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A COMPARATIVE SURVEY

OF STRUCTURAL CHARACTERISTICS

OF FINNISH UNIVERSITY DEPARTMENTS

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ABSTRACT: This descriptive paper analyses structural characteristics of Finnish university departments (FIDs) and benchmarks them against foreign university departments from Scandinavia, the UK and the US (FODs). In the first place the study aims to reveal information on differences in department size. In addition, the analysis pays attention to internationalization, study times and the level of business activities at different university departments. The paper is based on new survey data that distinguish between the national rankings of the university departments and between the department fields. The first finding shows that FIDs are small. This finding seems to hold irrespective of the department field. The second finding shows that the best departments tend to be bigger than the rest. The third result shows that FIDs have low shares of foreign students. Finally the results show that the faculty of Finnish university departments is relatively well involved in business creation.

KEYWORDS: Universities, University departments, Research, Education, Innovation

JEL-codes: I23, I28, O31, O38

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TIIVISTELMÄ: Tässä kuvailevassa tutkimuksessa tarkastellaan valittujen tieteenalojen laitoksia suomalaisissa yliopistoissa ja verrataan niitä vastaaviin ulkomaisten yliopistojen laitoksiin pohjoismaissa, Iso-Britanniassa ja Yhdysvalloissa. Ensisijaisesti tutkimus tuottaa tietoa laitosten kokoeroista. Lisäksi tutkimuksessa tarkastellaan kansainvälistymistä, toteutuneita opiskeluaikoja ja tutkimuksen kaupallistamiseen liittyvää toimintaa. Tutkimus perustuu uuteen kyselyaineistoon, jossa laitokset on mahdollista erotella sekä tieteenalan että kansallisen paremmuusjärjestyksen mukaan. Tulokset osoittavat, että suomalaisten yliopistojen laitokset ovat suhteellisen pieniä tieteenalasta riippumatta. Ulkomaisten opiskelijoiden ja vaihto-opiskelijoiden osuus on myös verrattain pieni. Tulosten mukaan paremmin menestyvät laitokset ovat tyypillisesti suurempia kuin saman maan muut laitokset. Lisäksi havaitaan, että tutkijat suomalaisissa yliopistoissa osallistuvat suhteellisen aktiivisesti tutkimuksen kaupallistamiseen tähtäävään toimintaan.

AVAINSANAT: Yliopisto, yliopiston laitos, tutkimus, koulutus, innovaatio

JEL-koodit: I23, I28, O31, O38

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1. Introduction

High quality research is an important driver for innovative activities fueling economic growth and welfare. In this respect the role of universities is to carry out research so as to be able to expand the knowledge circle. In addition, universities aim at spreading (new) knowledge by educating people and by transferring knowledge to different economic actors. As such they form a key building block of the national innovation system. But what makes certain universities shift the knowledge edge further than others - or rephrased - which factors drive the quality of research undertaken at universities? This question has been asked by several countries in their quest to create and or maintain the right innovation environment. In recent years Finnish policymakers have also increasingly paid attention to the above issue.

When looking at recent global rankings of universities Finland not only lags behind the US but also behind Switzerland, the UK, the Netherlands and their Scandinavian neighbours (Aghion, Dawatripont et al. 2007). In order to close the gap with these countries Finland is forced to reform its universities so as to bundle efforts to produce better quality research. In recent years several important reforms have already been undertaken and the reformed Universities Act was enacted in September 2009. One of the weaknesses of the Finnish university system often mentioned is that there are too many small university departments that overlap. This paper presents detailed data on the structural characteristics of *Finnish university departments* (FIDs). This evidence should form a good starting point for the evaluation of the current state of the system.

This descriptive paper addresses the questions: what are the structural characteristics of FIDs and how do they differ from foreign university departments (FODs)? The main focus of the analysis is on the size characteristics of the university departments. Size is assessed both in terms of staff and student intake. The analysis also looks at how internationalized university departments are, how quickly students obtain their degrees, and how much the departments are involved in business creation. Results are based on new survey data obtained from university department heads from seven selected fields[1]. Finnish 2008 data is compared with those of the US, UK and Scandinavia. The data allows a distinction to be made not only between countries and department fields, but also between the national rankings of the departments.

The contribution this analysis makes is threefold. The analysis is carried out at the university department level and not, as is usually the case, at the university level or a broader level, because there can be much heterogeneity between the departments

[1] The KOTA database (KOTA 2009) focuses on broader fields (Natural Sciences, Engineering, Psychology, Humanities, etc.) rather than on the department level. For the purposes of this paper the focus on departments rather than on broader fields is crucial and makes international comparison easier. In addition the KOTA database uses only aggregate measures when it comes to the number of research staff and has no information on business creation.

within a university. The focus is mainly on departments that play an important role in the Finnish National Innovation System. The second new aspect in the approach is that FIDs are directly compared with *FODs (Foreign university departments)* in order to better understand the characteristics of the FIDs. The last contribution lies in comparing the best departments in the sample with the rest of the departments.

The remainder of the paper is structured as follows. The next chapter describes the data. Chapter 3 presents the major set of descriptive results on the size of the university departments. The size is assessed along two dimensions: the number of staff (3.1) and the number of students (3.2). Chapter 4 presents the second set of results and covers the internationalization of FIDs (4.1), the average study times (4.2) and the business creation activities (4.3) at the department level. Part 5 concludes by discussing the overall results.

2. Data

This paper uses unique data on the structural characteristics of FIDs. The information collected relates to the size, internationalisation, average graduation times and business creation activities of university departments. Data on size contains detailed information on both the number of staff and students. Questions on the number of staff distinguish between senior professors (tenured professors), junior professors (tenured-track professors) and Ph.D. level researchers on outside funding. The survey results also provide information on the number of foreign staff and students. Questions on the number of students and the average time to obtain a degree distinguish between Bachelor's students, Master's students and Ph.D. students. All the above questions concern 2008 figures. The last question on business creation relates to the number of faculty involved in business creation during the last five years (the full questionnaire can be consulted in appendix 1).

Table 1 Number of university departments surveyed and their response rates by country.

Country	# Surveys send out	# Completed surveys	Response rate
Denmark	8	3	38 %
Finland	70	49	70 %
Norway	8	4	50 %
Sweden	27	12	44 %
UK	24	11	46 %
US	32	16	50 %
TOTAL	169	95	56 %

Note: The response rate for the Scandinavian departments is 44.2% (19 out of 43 departments).
Source: Etlatieto Oy.

The questionnaire was sent to 169 university departments. The response rate for the survey was 56% with individual country response rates ranging from 38% (Denmark) to 70% (Finland) (see table 1 for more details). The survey was sent via a personalized email March to May 2009 and followed by 2 reminders. Answers were

provided by department heads or their administration either via email or an online survey using webropol's software.

In the first stage the survey was sent to the heads of all FIDs in 7 selected fields (see table 2). Five of the selected fields are active research areas that can play an important role in the creation of innovation (Mathematics, Physics, Chemistry, Electrical Engineering, Computer Sciences) whereas two additional department fields were used for comparison (History and Psychology).To be able to trace the best departments of the Nordic countries, the Finnish department heads were also asked to name the best Nordic departments in their field[2]. This additional question for the Finnish department heads allows for a distinction between the best Finnish departments and the other Finnish departments.

Table 2 Coverage of surveyed department fields by Finnish universities and response rates by university and department field.

Department field	Engineering	Mathematics	Physics	Chemistry	Computer Science	History	Psychology	Response rate	TOTAL*
University									
University of Helsinki	0	X	X	X	X	X	X	100 %	6
University of Joensuu	0	X	X	X	X	X	X	83 %	6
University of Jyväskylä	0	X	X	X	X	X	X	50 %	6
University of Kuopio	0	X	X	X	X	0	X	80 %	5
University of Oulu	X	X	X	X	X	X	0	50 %	6
University of Tampere	0	X	0	0	X	X	X	60 %	4
University of Turku	0	X	X	X	X	X	X	71 %	6
University of Vaasa	X	X	0	0	X	0	0	67 %	3
Åbo Akademi University	0	X	X	X	X	X	X	60 %	6
Helsinki University of Technology	X	X	X	X	X	0	0	67 %	5
Lappeenranta University of Technology	X	X	X	X	X	0	0	50 %	5
Tampere University of Technology	X	X	X	X	X	0	0	100 %	5
Response rate	71 %	58 %	60 %	71 %	73 %	57 %	86 %	70 %	
TOTAL number of universities covering the field	5	12	10	10	12	7	7		63

Note: 0 means the selected university does not cover that particular department field whereas X means the university does cover the department field; * Total number out of the 7 fields covered by the survey that the selected university covers.
Source: Etlatieto Oy.

