, and according to size within that group. This table shows how many researchers and professors, respectively, are employed at each declared research subject within that organization. For example, Lund has more than one researcher in 63 of their research subjects, and more than 50 researchers in 23 of their research subjects.

The first column in Table 3 suggests the total number of research subjects, per organization.[10] A first reflection is that the regional universities and colleges are present in almost as many research subjects as the larger and older HEIs. Hence, if one only looks at the column with active (declared) research subjects, it appears that all Swedish HEIs are quite similar. No striking diversity between the two groups is visible in this regard.

However, looking across the other columns, a rather striking difference is shown. This difference in density across research subjects grows the more researchers and professors you set as the minimum, as can be seen moving from left to right in Table 3.

The 'Larger Research and Teaching Intensive' universities have a high density across research subjects, such that they are represented in most research subjects by at least 20 researchers, and in many subjects also with at least 50 people. In contrast, the 'Smaller Education Dependent' HEIs have few research subjects represented by more than 20 people, and with few exception no subjects with more than 50. In fact, in most cases a large share of the research subjects in these HEIs are represented by less than five people. Hence, major differences between the first and second group also hold for this characteristic.

Interestingly, while a substantial share of research subjects in the universities in the first group have more than five professors, a surprisingly small share at the smaller regional institutions in the second group have even one. For example, Dalarna UC has 38 declared research subjects with at least one researcher, but only 7 subjects with at

[9] The Swedish HEIs must report their own activities within different research subjects to the Swedish government, and this reporting may influence future funding. Thus, 'active' here refers to those research subjects that the specific HEI has reported.

[10] The number of research subjects represented by one, or more, full-time equivalent researcher(s).

Table 3: Number of research subjects with more than a specific number of researchers and professors

	Researchers					Professors	
HEI	**>1**	**>5**	**>10**	**>20**	**>50**	**>1**	**>5**
Lund U	63	54	48	40	23	60	34
Uppsala U	54	50	44	33	17	52	26
Göteborg U	54	49	40	31	14	49	24
Stockholm U	50	39	33	28	11	45	22
Karolinska I	12	11	11	10	10	11	10
Royal IT	23	17	15	13	12	18	13
Umeå U	59	45	36	25	6	43	17
Linköping U	58	44	34	25	7	45	17
SLU	15	13	11	10	10	12	10
Chalmers UT	19	16	14	13	10	15	12
Karlstad U	36	21	13	4	0	21	0
Örebro U	34	22	14	3	0	22	0
MittUniversity	38	21	11	3	0	17	0
Växjö U	31	17	13	3	0	18	1
Malmö UC	37	16	6	3	1	13	2
Södertörn UC	24	14	8	4	1	14	1
Mälardalen UC	32	17	9	3	0	15	1
Jönköping UC	30	10	6	2	0	14	0
Kalmar UC	36	11	4	2	0	12	1
Gävle UC	29	13	3	0	0	9	0
Blekinge IT	19	7	3	1	1	8	1
Dalarna UC	38	10	1	0	0	7	0
Halmstad UC	28	11	1	1	0	10	1
Skövde UC	23	6	3	1	0	6	0
Borås UC	27	8	2	1	0	9	0
Kristianstad UC	24	7	1	1	0	6	0
Väst UC	24	6	1	0	0	2	0
Gotland UC	10	2	0	0	0	2	0
Luleå UT	26	13	10	8	5	15	6
Stockholm SE	6	4	3	2	1	5	2

least one professor. Similar results are shown for several of the other HEIs in this second group.

This result about the density of researchers and professors, across declared research subject, is quite provocative in the Swedish context, given the declared public policy objective of developing research at the smaller, younger HEIs. Therefore, we decided to identify more systematic differences to distinguish organizations and groups. Looking across the Swedish university sector, we made a calculation of the absolute average of researcher per research subject. From this, ten researchers per subject was chosen as a reasonable benchmark to compare the density in research subjects in the different HEIs.

From this, Figure 2 plots, for each organization, the share of research subjects with more than ten researchers against the total number of researchers.

The figure confirms the usefulness of discussing 'Larger Research and Teaching Intensive' and 'Smaller Education Dependent' also for density of researchers across subjects. The ten universities identified as the first group previously have a significantly higher share of research subjects comprising more than ten researchers, than do those in the second group. More specifically, the organizations in the first group have ten or more researchers in more than half of their research subjects. The HEIs in the second group, on the other hand, have less than half of the research subjects comprising more than ten researchers, and in most cases substantially less. Table 8 in Appendix A provides more detailed information.

The outliers are interesting, and the same organizations are outliers here as well.

