

Centre for Global Higher Education working paper series

The changing finances of world-class universities

Alex Usher and Marcos Ramos

Working paper no. 41
August 2018

Published by the Centre for Global Higher Education,
UCL Institute of Education, London WC1H 0AL

www.researchcghe.org

© the authors 2018

ISSN 2398-564X

The Centre for Global Higher Education (CGHE) is a research partnership of international universities, funded by the Economic and Social Research Council (ESRC) and the Higher Education Funding Council for England (HEFCE) and based at the UCL Institute of Education.

CGHE's research is focused on higher education and its future development and aims to inform and improve higher education policy and practice. CGHE's three research programmes integrate local, national and global perspectives, and its researchers are based in nine countries across five continents: Europe, Asia, Africa, Australia and North America.

The support of the Economic and Social Research Council (ESRC) and the Higher Education Funding Council for England (HEFCE) is gratefully acknowledged.

The changing finances of world-class universities

Alex Usher and Marcos Ramos

Contents

Abstract.....	1
Introduction.....	2
Question 1: What is the financial position of ARWU universities?	4
Question 2: Are WCUs faring better or worse than they were 10 years ago? Which ones are doing better financially?.....	9
Question 3: Are WCUs faring better than non-WCUs in the same countries? Is there an obvious policy – stated or tacit – which is giving special attention to these institutions?.....	10
US private institutions	10
US public institutions	11
United Kingdom	12
Germany	14
Australia	15

Canada.....	15
Netherlands.....	16
Japan	17
Switzerland.....	18
Sweden	19
Nine-country comparative analysis	20
Question 4: Is there a relationship between “improved financial conditions” and changes in research output and rankings?.....	21
Publications	21
Rankings	23
Conclusion and further research	25
Appendix: Data Sources	26

The changing finances of world-class universities

Alex Usher and Marcos Ramos

Alex Usher is President of Higher Education Strategy Associates (HESA), a consulting firm which advises governments, institutions and corporations in the higher education sector on policy and strategy.

Marcos Ramos Jr. is a Research Associate at Higher Education Strategy Associates.

Abstract

While there is a great deal of comparative literature on how higher education systems fund themselves, there is virtually no comparative literature on institutional funding and, in particular, internationally comparative literature on institutional expenditures. This makes it difficult to evaluate claims made with respect to the benefits of greater levels of institutional funding. The purpose of this paper is to try to look specifically at the question of changes in real per-student expenditures over time in world-class universities (defined here as those which make the 2017 ARWU top-200). Using a variety of national and institutional data sources, we were able to obtain data on 166 institutions for which more or less comparable data on students and expenditures are available from 2006 onwards. We used this data to look at four main questions. First, what is the comparative financial position of the top-200 ARWU universities? Second, are world-class universities faring better or worse than they did 10 years ago? Third, are “world-class” universities being treated differently from other institutions in each country? Fourth, and perhaps most importantly, have changes in institutional funding over the past decade made much difference in institutions’ Shanghai rankings or improved institutional research output or impact? Results for the first three vary significantly across institutions and countries, but with respect to outputs there appears to be little to no correlation between increased funding and increased research output/impact and ranking position, at least in the medium term. We conclude that given this result, how money gets spent may be more important than the actual amount. More focus on institutional management techniques is therefore likely desirable.

Introduction

Over the past 15 years, the world of higher education has been focused on the question of world-class universities and whether countries should concentrate their resources on having a few such institutions or whether money should be distributed more widely to ensure other goals, such as broader access. However, despite this argument largely being about use of resources, very little research has actually examined the finances of world-class institutions. This paper compares the spending of institutions which place in the top-200 of the 2017 Academic Ranking of World Universities (ARWU)¹, often known simply as the “Shanghai Rankings”.

Our analysis relies on institutional financial statements, which are available for the large majority of top-200 universities. In the case of the main English-speaking countries – Australia, Canada, the United Kingdom and the United States – this task is made somewhat easier thanks to government databases that place institutions on a common statistical and definitional footing. Outside these countries, financial data are usually a part of institutions’ annual reports available on their websites. Complete details on data sources are available in the Appendix to this paper.

The indicator we choose to measure institutional financial capacity is total institutional expenditure. We prefer expenditure rather than income because its year-on-year trends tend to be smoother in Anglophone countries at least (and especially the United States, which makes up around 40% of our institutional sample). This is primarily because institutional endowment returns, which tend to fluctuate along with various equity indexes, can greatly affect income from one year to the next; over time, expenditures are a more reliable and smoother measure of financial capacity. Rather than relying on some notion of “operational” expenditures, our preference is for *total* expenditure which institutions appear to measure somewhat more consistently.