In addition, the same questionnaire was sent to selected departments in the US, the UK and Scandinavia (Norway, Sweden, Denmark). The selection of the FODs in the US and the UK was based on a ranking (see appendix 2) whereas the Scandinavian departments were selected by the Finnish department heads (see above). The selection approach for Scandinavian departments was motivated by a lack of national rankings at the department level. For the US the numbers 1, 10, 20, 50 of the university U.S. News Rank 2009 (U.S.NewsRank 2009) were selected so as to be able to capture distributional characteristics of the ranking. A similar approach was applied to the UK for which the numbers 1, 10, 20 of the RAE 2008 ranking (RAEranking 2008) were selected. This approach certainly has limitations in the sense that the same selection method for each country is not used in the sample. But to the best of our knowledge, there is no global ranking that looks at the department level rather than at the university level. The comparison of different rankings is a reason to

[2] Answers of respondents accrediting their own department as the best were omitted to obtain maximum reliability.

interpret the results with care. An overview of the descriptive statistics of the survey data is presented in table A.3. Having introduced the data the next two sections will focus on their analysis and on summarizing the main results.

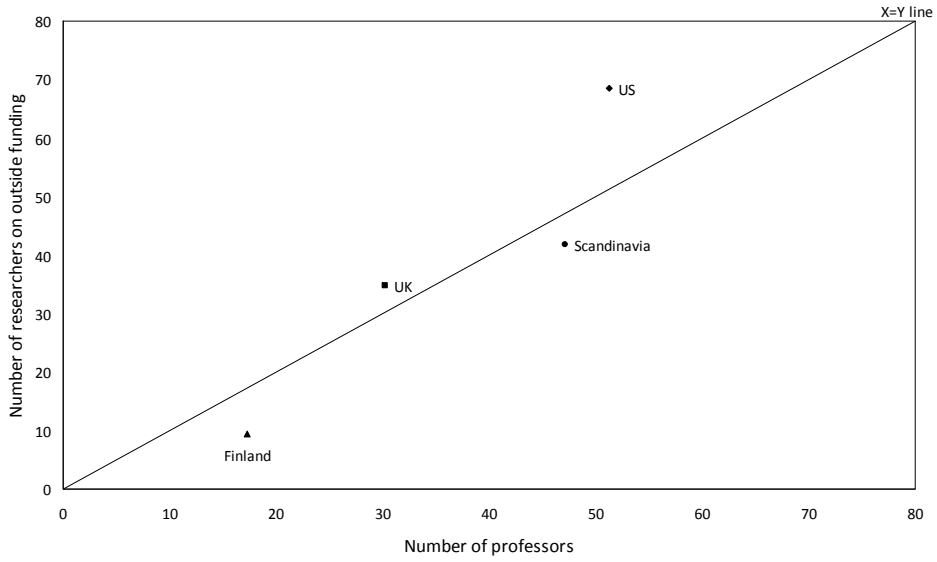
3. Size of the university departments

This section focuses on the main topic of the paper and analyses the size differences between FIDs and FODs. The size dimension is first assessed by looking at the number of staff and subsequently by analysing the number of students. In addition, the size of university departments is assessed by taking into account the distribution of national department rankings. A final approach looks at department size by department field.

3.1 Size assessed by the number of staff

An obvious way to capture department size is to look at the number of staff. The data contains detailed information on the number of research personnel, a proxy for the amplitude of the research activities of a department. Department personnel with a Ph.D. degree can either be part of the faculty or be on outside funding. Figure 1 plots the average number of professors and the number of Ph.D. level researchers on outside funding. The graph shows the average department size for each country in the sample.

Figure 1 Average size of university departments according to the number of research staff (2008)



Note: The number of professors includes the number of junior and senior professors while the number of researchers on outside funding only refers to Ph.D. level researchers. The departments in Scandinavia were selected by Finnish department heads as being the best Scandinavian departments in their field. Source: Etlatieto Oy.

The first finding is that FIDs are small in comparison with FODs. The average Finnish department size is by far the smallest of the countries represented in the sample. Indeed, the department size gap between Finland and other countries in the sample holds both for the UK and Scandinavia and is even more pronounced for the US. The above figure also highlights the fact that on average the UK and the US departments in the sample (situated above the x=y line) have more researchers on outside funding than professors whereas the opposite holds for the Nordic countries. US departments, in particular, seem to have relatively more researchers on outside funding than faculty.

3.2 Size assessed by the number of students

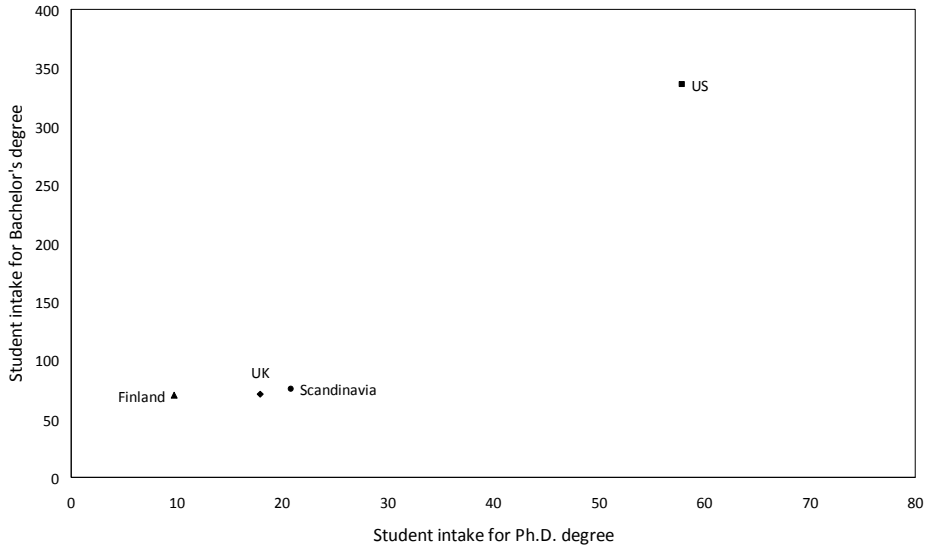
The survey data also allows the department size to be assessed by using information on the number of students[3]. The data distinguishes between the number of Bachelor's, Master's and PhDs either entering a department or obtaining a degree in 2008. The number of students is assessed by looking at the number of students who enter undergraduate and graduate schools. In the sample the focus on students who enter the system is expected to return more reliable results than focusing on students who obtain a degree. Indeed, in 2008 the Finnish university system produced an exceptionally high number of degrees as students, who started their undergraduate studies before the adoption of the new Bachelor's-Master's structure, got the last opportunity to graduate within the old undergraduate framework. Aggregate data shows that between 2007 and 2008 the number of Master's and Bachelor's degrees jumped roughly 60 percent (35%) due to this imposed deadline to graduate (KOTA 2009). According to a second source, the number of degrees was 71% higher than the year before (StatisticsFinland 2009). Therefore, the survey data on the number of Bachelor's and Master's degrees must be interpreted with care. The figures obtained on the number of new students (student intake), however, are not exceptional compared to previous years (KOTA 2009).

Using the number of students as a measure for size gives the same result as using the number of staff: FIDs are small in comparison with FODs. Figure 2 shows proxies of the average department size per country by plotting the average inflow of Ph.D. students and Bachelor's students in 2008. The average Finnish university department has the smallest number of Ph.D. students. Both the Scandinavian and UK departments have on average twice as many new Ph.D. students than the average Finnish department. The average U.S. department has six times more Ph.D. students than the average Finnish department. Repeating this comparison based on the number of new Bachelor's students confirms the size difference between the FIDs and university

[3] Not each country in the sample has the same university degree system. It is further noted that in the UK there are two kinds of Master's programmes, an undergraduate "integrated" Master of Engineering (MEng) programme and a 1-year postgraduate Master of Science (MSc) programme. In the US the most traditional (undergraduate) degree given by colleges and universities is the Bachelor's degree involving 4 to 5 years of full-time course-work. After obtaining a Bachelor's degree students can either follow a Master's degree programme that takes roughly 2 years or a Ph.D. degree programme that normally takes 3 to 6 years. People who have already completed a Master's programme may be allowed to do less coursework for the Ph.D. programme.

departments of the U.S. but also reveals that in the sample FIDs are comparable to university departments from the UK and Scandinavia[4].

Figure 2 Average size of university departments according to the number of new students (2008).



Note: For the US the average number of student intake for the Bachelor's degree is based on a ranking of graduate schools and not all graduate schools offer under-graduate studies. Source: Etlatieto Oy.

Overall, the conclusion is that FIDs are small compared to FODs. In comparison to the U.S. this result holds along all four dimensions of size considered (number of professors, number of researchers on outside funding, number of new Ph.D. students number of new Bachelor's students). But compared to the other European departments in the sample the result obtained holds for only three out of four size dimensions. Indeed FIDs do not seem to be smaller than Scandinavian and UK departments when assessing size by the number of new Bachelor's students.