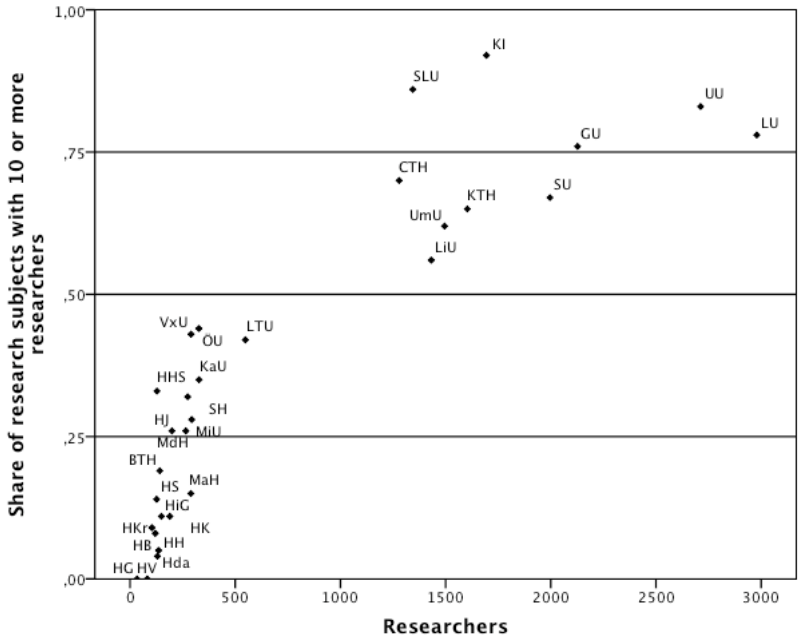

Figure 2: Density of researchers across research subjects

Looking at Figure 2, Stockholm SE lies rather close to the second group, although having a higher density relative to size. However, when studying Table 3, one can see that the higher the number of researcher you set as the minimum, the more SSE aligns with the ones in the first group. This also holds true for the density of professors in general. Luleå UT also shares these characteristics with this first group, but not as pronounced as SSE.

4.4 Research Productivity

Finally, a structural characteristic often used in the literature is quality and research productivity. Hence, we wish to check whether the HEIs in the Swedish university sector also differ when it comes to research productivity. Figure 3 therefore places the research productivity, in terms of normalized publications per researcher, against size, in terms of total number of researchers. For more detail, look at Table 8 in Appendix A.

Figure 3 further confirms that there are clear differences between the two groups previously identified, in that the data reveals a relationship between the size of research effort and research productivity. Plotting this relationship shows a clear tendency that researchers whom are active at organizations with large numbers of researchers on average also write more papers. In other words, they have a higher research productivity as measured in output per researcher.

Hence, for the 'Larger Research and Teaching Intensive' universities, the normalized publication rate is higher. They have all, with the exception of Stockholm U, more than

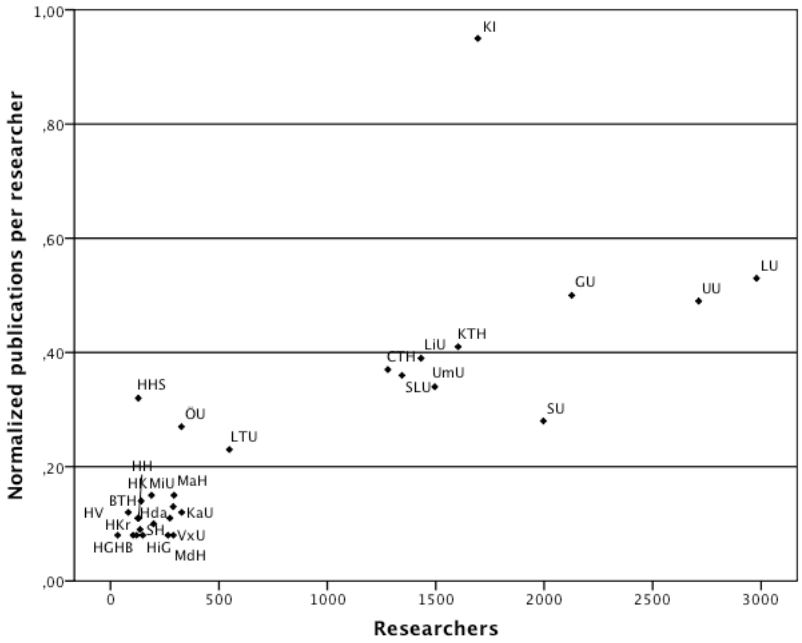

Figure 3: Research productivity

0,3 publications per researcher and year. For the 'Smaller Education Dependent' group, the publication rate is substantially lower. In fact, all the HEIs identified as belonging to the second group are all rather similar regarding publication rate, ranging between 0,15 for MittUniversity and 0,08 for as many as seven of the smaller institutions. Figure 3 demonstrates in other words a rather wide gap in publication rate between the first and the second group – that is, the larger universities have not only a higher research output but also higher research productivity.

For this variable as well, there are some nuances and outliers within the two groups and between the groups. Within the 'Larger Research and Teaching Intensive' group, Karolinska I has by far the largest publication rate in the first group, which may be expected since they specialize in medical research with many publication opportunities, while Stockholm U has the lowest in the group. Within the 'Smaller Education Dependent' group, the outlier is Örebro U, with substantially higher publication rate. With 0,27 publications per researcher, they are by far the most research productive in the second group, being not far from Stockholm U in the first group. Finally, as before, Stockholm SE differentiates itself, by having a high number of publications relative its size, and Luleå UT ends up in between the two groups.

Hence, this overview of descriptive statistics of the Swedish university sector clearly supports the idea of polarization, as outlined in the first assumption stated in Section 2.

5 External Research Funding

We now turn to the positive and negative impacts of structural characteristics in regards to external research funding.

An overview of the external research funding is presented in Table 4, so that the total external research funding is displayed alongside income from undergraduate education, for the Swedish HEIs. The table also shows the external research funding per researcher, and the ratio between income from education and external research funding. The table is ordered according to the two groups identified above, and the total amount of external research funding received. Again, the results confirm the distinction between the two

Table 4: External research funding and income from education [1000 SEK]