This is not to say that institutions measure expenditures consistently across countries. The biggest cross-national difference that we see is the inclusion or exclusion of expenditures related to hospitals. In the United States and Japan, these expenditures fall clearly within the university reporting envelop, but for the most part elsewhere they do not (Germany is an intermediate case, where some institutions report figures with “*medizin/klinik*” while others do not). This is not always an issue of accounting; it may also reflect differing ties between academic medicine and hospitals, or legal relationships between medical faculties and the hospitals in which they are embedded. However, for the most part, we base our analysis on changes in institutional expenditure over time, rather than absolute size of expenditures, so for the most part the effect of this difference is minimal.

¹ Available online at: <http://www.shanghairanking.com/ARWU2017.html>

Absolute expenditures are interesting but not particularly revealing unless one has a sense of the scale of the institution. A billion dollars goes considerably further at an institution with five thousand students than it does at one with fifty thousand students. For that reason, our preferred measure of fiscal capacity is not total expenditures, but total expenditures *per student*. We prefer spending per student over “per academic staff member” in part because student numbers are somewhat easier to obtain, but also because definitions of students are somewhat more consistent across countries than definitions of staff members. There remain challenges; whereas in countries where part-time studies are rare or non-existent a simple head count is usually reliable, other jurisdictions use a variety of conversions to full-time equivalency. But again, since most of our analysis is looking at institutional changes across time, the difference in definitions across institutions is not an insurmountable problem so long as each institution’s definition remains internally consistent.

In this paper, we will attempt to answer four questions. The first is: what is the comparative financial position of the top-200 ARWU universities? We attempt to answer this question simply by comparing expenditures per student across the 174 institutions for which we have data for fiscal years ending in 2015 or 2016. The foregoing paragraphs have already indicated why this cannot be done with a huge degree of accuracy, but we can nevertheless paint a broad portrait of the differences across countries and institutions, recognising that one should take the specific dollar values with caution.

The second question is: are world-class universities faring better or worse than they did 10 years ago? Here, we consider how finances have changed over time across a slightly smaller number of institutions (166) for which we have data consistently from 2006 to 2015 or 2016. All figures comparing spending over time account for inflation. From there we move to a third question, are “world-class” universities being treated differently from other institutions in each country? For this exercise, we examined changes in finances *both* for Shanghai top-200 institutions and for the university sector as a whole in the 10 countries with four or more institutions in the ARWU top-200 and with accurate, available financial data across all years: the United States, the UK, Germany, Australia, Switzerland, Canada, the Netherlands, Japan, Sweden and Israel. From this exercise, we can examine whether governments are treating “world-class” universities differently from the rest of the higher education sector, which is a key policy question and controversy.

The final and perhaps most important question is to look at whether changes in institutional funding over the past decade have made much difference in institutions’ Shanghai rankings or have improved institutional research output or impact. Data on these outputs are taken from both the Shanghai Rankings themselves, and from data available from the Leiden Rankings, a multi-dimensional ranking which uses Web of Science data to look at – among other things – questions of publications and citation. For this question, we remove two institutions (the Mayo Clinic College of medicine and

the University of Texas (UT) MD Anderson Cancer Centre) from the analysis because they are not included in the Leiden Rankings (which is our source for the WoS data), leaving 164 institutions in the sample. The paper then concludes by summarising the evidence gathered and suggesting directions for new research.

Question 1: What is the financial position of ARWU universities?

Before answering this question, it is worth putting forward three important caveats about cross-national comparisons of institutional spending.

The first is that having calculated per-student expenditures in various countries' home currency, it is not completely obvious how this should be turned into a single international currency for comparison. We have chosen to convert at purchasing-power parity (PPP) using the *Economist's* "Big Mac Index",² mostly because PPP is the traditional and preferred measure of comparing financial capacity. However, since academic labour is quite mobile there is a case to be made that for top-200 institutions at least, current currency conversions are a more appropriate way of measuring relative spending power. If one were to use the latter, most countries' reported expenditures would fall compared to the United States (in particular Hong Kong and China) and very few (Switzerland, Norway and Sweden) would rise.

The second is with respect to the responsibilities of universities. Not all institutions are buying the same basket of goods to "produce" higher education. American universities, for instance, are responsible for paying massive sums of money on behalf of their employees for health insurance, whereas in most of the rest of the world this is not the case. American institutions also have more ancillary businesses and in many cases operate what amount to professional sports teams – in some cases these activities do generate extra funds for teaching and research, but reporting gross expenditure rather than the net income from these activities overstates the financial clout of American universities compared to those of other countries. Conversely, universities in many central European countries do not provide housing to students, as that function has been delegated to a national organization such as Deutsche Studentenwerk (Germany) or CROUS (France). This tends to understate the financial clout in these institutions relative to those in other countries.