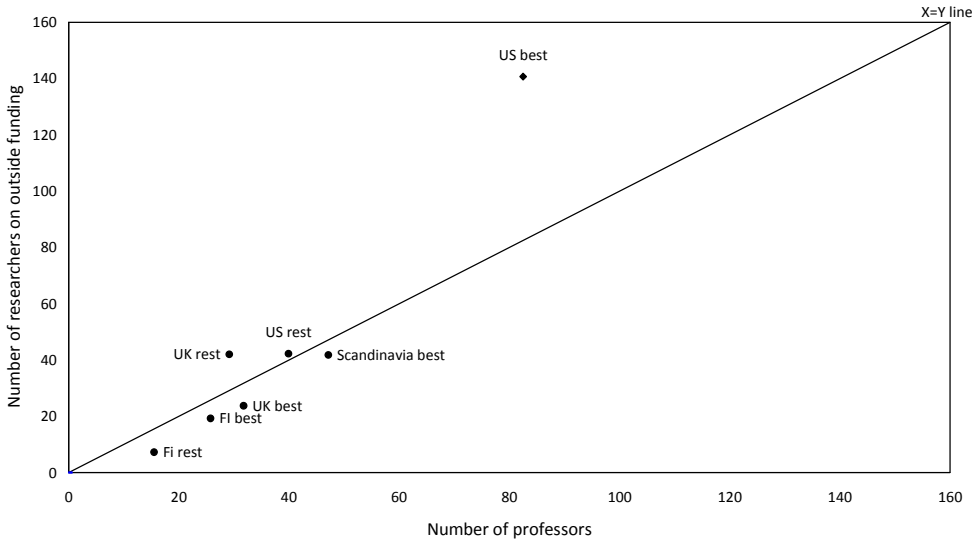
3.3 Size assessed by department quality

The data indicates that the best departments tend to be bigger than the rest of the departments. Indeed, there is a positive correlation between the size and ranking. But the results (figure 3) seem to vary by size measures used and the evidence shows that the relationship between size and quality is not linear (figure 4).

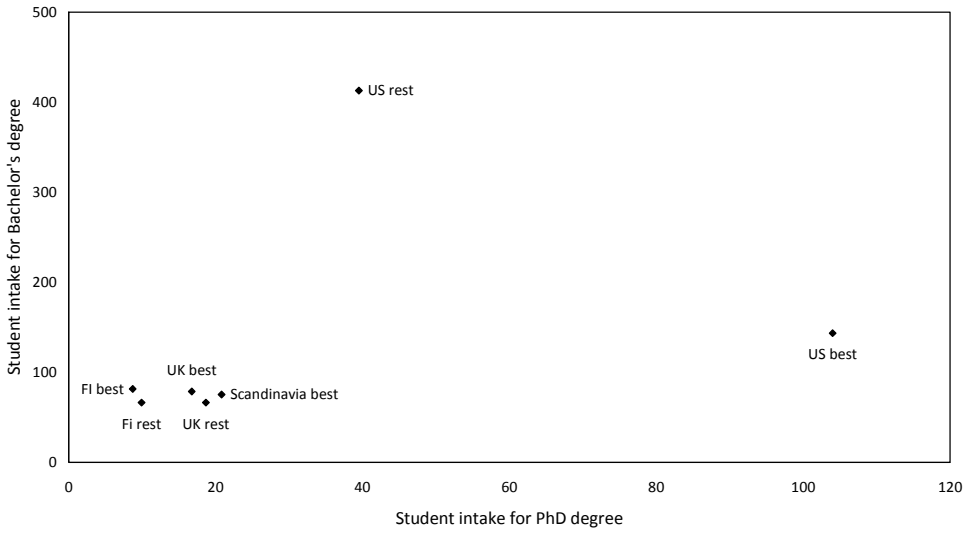
[4] It is difficult to verify this finding, because other available data cannot be directly compared. In the case of the UK the average figure on the number of new Bachelor's students must be interpreted with care because it is based on a small number of observations. It may further be informative to report entry rates to tertiary education from the OECD. For 2007 Finnish entry rates are higher than those for the UK (55%), Denmark (57%) and Norway (66%) but lower than those for Sweden (73%). Figures on the number of staff (instructional personnel) per 1000 students in tertiary education show that Finland (60.1) seems to have relatively more staff than the UK (56.9) but fewer than the US (66.1) and Sweden (114.2) (OECD, 2009).

Figure 3 Best departments versus the rest: average size of university departments (2008).

3.1 Department size measured by the number of staff



3.2 Department size measured by the number of students



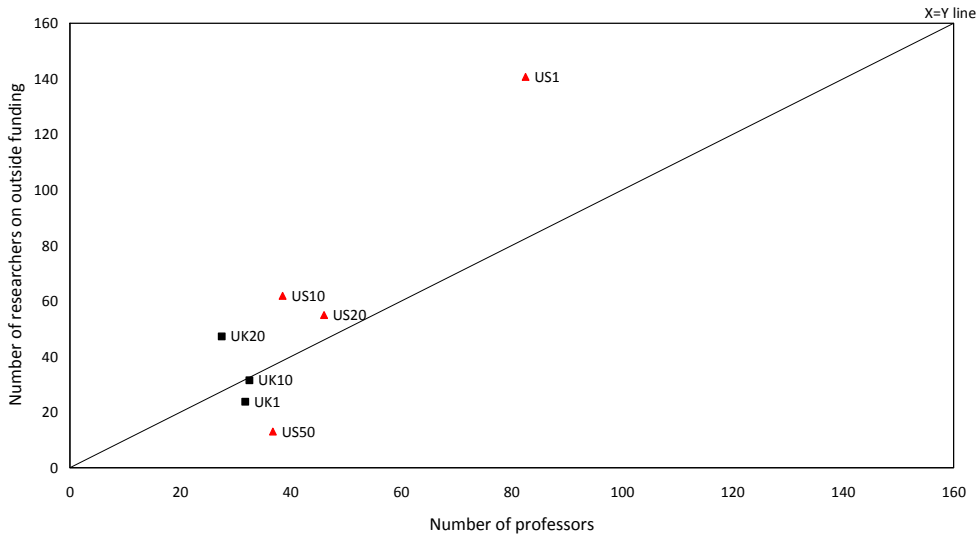
Source: Etlatieto Oy.

Figure 3 shows the difference between the best departments and the rest of the departments along the four size measures that were introduced before. The upper part of the figure shows that the best departments are bigger than the rest of the departments when size is measured by the number of professors per department. The same result holds when size is measured by the number of researchers on outside funding, except for the UK, where the opposite holds. The size gap between the best U.S. departments and the rest of the U.S. departments is impressive with the average department being 2 (number of professors) to 3.5 (number of researchers on external financing) times bigger than the rest. Finally, it was found that the best departments in both the US and the UK have a significantly higher number of tenured-track-faculty per department than the other US/UK departments (not shown in figure 3).

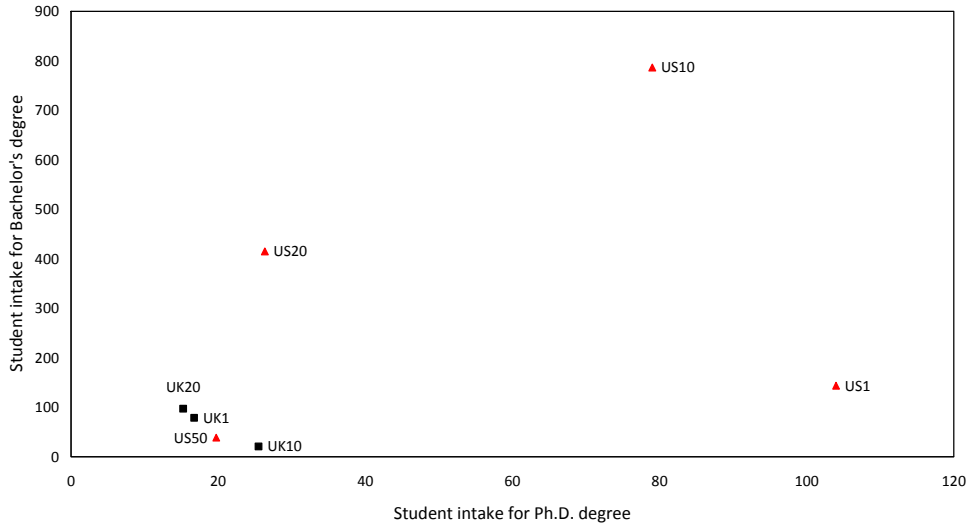
But the picture becomes less clear when size is assessed by the number of students. Results for the U.S. are straightforward as the best graduate schools in the U.S. have two to three times more new Ph.D. students than the other graduate schools while they have three times fewer new Bachelor's students. Results for other countries in the sample are less clear-cut although it seems that the opposite relationship holds for Finland and the UK, where the best departments have (slightly) more Bachelor's students and slightly fewer Ph.D. students.