HEI	**External research funding**	**Ext. funding/ researcher**	**Income education**	**Education/ Research**
Karolinska I	1 514 115	892	754 475	0,50
Lund U	1 465 017	491	1 648 200	1,13
Uppsala U	1 151 363	424	1 249 355	1,09
Göteborg U	1 050 701	477	1 643 561	1,56
Royal IT	1 007 505	628	928 021	0,92
Chalmers UT	932 178	729	700 439	0,75
Stockholm U	620 613	311	1 010 096	1,63
SLU	616 715	460	507 850	0,82
Umeå U	561 873	375	1 219 809	2,17
Linköping U	554 584	387	1 205 926	2,17
Södertörn UC	199 954	731	251 062	1,26
MittUniversity	132 612	453	511 988	3,86
Karlstad U	97 235	295	491 642	5,06
Örebro U	76 390	233	549 419	7,19
Mälardalen UC	65 701	246	535 220	8,15
Växjö U	59 277	204	428 017	7,22
Malmö UC	58 912	205	724 515	12,30
Jönköping UC	55 160	265	383 865	6,96
Kalmar UC	47 583	252	439 061	9,23
Blekinge IT	37 955	270	251 989	6,64
Gävle UC	35 561	247	349 178	9,82
Halmstad UC	32 727	250	272 259	8,32
Dalarna UC	29 459	221	340 532	11,56
Väst UC	22 039	267	255 622	11,60
Borås	19 423	165	349 679	18,00
Skövde	19 198	158	246 960	12,86
Kristianstad	13 379	128	305 012	22,80
Gotland	7 344	255	117 936	16,06
Luleå UT	290 511	530	595 780	2,05
Stockholm SE	97 269	769	70 163	0,72
Total	*10 872 352*		*18 337 631*	*1,69*

proposed groups, but now with regard to the ability to obtain external research funding. The ones that are attracting the largest amount of external research funding (>500 MSEK) are the ten 'Larger Research and Teaching Intensive' universities. The seven HEIs that attract the most external funding in this group are also the seven oldest in the sector. As can be calculated from the table, this one third of the Swedish HEIs receives on average 87 percent of the total external research funding and 60 percent of income from education.[11]

[11] This should be seen in relation to the fact that they also comprise approximately 80 percent of all the researchers.

Moreover, the smaller, regional, HEIs that previously were categorized as the 'Smaller Education Dependent' group attracted on average less than 200 million SEK each. Rather naturally, all of the institutions lacking the right to graduate research students, with the exception of Södertörn UC, are the ones attracting the least external research funding.[12]

Studying external research funding relative to size, the pattern remains similar as before, with a couple of exceptions. Most of the HEIs in the second group have a substantially lower funding per researcher than those in the first group. However, due to the reasons discussed before, Södertörn has one of the highest ratios. MittUniversity has also a noticeably high funding per researcher, being higher than for the younger HEIs, Stockholm and Uppsala in the first group.

Looking at the ratio between income from undergraduate education and external research funding reveals a large difference. The ten universities identified earlier as receiving the most external research funding, together with Stockholm SE and Luleå, all have a rather low ratio, generally receiving not more than double the sum from education than from research. Interesting is for instance that Karolinska receives much more funding for research than for education, and to some extent this is also true for the two older technical universities, Stockholm SE and SLU.

5.1 RCA Analysis

In order to say something about the relative role of different sources of external research funding, we use a number that reveals the importance of a particular funding source for a university relative to the importance for the whole population (so-called RCA).[13] In Table 5, the RCA for the HEIs of the seven categories of external funding and of the income from undergraduate education are displayed. The RCAs being more than one can be said to be funding sources that are more important to the specific organization than to the overall population of HEI here studied, i.e. a dependence above average. The table is ordered firstly according to the two groups identified, and secondly according to the absolute amount of external research funding received.

Looking at the universities categorized as the 'Larger Research and Teaching Intensive' group reveals that these are the HEIs with low relative dependence on education, in terms of income. Instead several of the external funding sources display high importance for all these universities. The HEIs categorized in the second group on the other hand all show a high reliance on income from education, while low or no reliance on most external funding sources.[14] These were identified earlier as being more oriented toward education,

[12] Södertörn is an exception, however, because almost all of the money that they receive comes, as can be seen in Table 10, from the category New foundations. This is because of the Foundation of Baltic and East European Studies (Östersjöstiftelsen) – a foundation more or less entirely focused on funding Södertörn, plus small sums to Uppsala University. For the period studied, this HEI has received approximately 130 million SEK on average every year from this foundation. Contrasting this sum to the rest of the income for the university makes it clear that this skews the total relation for this university, and thus also their relative position in this table.

[13] Revealed Comparative Advantage

[14] For some of these HEIs in the second group, one or two funding sources, limited mainly to New foundations and Contract research, in addition to education, seem to have some importance. However,

Table 5: RCA of the external research funding and income from undergraduate education