Finally, the issue of national conventions for financial accounting and reporting student numbers is non-trivial. The latter are particularly important, particularly where part-time studies are common. In Canada and the United States there are standard conventions about how to convert part-time numbers to full-time equivalencies (in Canada, a PT student is 29% of an FT student, in the US it is a variety of numbers depending on type

² Available at: <http://www.economist.com/content/big-mac-index>

of institution and level of study, all of which converge around 39%). However, in Australia and the UK, there is no such standard conversion, and while full-load equivalents are calculated at each institution, they tend not to be published. As a result, for UK and Australia we use headcounts. Where we look primarily at change over time at each institution or in each country, the specific definitions matter less, but where we compare snapshots in time, Australian/British universities will appear to have somewhat lower expenditures per student than Canadian or American ones because their student numbers will look artificially high.

All of which is to say that when comparing expenditures per student across country, figures need to be treated as indicative rather than definitive. We can see broadly what kind of differences exist, but it is best not to focus too much on small differences because they can easily be the result of one of the factors listed above. Nevertheless, at a fairly high level of generality, one can still use these per-student expenditure figures to come up with a broad categorisation of ARWU top-200 institutions, as follows:

Super-specialised and super-rich. Seven institutions have expenditures over \$500,000 USD per student, all of which are in the United States. Five of these are medical schools: the University of California San Francisco (UCSF), the Icahn School of Medicine, the Baylor University School of Medicine, the UT MD Anderson Cancer Centre, and the University of Massachusetts - Worcester Medical School. The UCSF's expenditures are an eye-watering \$1.7 million per student, but evidently most of this money is not actually destined for instruction costs. Indeed, the Mayo clinic, which closely resembles these institutions, only claims about \$84,000 in per-student expenditures, so there is presumably considerable leeway with respect to how stand-alone medical schools report income and expenditure under the US Department of Education's reporting criteria. The two non-medical institutions on the list are the California Institute of Technology (CalTech) and Rockefeller University, both of which have graduate-student focused mandates (exclusively so in Rockefeller's case), and receive a tremendous amount of research funding in extremely expensive areas of study. For instance, well over half of CalTech funds are tied up in a single lab (the world-famous *Jet Propulsion Laboratory*). In total, these seven American institutions collectively spend over \$10 billion per year while educating roughly 10,000 students.

The Rich. Another 35 institutions have expenditures between USD \$100,000 and \$500,000 per student. 30 of the institutions are American, with private universities taking up 20 of these spaces and the public sector 10, including the Los Angeles, Berkeley and Davis campuses of the University of California. The five non-American universities that make this grouping are the Weizmann Institute of Science in Israel (which financially speaking resembles Rockefeller University), Cambridge University in the UK and Tokyo, Kyoto and Tohoku universities in Japan.

The Well-off. There are 38 institutions with expenditures between USD \$50,000 and \$100,000 per student. This category remains mostly the preserve of American universities – 20 of them fall into this range (eight private, 12 public) – but it includes an expanded set of non-American ones as well. 12 of the 18 non-American universities come from Asia: Nagoya, Osaka and Hokkaido Universities and the Tokyo Institute of Technology (Tokyo Tech) in Japan, and a number of other flagship universities in East Asia (National University of Singapore, Hong Kong University, Chinese University of Hong Kong, as well as the mainland Chinese powerhouses of Tsinghua, Peking, Zhejiang, Shanghai Jiao Tong and Fudan). A few top continental European universities appear in this group as well, including Karolinska, ETH Zurich and the Technical University of Delft, as do the UK's Oxford and Imperial universities.

The Middle Class. The next 35 institutions have annual expenditures between \$35,000 and \$50,000. This band is mostly where you find the higher-ranked Canadian (e.g., McGill, University of British Columbia), European (e.g., Basle, LSE, Technical University of Munich) and Australian institutions (e.g. Australian National, Western Australia), as well as the poorest among the US publics (e.g. UC Riverside, Purdue).

The Stretched. The next-to-last grouping contains 39 institutions that must face significant challenges staying among the world's best on budgets of \$20,000 to \$35,000 per student. European universities comprise over two-thirds of this grouping, which also includes many institutions from Australia (e.g. Melbourne, Monash) and Canada (e.g. Toronto, McMaster), as well as Israel's Technion.

The Over-Stretched. The final grouping, containing those 16 institutions with expenditures per student of under USD \$20,000, is nearly entirely European. Only Israel's Hebrew University and Australia's Macquarie and Curtin universities – the only Australian institutions outside the Group of 8 to break into the top 200 – break up the continental monopoly. Two institutions – Kiel and Vienna – have per-student expenditures below \$10,000 per annum.

As shown below in figure 1, the distribution of the financial capacity of ARWU top-200 universities is enormous. A few specialised – mainly medical – institutions in the United States have well over \$1 million in annual expenditures per student, while at the other end, a number of European institutions make the top 200 with expenditures per student of only about \$10,000 per year.