Figure 4 Average size of university departments by ranking (2008).

4.1 Department size measured by the number of staff



4.2 Department size measured by the number of students



Source: Etlatieto Oy.
Note: UK1 (US1) represents the best departments of the UK (US). Other values represent the 10th (UK10, US10), the 20th (UK20, US20), or the 50th (US50) best departments in the UK or the US. Results are based on the 2008 rankings of RAE for the UK and of the U.S. News Rank for the US.

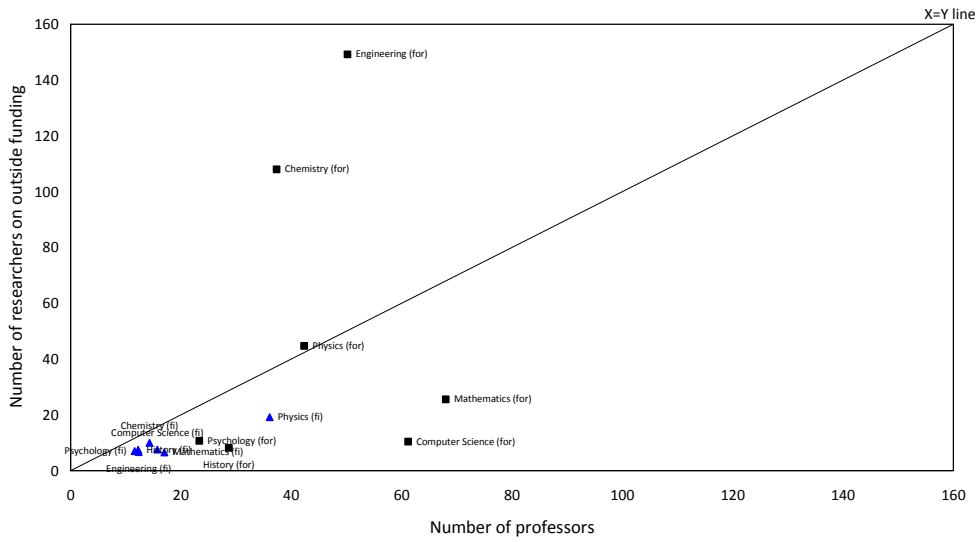
From the previous graphs it could be deducted that the direction of the relationship between the size and the quality of the university departments depends on the size measure used and on the country considered. Plotting the average department size per ranking reveals additional information on the relationship between department size and ranking and shows that that the relationship is not linear (see figure 4). Although size definitely seems to matter, one can not conclude that the bigger the department, the better its quality. An appropriate conclusion is that the best departments tend to be bigger.

3.4 Size assessed by department field

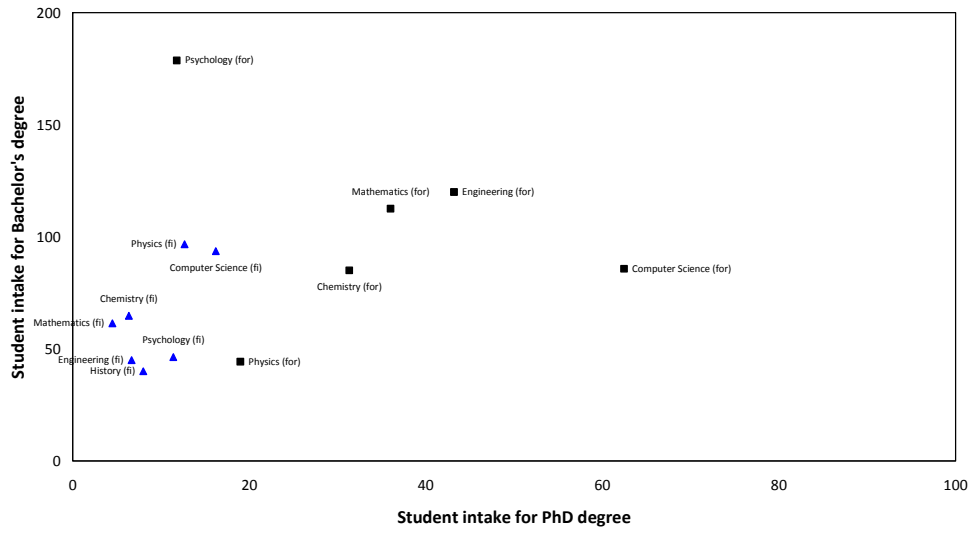
The final result reveals that Finnish university departments are small, irrespective of the department field. The variation in department size between different fields is

Figure 5 Average size of university departments by field (2008).

5.1 Department size measured by the number of staff



5.2 Department size measured by the number of students



Source: Etlatieto Oy.

smaller in Finland than abroad, and only in the case of Computer Science and Physics FIDs seem to approach the size (number of new students and/or number of staff) of the FODs in the sample.

Figure 5 further shows that within the foreign departments mathematics and computer science have most of the professors and engineering and chemistry departments have most of the researchers on outside funding. Measuring size of FODs by the number of students reveals that computer science has remarkably more Ph.D. students than any other field. The biggest fields when it comes to the number of Bachelor's are history and psychology.

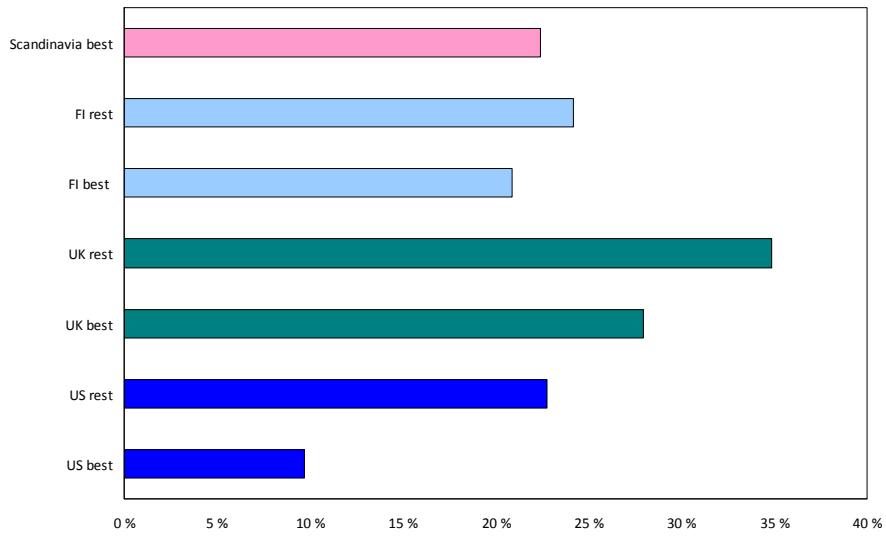
4. Other structural characteristics

4.1 Internationalization

The survey also collected information on the level of internationalization of the university departments. Figure 6 shows the average level of internationalization of university departments by country using the share of foreign faculty as a proxy. Finnish university departments in the selected fields report having rather high shares of foreign faculty (20% to 25%). Two possible explanations for those high shares are that the 7 selected department fields are more internationalized than the average field and that the shares of international faculty may have picked up in recent years.

The presented shares for FIDs are in line with those of Scandinavia and the US and are only slightly under those of the UK. The results should be interpreted with caution. The first factor that certainly influences the results is that "foreign" could have been interpreted in different ways. It can either mean "foreign born" or "having foreign nationality". For this reason, in particular, the results for the US may not be reliable, because they do not seem to take into account foreign-born faculty that (recently) obtained U.S. citizenship. Indeed, according to a new report from the National Science Board foreign-born scientists and engineers were 28% of all full-time doctoral Science and Engineering (S&E) faculty in 2003. In the physical sciences, mathematics, computer sciences, and engineering, 47% of full-time doctoral S&E faculty in research institutions were foreign born (National Science Board 2008). The figures for the other countries in the sample seem to be more credible.