HEI	RC	NF	F	G & EU	O	CR	I	E
Karolinska I	1,59	0,92	1,95	1,01	3,06	1,57	3,09	0,53
Lund U	1,69	1,03	1,20	1,24	1,41	0,60	1,00	0,84
Uppsala U	1,97	1,12	1,80	0,93	0,80	1,29	1,51	0,83
Göteborg U	1,09	0,62	1,10	0,91	1,34	1,52	0,83	0,97
Royal IT	1,41	1,64	0,98	1,76	0,71	0,47	1,84	0,76
Chalmers UT	1,36	2,08	0,60	1,45	2,26	0,85	1,41	0,68
Stockholm U	1,71	0,36	1,10	1,27	0,50	1,02	0,43	0,99
SLU	0,35	1,54	0,20	2,38	1,64	2,01	0,68	0,72
Umeå U	0,95	0,29	0,86	0,92	0,61	1,97	0,45	1,09
Linköping U	0,93	0,99	0,54	0,97	0,46	1,18	0,65	1,09
Södertörn UC	0,29	7,97	0,13	0,95	0,11	0,38	0,00	0,88
MittUniversity	0,07	0,99	0,04	0,98	0,33	0,11	0,49	1,27
Karlstad U	0,18	0,82	0,05	0,46	0,28	1,36	0,30	1,33
Örebro U	0,25	0,72	0,19	0,45	0,06	0,36	0,12	1,40
Mälardalens U	0,08	0,63	0,02	0,42	0,13	0,21	0,38	1,42
Växjö U	0,08	0,35	0,04	0,33	0,23	1,66	0,12	1,40
Malmö UC	0,16	0,28	0,01	0,27	0,12	0,30	0,16	1,47
Jönköping U	0,06	0,28	0,06	0,33	0,35	0,82	0,47	1,40
Kalmar UC	0,18	0,53	0,00	0,25	0,52	0,05	0,13	1,44
Blekinge IT	0,04	1,10	0,00	0,47	0,41	0,24	0,06	1,38
Gävle UC	0,03	0,40	0,06	0,44	0,08	0,32	0,17	1,45
Halmstad UC	0,04	0,95	0,01	0,34	0,15	0,23	0,31	1,42
Dalarna UC	0,02	0,49	0,00	0,31	0,00	0,15	0,45	1,47
Väst UC	0,01	0,71	0,00	0,27	0,23	0,00	0,08	1,47
Borås UC	0,02	0,37	0,00	0,15	0,29	0,05	0,04	1,51
Skövde UC	0,01	0,86	0,04	0,21	0,14	0,06	0,12	1,47
Kristianstad UC	0,09	0,31	0,03	0,10	0,05	0,23	0,04	1,53
Gotland UC	0,06	0,31	0,02	0,15	0,42	0,00	0,00	1,49
Luleå UT	0,29	0,45	0,01	1,22	0,66	1,28	1,69	1,07
Stockholm SE	0,39	0,09	1,56	0,66	2,94	1,86	4,73	0,66

which supports the RCA pattern.

Only the universities in the 'Larger Research and Teaching Intensive' group, together with Stockholm SE and Luleå, which show a high dependence on Industry funding. Stockholm SE is close to the first category, showing low relative dependence on education and, for example, a very high dependence on industry funding. Luleå, previously seeming to be in the middle of the two categorizes, shows a low dependence on education. The only dependence Södertörn seems to have is on New foundations, which on the other hand is extremely high. This is due to their dependence on the Foundation of Baltic and East European Studies as a funding source, as explained before.[15]

these cases can to a large extent be attributed to policy efforts, such as regional politics, manifesting itself in for example funding from certain foundations. For example, the Knowledge Foundation has as main objective to support the smaller regional HEIs, in order to stimulate university-industry interaction. It should be noted that MittUniversity show a somewhat high dependence on Government institutes & EU and not a very high reliance on income from education.

[15] This means that the unusually high dependence on New Foundations keeps down the RCA for all other funding sources. In other words, if left out, Södertörn would show the same pattern when it comes to education as the rest of the HEIs in the group.

6 Discussion and Conclusion

This paper used existing literature about European universities and university-industry interactions, in order to identify specific structural characteristics to position individual HEIs within, and to analyze, the Swedish university sector. The starting point of the paper was to examine whether the data would support the assumption that the Swedish university population is highly diverse, or polarized, as for other European countries. The results showed that examining size (and age), density, research orientation and productivity of the HEIs in the Swedish university sector divides the population into two distinct categories as well as two reoccurring outliers. This paper was explorative, and did not test hypotheses, despite the comprehensive data.

Overall, our results support the idea of polarization in the Swedish university sector. They thereby resemble the findings by Geuna (1999) for other European countries. Size of research effort and age are important characteristics, even if we can also identify younger universities which have, or are currently trying, to move from the second to the first group. The positions in the polarization are dynamic and relative, not fixed, so that at least outliers in terms of structural characteristics of 'their' group may move between groups.

Polarization is visible in many of the variables for structural characteristics of this sector, which were developed based upon studies of universities and firms. The data shows that we can distinguish universities and university colleges on basis of how specialized they are in terms of education or research. The Swedish HEIs can be divided according to the degree of research intensity, in terms of relative orientation in research or education. The results show that the 'Larger Research and Teaching Intensive' universities overall have a substantially lower number of students per professor, than the regional smaller HEIs. This indicates that the former have more room to conduct research, in relation to teaching, and are therefore said to be more research oriented.

It should be noted that the larger research-oriented (and older) HEIs actually do the bulk of teaching in Sweden. Table 2 above shows that the universities in that group approximately educate 60 percent of all students, although being significantly fewer than the HEIs in the other group. Even so, the 'Smaller Education Dependent' HEIs receive a high percentage of their total funding from their smaller numbers of students. In this respect, Sweden lacks a clear division of labour between HEIs when it comes to the tasks of education and research.

The proposed polarization between the two groups is also clear in terms of research personnel and output measures. Generally, smaller universities and university colleges report quite a large number of research subjects relative to their size. In fact, by and large, the smaller HEIs comprising the second group report that they have an amount of research subjects equal to those in the first group. In other words, a quick glance at the Swedish universities would suggest a low degree of diversity. However, this diversity is not supported by the figures on actual numbers of researchers or by examining density of researchers across research subjects. The 'Larger Research and Teaching Intensive' universities have many researchers. Hence, they can concentrate employees – and thereby

assumedly research activities – within a broader set of research subjects. They have more people and a higher density across subject. In contrast, the 'Smaller Education Dependent' HEIs do the opposite. They declare many subjects but do not have many researchers, and so they can be said to have a quite wide range of research subjects, but no depth. In a surprisingly high proportion of research subjects, the HEIs in the second group are represented by less than five people and no professors. The figures suggest that most of the research subjects in these HEIs are fairly empty, lacking to some extent a 'critical mass'.