Figure 6 Share of number of foreign faculty staff to total number of professors (averages)

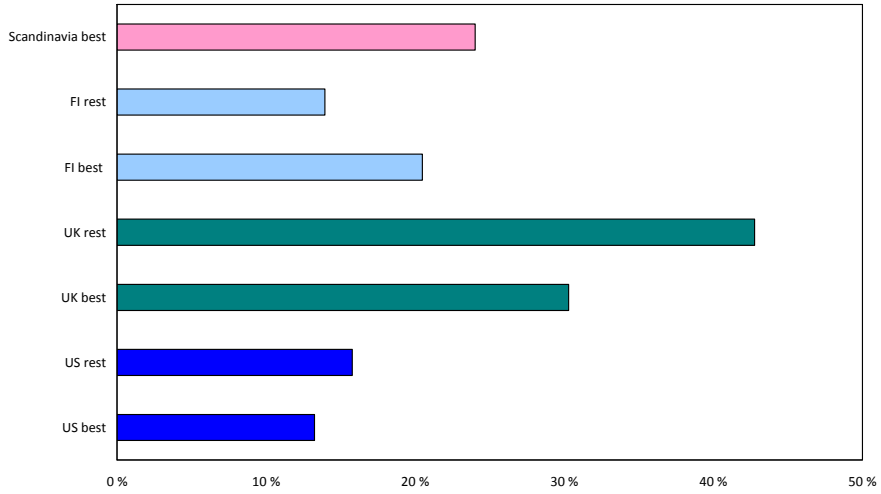


Source: Etlatieto Oy.

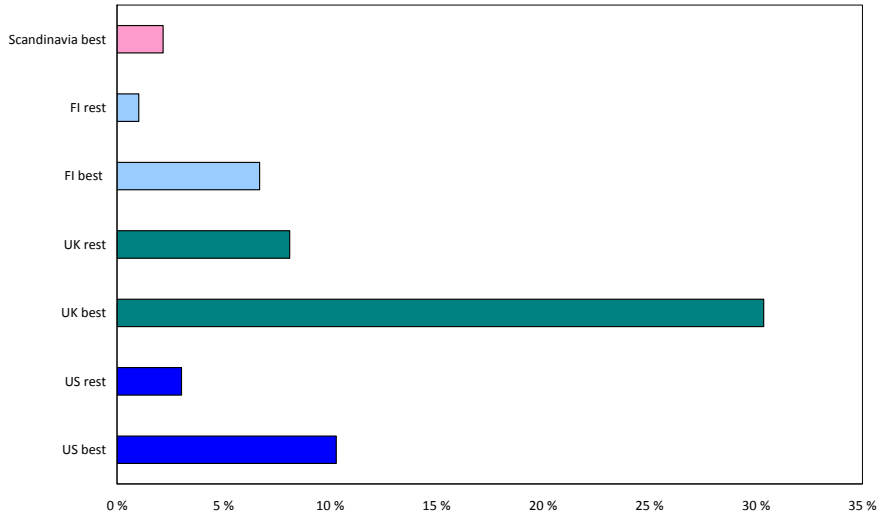
But assessing the internationalization of the university departments by looking at the shares of foreign students clearly shows that Finland does not score well, especially when it comes to the share of foreign undergraduate students. Figure 7 presents the share of foreign students to the total number of students in order to approximate the internationalisation of the Finnish university system. However, the shares must be interpreted with care because they are calculated based on the total number of new students in 2008, the average study times and the number of foreign students[5].

Figure 7 Share of foreign students to the total number of students

7.1 Share of foreign PhD students to total number of PhD students



7.2 Share of foreign Bachelor students to total number of Bachelor students



Source: Etlatieto Oy.

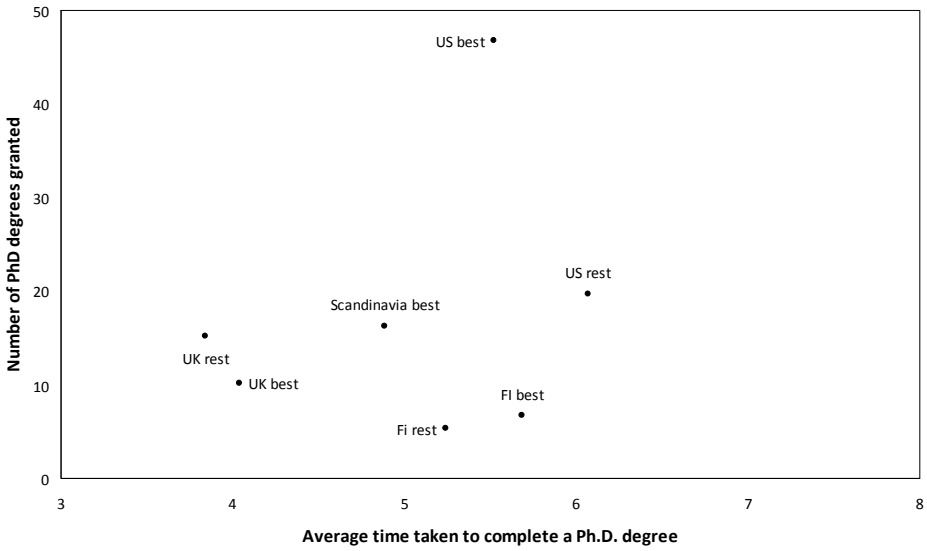
[5] The OECD reports the aggregate share of foreign students in tertiary education to be 7.4% in 2007. Finnish universities have been characterized by low levels of internationalization although according to certain indicators the situation may recently have started to change. Between 2004 and 2007 the number of foreign students in tertiary education in Finland increased by roughly 25%, while the total number of students in tertiary education rose by only 3%. Source: OECD Statistics.

Overall, the shares of foreign students in Finnish universities turn out to be low. This holds for Ph.D. level students, but is more obvious for Bachelor's students (and Master's students). As noted earlier figures for the U.S. should be interpreted carefully, because there is a difference between foreign and foreign born. From the National Science Board we know that in 2005 Science and Engineering (S&E) graduate students on temporary visas comprised 25% of all S&E graduate students. Foreign students make up a much higher proportion of S&E Master''s degree recipients than they do of Bachelor's or associate's degree recipients. The share of S&E Master''s degrees earned by temporary residents was 28% (National Science Board 2008).

4.2 Average study time

This section focuses on the average time a student needs to complete a degree[6]. This additional information is highly relevant when assessing Finnish university departments, because one of the weak spots in the Finnish university system has been that university students take a long time to graduate. This section offers more detailed information on the time Finns take to obtain their university degrees.

Figure 8 Average study time of Ph.D.'s versus the average number of Ph.D. degrees granted (2008).



Source: Etlatieto Oy.

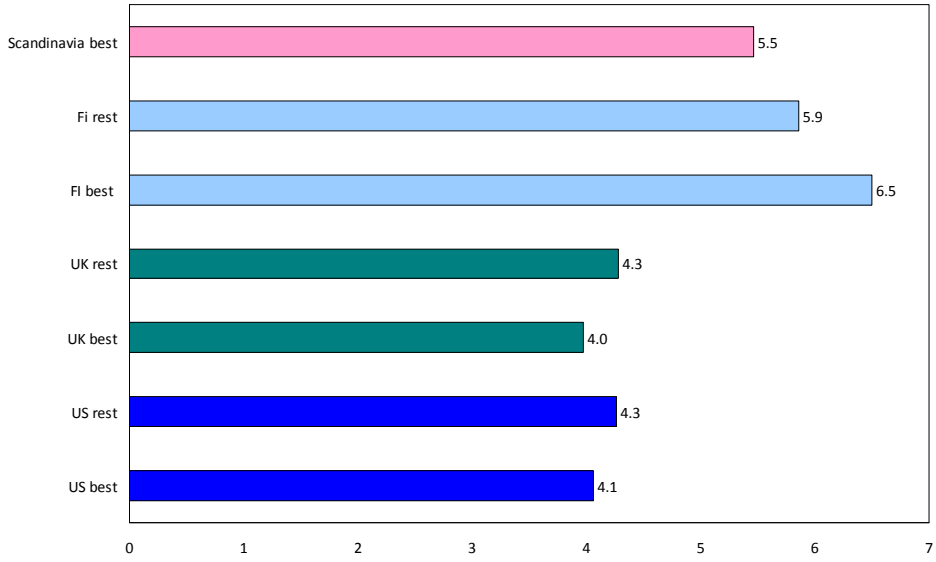
Finnish university departments report it takes on average 5.2 years (rest) to 5.7 years (best) to obtain a Ph.D. degree. This figure is lower than the ones for the U.S (5.5 to 6.1) but is clearly higher than figures for the UK (3.8 to 4) and slightly higher than the figure for Scandinavia (4.9). The figure further shows that the relationship

[6] Unlike the KOTA database this analysis reports averages and not medians for study times. Averages have the advantage that they take into account the outliers and were believed to be easier to obtain from the respondents.

between the time it takes to obtain a degree and the quality of the university (rank1 versus the rest) can either be positive (FI and UK) or negative (US).

For the sake of comparability between countries and because 2008 was an exceptional year this section will not include the number of Master's and Bachelor's degrees granted in a plot similar to figure 8 but rather focus on the average times it takes to complete undergraduate studies in each country represented in our sample. This approach is not waterproof either but seems to be a good starting point for comparison.

Figure 9 Average time (in years) to complete a standard* university degree (2008).



Source: Etlatieto Oy. Note: Standard degree refers to undergraduate studies: for Scandinavia, Finland and the UK it refers to Master's degrees, for the U.S. to Bachelor's degrees (see variable q152 in Appendix 1).

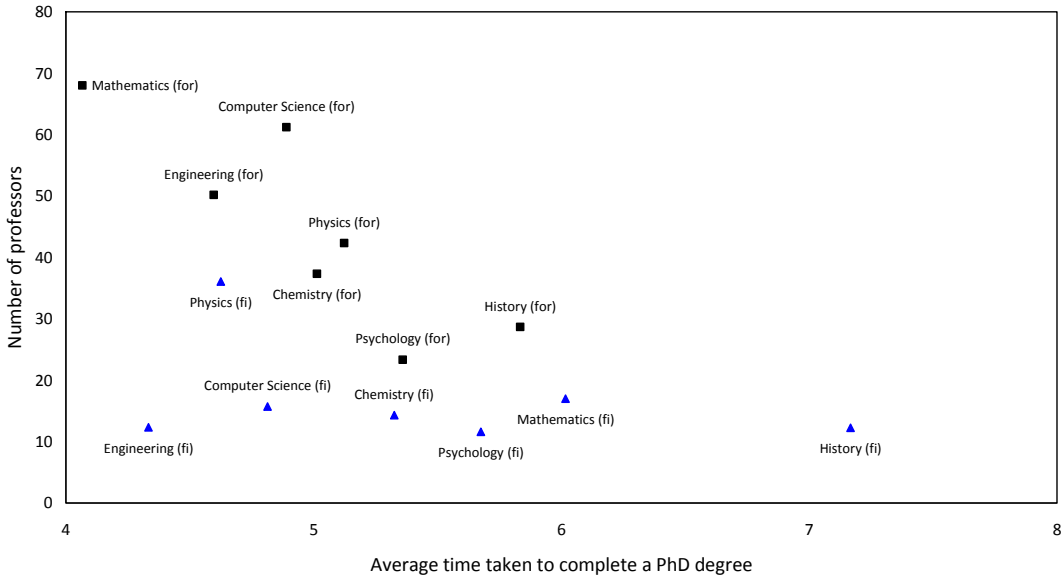
To complete undergraduate studies in Finland takes on average 6 years (see figure 9). In Scandinavia this takes about 6 months less than in Finland but in the case of the UK and the US the gap rises to 2 years. So Finns need on average 1.5 times more time than Americans to complete their undergraduate studies. This finding is in line with the common perception that obtaining a degree in Finland takes longer than in other countries. The reason for that may lie in Finland having a flexible system that allows a combination of studying and working (full or part-time). The Finnish state supports students financially by covering part of their costs for housing and living. Adding an additional income from part-time work to the public financial support allows students to cover most of their expenses and may also explain the high share of students working part-time. A rather awkward result shows that the best Finnish universities have higher average study times than the rest of the Finnish universities. This holds for the selected departments in 2008 and could not be verified with data from the KOTA database.

Turning to the average times to obtain a degree per field shows that there is much variation between fields. Figure 10 shows that depending on the field FIDs perform

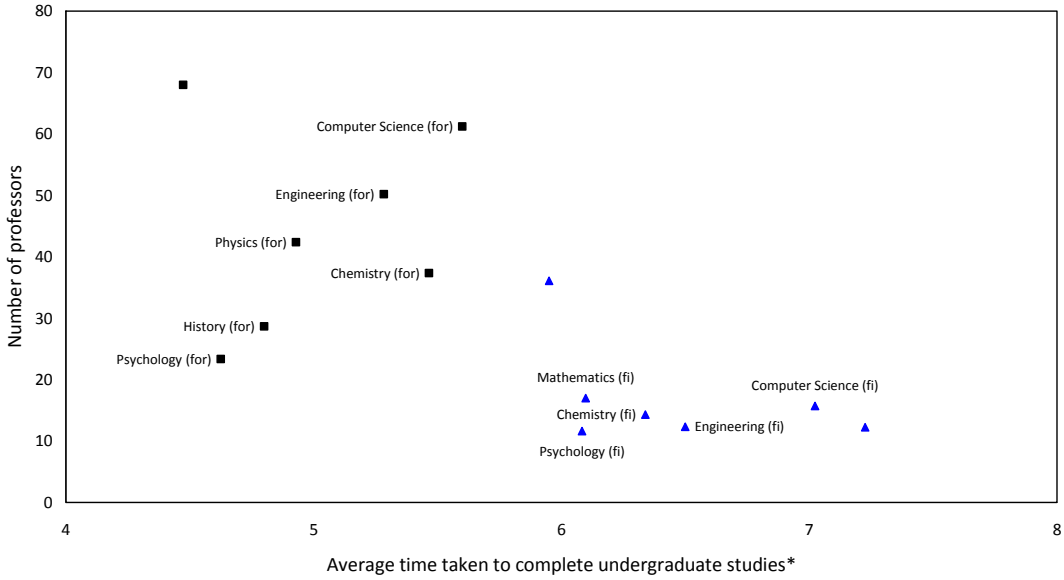
either better than FODs or worse. This explains why figure 10.1 represents a mixed cloud of Finnish and foreign observations. In the case of undergraduate studies another pattern shows up. Foreign departments outperform Finnish ones in all fields explaining the two data clouds in figure 10.2.

Figure 10 Average study time versus average department size (number of professors) by field.

10.1 Average study time of PhDs versus department size



10.2 Average study time of undergraduates versus department size



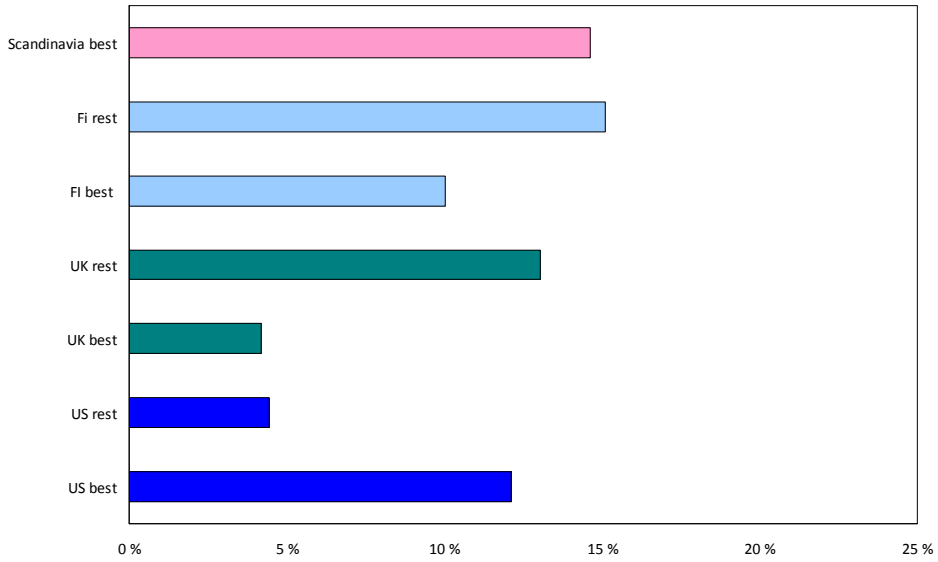
Source: Etlatieto Oy. *Note: In figure 10.2 average study time taken to complete undergraduate studies refers for Scandinavia, Finland and the UK to time taken to obtain a Master's degree for the U.S. to time taken to obtain a Bachelor's degree (see variable q152 in appendix 1).

In the case of Finland study times are the longest in the field of history, both for the Ph.D. degree and for the undergraduate studies. An interesting result shows that average study times for undergraduates are rather high in mathematics and engineering whereas the opposite holds for Ph.D.s in both fields.

4.3 Business creation

It is possible that lecturers and researchers at university departments set up a company and become entrepreneurs. This academic entrepreneurship is one possible channel to transfer research to business. Innovation policy aims to unblock that channel and keep it functioning well. Overall, bringing the results of research to the market is an important challenge and in the case of Finland it is often heard that too many commercialisation opportunities of promising research ideas and results are missed. To assess the current state of the role of faculty members in business creation we collected information on the share of faculty members involved in business creation in the last five years (2004-2008). This measure of business creation covers many activities (connection to product development, number of invention disclosure notifications, patents, spin-offs, etc.) and should therefore be interpreted as a broad approximation for academic entrepreneurship.

Figure 11 Share of faculty members involved in business creation in the last five years (2004-2008).