Thus, maybe not surprisingly, only the largest universities are able to simultaneously uphold diversity, density and size. However, the four organizations which specialize in engineering, medicine or economics and management are able to combine a medium or even smaller size with high density within specific topics.. Hence, an alternative for the smaller, diversified universities might be to focus upon specializations, to gain critical mass. Future research could further explore whether, and what, trade-offs exist between specialization and diversity in terms of research, education, and the linkages between research and education. For example, business schools need a variety of subjects, in order to be accredited as educational providers, and yet to reach scientific excellence, they may have to choose between specialization and diversification. Similar arguments may be developed and applied to understand why the Swedish university sector includes both large, diversified universities as well as institutes dedicated to specific fields.

Furthermore, the figures do suggest that the organizations that are older, larger, and have a higher density of researchers per subject tend also to publish more papers per researcher, i.e. have a higher research productivity. These results further confirm our empirical picture of the polarization within the Swedish university sector. The causality is not specified, but given the much lower ratio of students to professors and greater number of external research funding, we can suggest that these researchers can spend time doing research, rather than teaching, and also support larger, stimulating environments to interact over research issues.

Our results also bring this idea of polarization into the specific issue of external research funding, obtained in competitive situations. The same structural characteristics seem to matter in this regard. These results support the clear differences amongst the two groups. The first group, 'Larger Research and Teaching Intensive', comprising the larger universities, is 'high-performing' in regards to obtaining competitive external research funding, both in absolute numbers and in relative importance as compared to income from education. The second group, consisting of the smaller HEIs, can be viewed as 'low-performing' in this regard.

Also, our results point to that the larger HEIs with the most research funding and highest research productivity also attract more industry funding and have a higher relative reliance on this funding as compared to other sources of external research funding. In this regard, we do not find that the 'Smaller Education Dependent' HEIs change foci of research, in order to attract industrial funding, which would be the case following the suggestion that financially weaker HEIs rely more on funding from industry (e.g. Geuna, 1999).

This result is a bit surprising in the Swedish context. As noted in the literature review, Swedish policy has had explicit goals to stimulate regional economic growth and to allow regional HEIs to address the needs of local companies. Moreover, certain financiers such as some of the New Foundations are explicitly dedicated to developing research – and especially 'needs-driven', industrially relevant research – at these regional HEIs.

What can then the explanations behind this apparent polarization of the Swedish university sector be? On the overall European level, it has been suggested that the polarization to some extent stems from a reinforcement of the so-called Matthew effect (Merton 1968). This may be due to the increased competitiveness regarding research funding (Geuna, 1999).

This is something that has previously been lifted forward in literature as an explanation of the diversity of the overall European population. The original formulation of the Matthew effect adhered to the reward system of science, and was largely an attempt to explain the disproportionate credit awarded already acknowledged researchers. Later on, Merton and his followers come to generalize it by proposing the existence of self-reinforcing processes, usually denoted as "cumulative advantage", driving both scientific productivity and recognition.[16] The studies on the subject primarily keep on the level of the individual scientist but also deal (mostly briefly) with the institutional side of cumulative advantage. Centres or universities of proven scientific excellence through this effect are allocated larger resources, such as research funding, and attract more talented researchers, in a cumulative fashion. Good scientists usually affiliate with institutions of historically proven excellence, which are more likely to have the resources necessary for high-end research. This leads to a higher quality on the institutional level, and associated higher research productivity in terms of publications. In its turn, more research resources as well as high-quality researchers are attracted.

This cumulative advantage would in the long run lead to a stratification of research institutions – a self-reinforcing cycle that would be hard for new small actors to break. When the resource allocation becomes more competitive in nature, this will likely concentrate the research resources more at the 'high-quality' universities and thus further increase the impact of the Matthew effect.

Another, quite close, explanation, also adhering to the logic behind the Matthew effect, can be discussed in terms of the fundamental difference in starting conditions for the HEIs in the two different groups. Strategic management discusses positioning and relative competencies, and this may be relevant in future research about the 'competitive advantage' of certain actors within a national university industry sector. In Sweden, most of the younger regional HEIs are quite new to the research game and so far have been unable to perform at the same level as 'incumbents', when it comes to research productivity (to some extent indicating quality), 'critical mass' in research subjects and the ability to attract external research funding. The older traditional universities have naturally had a longer time to build up recognition of research excellence, as well as

[16] See e.g. Cole and Cole (1973) and Zuckerman (1977). For a review and references see e.g. Allison et al. (1982) and Merton (1988). For a review of "cumulative advantage" in terms of economic analysis see e.g. David (1994)

financial and other research resources. This lead would naturally be additionally reinforced in the potential presence of 'cumulative advantages'. On the other hand, the HEIs in the 'Smaller Education Dependent' group in this respect have had less time to leave their mark, explaining their relatively lower ability to attract external research funding. This is despite dedicated funding to build competencies in the smaller regional HEIs. Our results show the aggregate figures, but ad hoc insights suggest that HEIs can build significant research competencies within niche areas. Research about strategic management, niches and development of competences are thus highly relevant to future studies of Sweden and other European countries.

From this perspective, one wonders about the future of specific organizations within the Swedish university sector. We believe that, the smaller regional HEIs will find it increasingly hard to keep up their present diversity in research. In light of an increased focus on research assessments in Sweden (as proposed in e.g. Brändström, 2007), we suspect that several of these HEIs in due time will be forced to narrow down the numbers of research subjects, because of lacking quality and 'critical mass'.[17]

Related to this, an interesting debate would be about specialisation in research for the smaller younger HEIs. We know from studies of firms and industries that division of labour lie at the heart of productive progress (Smith, 1812; Young, 1928). Smith further states that the level of division of labour is dependent on the extent of the market, in that it is limited by the amount of products produced. This argument was later extended to the industry level by Young (1928). He suggests that the extent of the market is in its turn dependent on the level of division of labour, in that the market is defined by the volume of production. In effect this means that the division of labour builds the foundation for further specialization, making productivity change progressive and cumulative. At the present, with a widened market with more organizations conducting research and more competitive resource allocation, why should this not apply also to the world of academic research? It is not farfetched to think that smaller younger HEIs that narrows their research focus and perhaps also try to occupy a research niche would more easily be able to accumulate talent, gain critical mass and increase reputation. Hence, by specialising their research smaller HEIs would be able to build up a competitive advantage.