Source: Etlatieto Oy. Note: The share of faculty represents the number of faculty involved in business creation in the last five (2004-2008) years as a percentage of the number of junior and senior professors in 2008. Reported values that seemed too high to be the number of faculty were interpreted as the number of patents or spin-offs and were therefore not taken into account to calculate the above shares.

The above figure shows that FIDs perform relatively well when it comes to business creation. Finnish shares of faculty involved in business creation are comparable or

even higher than those in Scandinavia, the UK and the US. Our approximation tells that in Finland roughly 13% of the university departments' faculty has been involved in business creation during the last 5 years. For FODs that share varies between 4.2% and 14.6%. The fact that the Finnish share seems to be relatively high can be partly related to the small absolute size of FIDs. The corresponding absolute figures on the number of staff involved in business creation were 6.9 for the best university departments of Scandinavia, 2.6 for the best FIDs and 2.3 for the rest, 1.3 for the best university departments from the UK and 3.8 for the rest and 10 for the best US university departments and 1.8 for the rest. These absolute numbers show, for example, that the best U.S. departments have 4 times more faculty involved in business creation. Looking at the business creation shares of Finland per field shows that business creation typically occurs in the fields of engineering (41%), computer science (23%), chemistry (18%) and physics (12%).

Figure 11 also shows that it is not always the best departments (academically speaking) that are the most active in business creation as we measured it. In the literature it has been questioned if there is a trade off of scholarly research productivity when faculty members found or join for profit firms. Overall there seems to be mixed evidence about the relationship between the quality of university research and the frequency of business creation activities of universities. Recent results seem to suggest that scientists who found or join a firm were more productive during their academic careers than a randomly selected control group. When they pursue entrepreneurship in the private sector, however, their scholarly productivity falls. The entrepreneurial faculty members who return to academe are not as productive as they were before their entrepreneurial experience in terms of journal publications (Czarnitzki and Toole 2009).

5. Discussion and concluding remarks

The standard point of departure for evaluating the competitiveness of the Finnish university system is to look at how well Finnish universities score in global university rankings. Recent evidence shows that in those rankings Finland scores rather poorly and lags behind the US, Switzerland, the UK, the Netherlands and its Scandinavian neighbours (Aghion, Dawatripont et al. 2007). Instead of approaching the Finnish universities as aggregates it was decided to dissect them and analyse their building blocks, the university departments. Within a university or even within a broad field of study there can be much variation in how good departments, programmes or projects are. As existing Finnish data mainly focus on the university level or on broader fields (KOTA 2009) an additional survey was carried out to collect data on university departments. The data collected cover structural characteristics of both Finnish and selected foreign university departments and focus on seven fields (Mathematics, Physics, Chemistry, Electrical Engineering, Computer Sciences, History and Psychology). The aim of the descriptive analysis is to ascertain what are the structural characteristics of Finnish university departments (FIDs), the main focus of the paper being on size characteristics. The analysis compared FIDs with Foreign University Departments (FODs) and compared the best departments with the rest of the departments. In addition, differences between department fields were distinguished. It is noted, however, that the results must be interpreted with care due to data quality issues. From the survey data 6 main conclusions could be drawn:

1. FIDs are small: FIDs are significantly different from FODs. A closer look at the data reveals that it has significantly smaller numbers of personnel and students. Indeed, within the multi-country sample the small scale of FIDs seems to be a unique feature.

2. FIDs are small, irrespective of the department field. The variation in department size seems to be smaller in Finland than abroad. Only in the case of computer science and physics are FIDs comparable to the FODs in the sample.

3. The best departments tend to be bigger. In the countries sampled the best departments tend to be bigger than the rest. But the relationship between size and ranking does not seem to be linear. The average number of professors of the best departments is larger than that of the other departments. Comparing the best departments in the US and the UK with other departments in these countries shows that they differ significantly when it comes to the number of tenured-track-faculty per department. In addition, the number of Ph.D. level researchers on outside funding is relatively high in the best US universities. At first sight this pattern also holds for the number of students, but here the results seem to depend on which category of students is considered (undergraduates or graduates) and there seem to be additional differences between Europe and the US.

4. FIDs do not score well on internationalisation: they have a smaller share of foreign students. This holds in the first place for Bachelor's and Master's levels and

seems to be less stringent for the Ph.D. level. But the Finnish sample reports a relatively high share of foreign faculty. Based on this measure it performs as good as Scandinavia. Results have to be interpreted with care as the interpretation of "foreign" is not straightforward.

5. Average study times in FIDs are rather high. To complete undergraduate studies Finns take on average 6 months more than Scandinavians and 2 years more than students from the UK and from the US. Also the average times to complete the Ph.D. studies are rather high in Finland. But there is much variation between department fields. An awkward result that could not be verified by other data is that the best departments have longer average times to complete their degrees than the rest of the departments.

6. FIDs do not seem to score bad on business creation. On average the faculty of FIDs seems to be rather active when it comes to the creation of businesses. Using an approximation for academic entrepreneurship it was found that in relative terms the Finns are doing as good as foreigners when it comes to the share of faculty involved in business creation.

A final conclusion of the analysis relates to the need of further improving the availability of data on the Finnish university system as to be able to assess the building blocks of Finnish universities in more detail. The KOTA database offers an excellent source of information and is unique along international standards. But, with a relatively small marginal effort the database could be further improved so that it allows for assessing micro-level information, in the first place on the level of university departments, but also concerning more complex entities such as university programmes, university projects and centres of excellence. If current information providers stick with the university level (or with broad fields) important information stays hidden for policy makers. This could lead to sub-optimal decision-making.

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Appendices

Appendix 1: Questions of the survey and corrected variables

1. Staff

q1 What was the number of tenured/ senior professors in your department
q2 What was the number of tenured-track / junior faculty in your department
q3 What was the number of PhD level researchers on outside funding in your department
q4 What was the number of foreign faculty staff in your department
Corrected[7] variables q1_1, q2_1, q3_1, q4_1

2. Students

q5 What was the student intake for the PhD degree in your department
q6 What was the number of PhD degrees granted in your department
q7 What was the number of foreign PhD students in your department
Corrected* variables q5_1, q6_1, q7_1

q8 What was the student intake for the Master's degree in your department
q9 What was the number of Master's degrees granted in your department
q10 What was the number of foreign Master's students in your department
Corrected* variables q8_1, q9_1, q10_1

q11 What was the student intake for the Bachelor's degree in your department
q12 What was the number of Bachelor's degrees granted in your department
q13 What was the number of foreign Bachelor's students in your department
Corrected* variables q11_1, q12_1, q13_1.

3. Graduation time

q14 What was the average time to graduation for the PhD degree in your department (in years)

q15 What was the average time to graduation for the Master's degree in your department (in years)
q151 Variable based on q15 but eliminating information concerning the 1-year postgraduate Master of Science (MSc) programme in the UK

[7] * The "corrected" variables q1_1, q2_1, q3_1, q4_1 only take into account the observations of departments that answered all questions in their block (in this case q1, q2, q3 and q4). Graphs that compare the means of two of the above variables will use the corrected variables for obvious reasons. This footnote also applies to the corrected variables q5_1 to q13_1.

q152 Variable based on q151 but changing the US observations to the q16 observations so as to capture information on a comparable undergraduate degree (standard degree) over countries

q16 What was the average time to graduation for the Bachelor's degree in your department (in years)

4. Other questions

q17 In the last five years, how many faculty members of your department have been involved in business creation?

q18 (extra question, only sent to Finnish departments) In your opinion, which are the best three departments in your department field in the Nordic countries?

Appendix 2: Ranking university departments in the UK and the US: introducing the RAE ranking and the U.S. News Rank

1. Research Assessment Exercise 2008 (RAE): ranking research in the United Kingdom

In the UK the RAE aims to produce quality profiles of the research activities of universities. For the purpose of the RAE 2008, each academic discipline was assigned to one of 67 units of assessment (fields of specialisation). Work submitted to the exercise was assessed by panel members, experts drawn from higher education institutions and the wider research community, and nominated by subject associations and other stakeholder organisations. 67 sub-panels of experts, one for each unit of assessment, worked under the guidance of 15 main panels. Each main panel included sub-panels in broadly cognate disciplines whose subjects have similar approaches to research. The four higher education funding bodies intend to use the quality profiles to determine their grant for research to the institutions which they fund with effect from 2009-10.
Universities are assessed based on a common set of data they are invited to submit comprising:

a. Overall staff summary (research-active staff selected + related academic support staff)
b. Research-active individuals: detailed information on research active staff.
c. Research output: up to four items of research output produced during the publication period (1 January 2001 to 31 December 2007) by each individual named as research.
d. Research students: numbers of fulltime and part-time postgraduate research students and degrees awarded.
e. Research studentships: numbers of postgraduate research studentships and the source of funding for them.
f. External research income: amounts and sources of external funding.
g. Textual description: including information about the research environment and indicators of esteem.
h. Individual staff circumstances.
i. Category C staff circumstances.

Certain panels (meaning fields) may require to submit further specific, quantitative information.

2. The U.S. News Rank for Graduate Schools in the United States

The 2009 U.S. News Rank includes rankings for U.S. Graduate Schools. Produced rankings can be based on two types of data: expert opinions about programme quality and statistical indicators that measure the quality of a school's faculty, research and students. Ranking methodologies do vary by field and we underline that the ranking methodology for the 7 fields we focus on in this paper are solely based on expert opinions (and not on statistical indicators).

Rankings of *electrical engineering* are based on fall 2008 assessments by department. Department heads rated the other schools that offered a doctoral degree in electrical engineering on a 5-point scale. For engineering the response rate was roughly 55%.

Rankings of doctoral programmes in the *sciences* are based on the results of surveys sent to academics in, among others, computer science, mathematics, and physics during autumn 2007 and in chemistry during autumn 2006. The individuals rated the quality of the programme at each institution from "marginal" (1) to "outstanding" (5). Individuals who were unfamiliar with a particular school's programmes were asked to select "don't know." The universe of schools surveyed in computer science, mathematics and physics consisted of schools that awarded at least five doctoral degrees, according to the National Science Foundation report "*Science and Engineering Doctorate Awards*," for the years from 2001 through 2006; in chemistry for the years from 2000 through 2005. Questionnaires were sent to the department heads and directors of graduate studies at each programme in each discipline. Response rates were: 32 % for chemistry; 48 % for computer science; 33 % for mathematics and 32% for physics.

Rankings of doctoral programmes in *the social sciences and humanities* (such as psychology and history) are based on the results of peer assessment surveys sent to academics in each discipline. Each school offering a doctoral programme was sent two surveys. The questionnaires asked respondents to rate the academic quality of the programme at each institution on a 5-point scale: outstanding (5), strong (4), good (3), adequate (2), or marginal (1). Individuals unfamiliar with a particular school's programmes were asked to select "don't know." Scores for each school were determined by computing a trimmed mean (eliminating the two highest and the two lowest responses) of the ratings of all respondents who rated that school; average scores were then sorted in descending order. Surveys were conducted in autumn 2008. Questionnaires were sent to department heads and directors of graduate studies (or, alternatively, a senior faculty member who teaches graduate students) at schools that had granted five or more doctorates in each discipline during the five-year period from 2001 through 2005, as indicated by the 2006 Survey of Earned Doctorates. The survey's response rates were 23% for history and 25% for psychology.

Appendix 3: Summary of the survey data on structural characteristics of university departments

In the first four numerical columns of table A.3 the mean, the standard deviation, the median and the number of observations refer to the whole sample. Since the set up of the analysis is to look at differences of the structural characteristics between FIDs and FODs it is also useful to list the same information across both groups. The last three columns report the means for the FIDs and the FODs, as well as the statistical significance of the difference between these means (a two sided t-test without assuming equal variances across the two groups). From the table it can be concluded that there is a 1% level statistically significant difference between FIDs and FODs when it comes to (1) the number of tenured / senior professors, (2) the number of Ph.D. level researchers on outside funding, (3) the student intake for the Ph.D. degree, and (4) the number of foreign Ph.D. students per department.

Table A.3 Descriptive statistics (two-tailed t-tests in means).

Variable	Description variable	Mean	S.D.	Median	# Obs.	Fin. Mean	For. Mean	Signif.
Original variables								
q1	Number of tenured/senior professors	20.01	2.30	10.00	95	7.90	32.90	***
q2	Number of tenured track/junior faculty	11.79	1.13	8.00	93	9.86	13.76	*
q3	Number of PhD level researchers on outside funding	30.18	6.21	10.00	93	10.88	50.77	***
q4	Number of foreign faculty staff	7.72	1.34	4.00	89	5.94	9.71	'
q5	Student intake for the PhD degree	21.25	3.78	10.00	89	9.51	33.25	***
q6	Number of PhD degrees granted	13.10	1.87	7.00	90	5.75	21.14	***
q7	Number of foreign PhD students	19.39	3.41	7.50	88	7.83	32.06	***
q8	Student intake for the Master's degree	67.39	9.95	42.50	82	68.67	65.75	
q9	Number of Master's degrees granted	59.64	6.92	42.50	82	60.53	58.50	
q10	Number of foreign Master's students	26.97	5.83	8.00	79	17.23	39.87	*
q11	Student intake for the Bachelor's degree	114.29	23.06	60.00	75	64.49	168.25	**
q12	Number of Bachelor's degrees granted	80.47	13.98	35.00	73	38.33	128.81	***
q13	Number of foreign Bachelor's students	15.71	4.66	3.00	69	6.62	26.85	**
q14	Average time to graduation for PhD degree (in years)	5.15	0.12	5.00	84	5.32	4.99	'
q15	Average time to graduation for Master's degree (in years)	4.42	0.23	5.00	78	5.54	3.05	***
q16	Average time to graduation for Bachelor's degree (in years)	3.64	0.10	3.50	65	3.69	3.61	
q17	# department members involved in business creation in last 5 y.	5.07	1.11	2.00	76	5.31	4.78	
Corrected variables								
q1_1	Number of tenured/senior professors (corrected average)	18.93	2.30	10.00	87	7.31	31.37	***
q2_1	Number of tenured track/junior faculty (corrected average)	11.56	1.18	7.00	87	10.01	13.21	'
q3_1	Number of PhD level researchers on outside funding (corrected average)	28.81	6.56	10.00	87	9.38	49.63	***
q4_1	Number of foreign faculty staff (corrected average)	6.81	0.85	4.00	86	4.05	9.71	***
q5_1	Student intake for the PhD degree (corrected average)	20.85	3.85	10.50	84	9.73	33.08	***
q6_1	Number of PhD degrees granted (corrected average)	12.15	1.63	7.00	84	5.58	19.38	***
q7_1	Number of foreign PhD students (corrected average)	20.13	3.60	8.00	83	7.72	33.46	***
q8_1	Student intake for the Master's degree (corrected average)	70.64	10.74	45.00	75	70.43	70.94	
q9_1	Number of Master's degrees granted (corrected average)	62.31	7.48	45.00	75	62.08	62.65	
q10_1	Number of foreign Master's students (corrected average)	28.15	6.12	10.00	75	17.63	43.10	*
q111[a]	Student intake for the Bachelor's degree (corrected)[a]	114.58	22.06	62.00	79	69.65	168.25	**
q11_1	Student intake for the Bachelor's degree (corrected average)	102.53	26.15	60.00	59	69.85	146.96	
q12_1	Number of Bachelor's degrees granted (corrected average)	69.93	13.08	36.00	60	41.35	107.31	**
q13_1	Number of foreign Bachelor's students (corrected average)	16.86	5.38	3.00	59	7.40	29.74	*
q151[b]	Average time to graduation for Master's degree (corrected, in years)[b]	5.73	0.12	5.73	74	5.98	5.39	**
q152[c]	Average time to graduation for Master's degree (corrected by country, in years)[c]	5.39	0.12	5.35	78	5.98	4.66	***
q171[d]	# department members involved in business creation in last 5 y. (corrected)[d]	3.50	0.64	2.00	73	2.38	4.78	*

Note: The upper block of the table represents the survey data using all available observations whereas the lower block summarizes the corrected averages that do not take into account problematic observations or that take into account differences in degree systems across countries. [a] Variable based on q11 capturing how many new students started their first year at the university in 2008; [b] Variable based on q15 but eliminating information concerning the 1-year postgraduate Master of Science (MSc) programme in the UK; [c] Variable based on q151 but changing the US observations to the q16 observations as to capture information on a comparable undergraduate degree (standard degree) over countries; [d] Variable based on q17 but eliminating numbers that seem to refer to the number of business creations rather than to the number of faculty involved in business creation. For a description of all variables see appendix 1. S.D. stands for the standard error of the mean. Statistical significance: *** p<0.01, ** p<0.05, * p<0.10, + p<0.15, ' p<0.20. Source: Etlatieto Oy.

Appendix 4: Related information that is available in the KOTA database

1. The database contains information on:

- Size variables:
    - Staff
        - Teachers and other staff
        - Teacher and Researcher visits
    - Students
        - New students
        - Foreign students
        - Degrees
- Time to graduate variables
    - Median graduation times

- Internationalisation variables
    - Teacher and researcher visits
    - Foreign students
    - Foreign first degree education
    - International student mobility (over 3 months)

2. Related fields of aggregation are Natural Sciences, Engineering, Psychology and the Humanities.

3. Most recent data is for 2008 but not all the above variables are available yet.