7 References

Allison, P. D., J. S. Long and T. K. Krauze, (1982): "Cumulative Advantage and Inequality in Science", *American Sociological Review*, 47, (5): 615-625.

Beise, M. and H. Stahl, (1999): "Public Research and Industrial Innovations in Germany", *Research Policy*, 28: 397-422.

Benner, M. and S. Sörlin (eds) (forthcoming 2008), *Kunskap - Sveriges Framtid?*: SNS, Swedish ["Knowledge - The future of Sweden?"].

[17] For example, just recently an investigation of the economics education found that 17 of 23 HEIs applying to join the new Swedish economics program, all smaller and regional, lacked in research quality within the subject and was therefore denied the program (HSV, 2007)

Bonaccorsi, A. and C. Daraio, Eds. (2007). *Universities and Strategic Knowledge Creation: Specilization and Performance in Europe*, Edward Elgar.

Brändström, D. (2007): "Resurser För Kvalitet", Slutbetänkande av Resursutredningen, SOU 2007:81, Swedish, ["Resources for quality"].

Bush, V. (1945): *Science and the Endless Frontier.* Washington D.C., National Science Foundation.

Cohen, W. M., R. R. Nelson and J. P. Walsh, (2002): "Links and Impacts: The Influence of Public Research on Industrial R&D", *Management Science*, 48, (1): 1-23.

Cole, J. R. and S. Cole (1973): *Social Stratification in Science.* Chicago, The University of Chicago Press.

D'Este, P. and P. Patel, (2007): "University–Industry Linkages in the Uk: What Are the Factors Underlying the Variety of Interactions with Industry?", *Research Policy*, 36, (9): 1295-1313.

David, P. A. (1994). "Positive Feedbacks and Research Productivity in Science: Reopening Another Black Box". In O. Granstrand (Ed.), *Economics of Technology,* North Holland.

Dosi, G., P. Llerena and M. Sylos Labini, (2006): "The Relationship between Science, Technologies, and Their Industrial Exploitation: An Illustration through the Myths and Realities of the So-Called 'European Paradox'", *Research Policy*, 35, (10): 1450-1464.

Geuna, A., (1998): "The Internationalisation of European Universities: A Return to Medieval Roots", *Minerva*, 36, (3): 253-270.

Geuna, A. (1999): *The Economics of Knowledge Production: Funding and the Structure of University Research,* Edward Elgar.

Geuna, A., (2001): "The Changing Rationale for European University Research Funding: Are There Negative Unintended Consequences?", *Journal of Economic Issues*, 35, (3): 607.

Granberg, A. and S. Jacobsson, (2006): "Myths or Reality - a Scrutiny of Dominant Beliefs in the Swedish Science Policy Debate", *Science and Public Policy*, 33, (5): 321-340.

Henrekson, M. and N. Rosenberg, (2001): "Designing Efficient Institutions for Science-Based Entrepreneurship: Lesson from the Us and Sweden", *Journal of Technology Transfer*, 26: 207-231.

Heyman, U. and E. Lundberg (2002): "Finansiering Av Svensk Grundforskning", Vetenskapsrådet, Swedish, ["Funding of Swedish basic research"].

HSV (2007): "Examensrättsprövning För Civilekonomexamen", Report 2007:48 R, Swedish, ["Scrutiny of the right to exam economists"].

Hällsten, M. and U. Sandström (2002): "Det Förändrade Forskningslandskapet", Region- och trafikplanekontorets rapportserie, PM 8, Swedish, ["The changed research landscape"].

Laursen, K. and A. J. Salter, (2004): "Searching Low and High : What Types of Firms Use Universities as a Source of Innovation?", *Research Policy*, 33: 1201-1215.

Lawton Smith, H. (2006): *Universities, Innovation and the Economy.* Routledge.

Mansfield, E., (1995): "Academic Research Underlying Industrial Innovations: Sources, Characteristics, and Financing", *The Review of Economic Statistics*, 77, (1): 55-65.

Mansfield, E. and J. Y. Lee, (1996): "The Modern University: Contributor to Industrial Innovation and Recipient of Industrial R&D Support", *Research Policy*, 25: 1047-1058.

McKelvey, M. and M. Holmén, Eds. (forthcoming, 2008). *European Universities Learning to Compete: From Social Institution to Knowledge Business*, Edward Elgar.

Merton, R. K., (1968): "The Matthew Effect in Science: The Reward and Communication Systems Are Considered", *Science*, 159: 56-63.

Merton, R. K., (1988): "The Matthew Effect in Science, Ii: Cumulative Advantage and the Symbolism of Intellectual Property", *Isis*, 79, (4): 606-623.

Meyer-Krahmer, F. and U. Schmoch, (1998): "Science-Based Technologies: University-Industry Interaction in Four Fields", *Research Policy*, 27: 835-851.

Mohnen, P. and C. Hoareau, (2003): "What Type of Enterprise Forges Close Links with Universities and Government Labs? Evidence from Cis 2", *Managerial & Decision Economics*, 24, (2/3): 133-146.

Salter, A. J. and B. R. Martin, (2001): "The Economic Benefits of Publicly Funded Basic Research: A Critical Review", *Research Policy*, 30: 509-532.

Sandström, U. (1997): "Forskningsstyrning Och Anslagspolitik: Studier I Fou-Handläggning", 1996:2, Swedish, ["Research governance and grant politics: Studies of R&D handling"].

Santoro, M. D. and A. K. Chakrabarti, (2002): "Firm Size and Technology Centrality in Industry-University Interactions", *Research Policy*, 31: 1163-1180.

Schartinger, D., C. Rammer, M. M. Fischer and J. Fröhlich, (2002): "Knowledge Interactions between Universities and Industry in Austria: Sectoral Patterns and Determinants", *Research Policy*, 31: 303-328.

Schartinger, D., A. Schibany and H. Gassler, (2001): "Interactive Relations between Universities and Firms: Empirical Evidence for Austria", *Journal of Technology Transfer*, 26, (3): 255.

Schilling, P. (2005): *Research as a Source of Strategic Opportunity? : Re-Thinking Research Policy Developments in the Late 20th Century.* PhD thesis, Umeå Univ.

Smith, A. (1812): *An Inquiry into the Nature and Causes of the Wealth of Nations.* London, Ward, Lock and Tyler.

SNAHE (2007): "Universitet & Högskolor: Högskoleverkets Årsapport 2007", HSVs rapportserie, 2007:33, Swedish, ["Universities & university colleges: The Swedish National Agency for Higher Education's annual report 2007"].

Sörlin, S. and G. Törnqvist (2000): *Kunskap För Välstånd : Universiteten Och Omvandlingen Av Sverige. Stockholm*, SNS (Studieförb. Näringsliv och samhälle).

Vincent-Lancrin, S., (2006): "What Is Changing in Academic Research? Trends and Futures Scenarios", *European Journal of Education*, 41, (2): 169-202.

Young, A. A., (1928): "Increasing Returns and Economic Progress", *Economic Journal*, 38: 527-542.

Zucker, L. G. and M. R. Darby, (1996): "Star Scientists and Institutional Transformation: Patterns of Invention and Innovation in the Formation of the Biotechnology Industry", Proceedings of the National Academy of Science of the United States of America, 93, (November 12): 709-716.

Zuckerman, H. (1977): *Scientific Elite*, Free Press New York.

8 Appendix: Tables

Table 6: Structural characteristics of the Swedish HEIs

	Age	**Size**		**Research intensity**
HEI	**Found. Year**	**Researchers**	**Professors**	**Students/ Professor**
Lund U	1666	2979	549	48
Uppsala U	1477	2712	447	46
Göteborg U	1891	2127	412	61
Stockholm U	1904	1996	326	73
Karolinska I	1810	1694	286	18
Royal IT	1826	1603	221	53
Umeå U	1965	1495	231	71
Linköping U	1970	1432	238	74
SLU	1977	1344	180	19
Chalmers UT	1829	1279	149	57
Luleå UT	1971	548	81	101
Karlstad U	1977	328	38	222
Örebro U	1965	327	45	212
MittUniversity	1993	293	30	293
Växjö U	1977	290	35	226
Malmö UC	1998	289	37	275
Södertörn UC	1995	274	31	203
Mälardalen UC	1977	265	33	262
Jönköping UC	1977	199	28	236
Kalmar UC	1977	189	23	293
Gävle UC	1977	149	15	532
Blekinge IT	1989	141	19	164
Dalarna UC	1977	136	11	606
Halmstad UC	1983	130	17	322
Stockholm SE	1909	128	40	34
Skövde UC	1977	126	10	401
Borås UC	1977	120	15	399
Kristianstad UC	1977	104	9	670
Väst UC	1990	82	3	2 301
Gotland UC	1998	33	3	517

Table 7: Number of publications

HEI	Total publications	Normalized publications	Total publ/ researcher	Normalized publ/ researcher
Karolinska I	4 987	1 565	37,49624	0,95
Lund U	4 317	1 590	32,45489	0,53
Göteborg U	2 929	1 044	22,0188	0,50
Uppsala U	3 688	1 318	27,7312	0,49
Royal IT	1 336	652	10,04699	0,41
Linköping U	1 234	543	9,278195	0,39
Chalmers UT	1 048	485	7,881579	0,37
SLU	1 312	496	9,866541	0,36
Umeå U	1 258	508	9,458647	0,34
Stockholm SE	101	42	0,317195	0,32
Stockholm U	1 168	550	8,783835	0,28
Örebro U	254	87	1,911654	0,27
Luleå UT	229	122	1,719925	0,23
MittUniversity	86	43	0,644737	0,15
Kalmar UC	61	27	0,456767	0,15
Blekinge IT	38	20	0,287594	0,14
Malmö UC	91	36	0,680451	0,13
Väst UC	24	9	0,178571	0,12
Karlstad U	74	37	0,554511	0,12
Halmstad UC	39	15	0,289474	0,11
Skövde UC	35	14	0,259398	0,11
Jönköping UC	55	19	0,409774	0,10
Dalarna UC	24	11	0,178571	0,09
Växjö U	45	24	0,338346	0,08
Kristianstad UC	18	8	0,135338	0,08
Gävle UC	25	11	0,18985	0,08
Södertörn UC	59	21	0,445489	0,08
Borås UC	19	9	0,144737	0,08
Gotland UC	5	2	0,037594	0,08
Mälardalen UC	48	19	0,359023	0,08

Table 8: Share of research subjects comprising more than a specific number of researchers and professors

	Share of RAs with # of researchers				Share of RAs with # of professors	
HEI	**>5**	**>10**	**>20**	**>50**	**>1**	**>5**
Karolinska I	0,93	0,92	0,85	0,83	0,95	0,83
Uppsala U	0,93	0,81	0,61	0,31	0,95	0,48
Lund U	0,85	0,75	0,63	0,36	0,94	0,53
SLU	0,84	0,75	0,67	0,64	0,79	0,65
Göteborg U	0,91	0,73	0,57	0,27	0,90	0,44
Chalmers UT	0,81	0,73	0,70	0,50	0,79	0,60
Stockholm U	0,78	0,67	0,57	0,22	0,90	0,43
Royal IT	0,74	0,65	0,57	0,50	0,77	0,54
Umeå U	0,76	0,60	0,42	0,11	0,72	0,29
Linköping U	0,75	0,58	0,42	0,12	0,77	0,29
Stockholm SE	0,71	0,54	0,36	0,18	0,82	0,39
Örebro U	0,64	0,41	0,08	0,00	0,65	0,01
Växjö U	0,54	0,41	0,10	0,00	0,57	0,04
Luleå UT	0,52	0,38	0,31	0,18	0,59	0,22
Karlstad U	0,60	0,36	0,12	0,00	0,58	0,00
Södertörn UC	0,59	0,32	0,19	0,05	0,60	0,05
MittUniversity	0,56	0,30	0,08	0,00	0,46	0,01
Mälardalens U	0,55	0,28	0,10	0,00	0,47	0,03
Jönköping U	0,35	0,20	0,07	0,00	0,47	0,01
Malmö UC	0,43	0,17	0,08	0,03	0,35	0,05
Blekinge IT	0,37	0,15	0,05	0,05	0,44	0,04
Skövde UC	0,28	0,13	0,04	0,00	0,24	0,00
Gävle UC	0,43	0,12	0,00	0,00	0,30	0,00
Kalmar UC	0,31	0,10	0,04	0,01	0,33	0,03
Borås UC	0,31	0,08	0,04	0,00	0,33	0,00
Kristianstad UC	0,30	0,06	0,03	0,00	0,26	0,00
Halmstad UC	0,38	0,05	0,03	0,00	0,35	0,02
Gotland UC	0,22	0,04	0,00	0,00	0,24	0,00
Dalarna UC	0,25	0,04	0,00	0,00	0,18	0,00
Väst UC	0,26	0,03	0,00	0,00	0,08	0,00

Table 9: University code

University name	University code
Blekinge IT	BTH
Borås UC	HB
Chalmers UT	CTH
Dalarna H	Hda
Gotland UC	HG
Gävle UC	HiG
Göteborg U	GU
Halmstad UC	HH
Jönköping UC	HJ
Kalmar UC	HK
Karlstad U	KaU
Karolinska I	KI
Kristianstad UC	HKr
Linköping U	LiU
Luleå UT	LUT
Lund U	LU
Malmö UC	MaH
MittUniversity	MiU
Mälardalen UC	MdH
Royal IT	KTH
Skövde UC	HS
SLU	SLU
Stockholm SE	HHS
Stockholm U	SU
Södertörn UC	SH
Umeå U	UmU
Uppsala U	UU
Väst UC	HV
Växjö U	VxU
Örebro U	ÖU

Table 10: External research funding in the 7 categories [1000 SEK]

HEI	Research councils	New foundations	Foundations	Gov & EU	Other	Contract	Industry
Karolinska I	220 523	76 654	140 462	277 529	399 143	98 394	301 410
Lund U	321 508	119 754	117 389	465 005	254 707	52 770	133 884
Uppsala U	289 815	101 708	134 850	267 911	117 427	82 845	156 805
Göteborg U	180 624	62 130	92 766	295 226	213 111	110 283	96 560
Royal IT	165 615	117 764	58 886	409 181	77 373	25 163	153 523
Chalmers UT	134 752	125 818	30 518	285 239	219 831	37 366	98 654
Stockholm U	171 926	21 522	56 168	246 454	47 963	46 371	30 209
SLU	24 565	64 366	7 209	319 786	104 320	63 451	33 017
Umeå U	102 953	18 987	48 072	195 773	63 889	97 642	34 557
Linköping U	101 027	65 428	29 560	204 124	47 700	57 238	49 506
Södertörn UC	8 370	131 427	1 879	50 159	2 813	5 268	38
MittUniversity	2 755	24 058	729	76 783	13 038	1 938	13 311
Karlstad U	6 785	17 890	859	32 741	9 223	22 155	7 583
Örebro U	9 824	17 028	3 812	34 138	2 025	6 174	3 389
Mälardalen UC	2 882	13 790	470	30 913	4 404	3 382	9 859
Växjö U	2 661	6 179	589	19 710	6 344	21 362	2 431
Malmö UC	8 082	8 162	365	25 848	5 333	6 091	5 031
Jönköping UC	1 867	4 436	809	17 859	8 732	12 210	9 247
Kalmar UC	5 609	9 430	48	14 693	14 530	604	2 669
Blekinge IT	713	11 777	0	16 336	6 775	1 638	716
Gävle UC	766	5 753	684	20 482	1 766	3 362	2 747
Halmstad UC	698	10 960	111	12 332	2 501	2 065	4 060
Dalarna UC	374	6 493	0	13 672	136	1 405	7 381
Väst UC	151	7 104	27	9 292	3 865	419	1 182
Borås UC	524	5 132	0	6 514	6 074	542	637
Skövde UC	241	8 682	297	6 734	2 141	0	1 103
Kristianstad UC	2 031	3 683	264	3 778	831	2 213	579
Gotland UC	482	1 444	101	2 151	3 166	0	0
Luleå UT	15 322	14 977	148	130 558	33 954	31 256	64 296
Stockholm SE	4 249	516	8 442	13 402	27 790	10 361	32 510
Total	*1 787 694*	*1 083 051*	*735 516*	*3 504 324*	*1 700 907*	*803 967*	*1 256 893*