Figure 1: Distribution of Annual Expenditures per Student, ARWU top-200 institutions

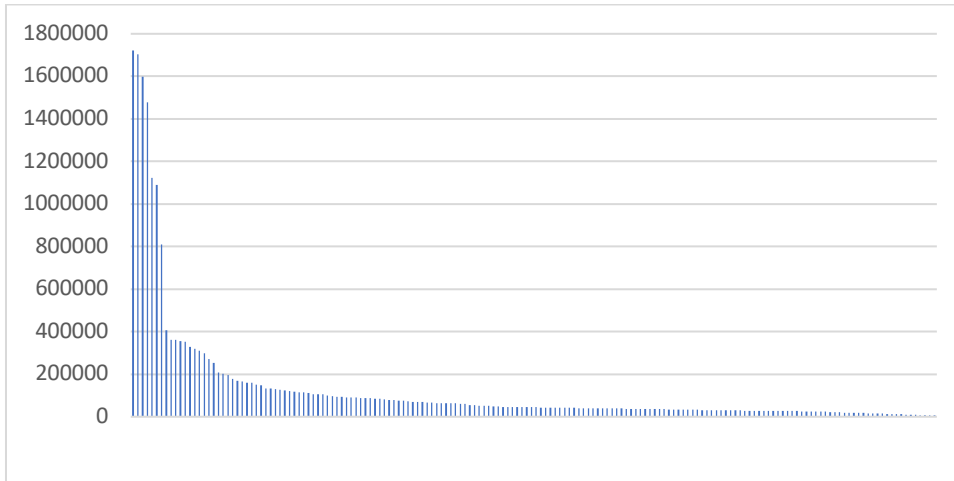


Figure 2 shows the distribution of institutions with expenditures of \$100,000 or less (that is, it excludes the mainly American and private rich and super-rich institutions that make Figure 1 difficult to read properly). What is striking is how little clustering there is in expenditures per student. The pattern is closer to a power law than it is to a normal distribution.

Figure 2: Distribution of Annual Expenditures per Student, ARWU top-200 institutions with expenditures below \$100,000 only

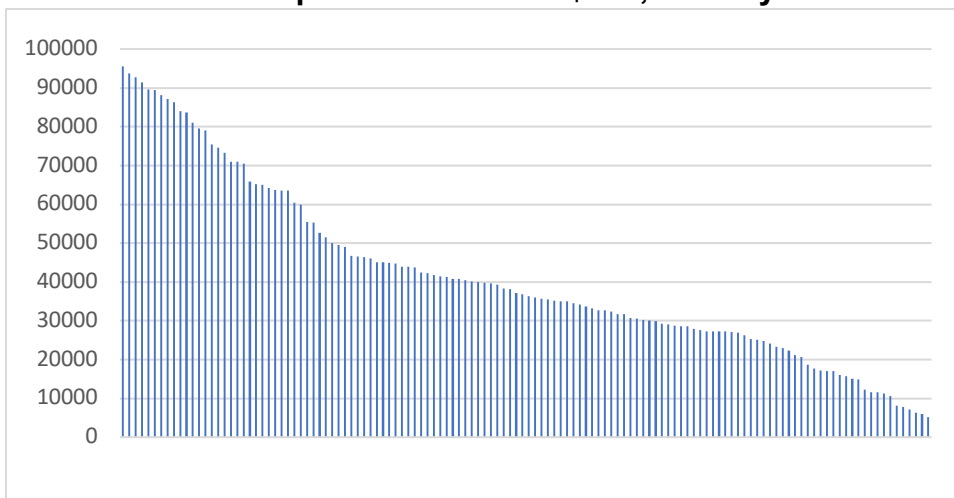


Table 1 summarises financial capacity at ARWU top-200 institutions by country by showing average per student spending across all its institutions, as well as the highest and lowest values for spending. Data is for the latest year available; the fiscal years ending either in 2015 or 2016. The United States and various Asian countries dominate the top of the list (Israel makes the top three, but this is exclusively because of extraordinarily high per-student spending at the Weizmann Institute, which dwarfs spending elsewhere; its other institutions more closely resemble European ones in funding levels). European nations, particularly central European ones, tend to do much

worse on this measure. Germany, as a country, has 15 institutions in the top 200 despite comparatively very low levels of average spending.

Table 1: Average, High and Low Spending Across ARWU top-200 universities, by country (2015/2016)

Country	Average	High	Low
US (Private) (33)	\$332, 156	\$1,702,273	\$60,427
US (Public) (37)	\$180,294	\$1,722,533	\$29,857
Israel (3)	\$133,111	\$407,076	\$11,198
Japan (8)	\$91,166	\$125,178	\$63,619
Hong Kong (2)	\$88,233	\$95,467	\$80,980
China (5)	\$62,020	\$78,450	\$51,770
Singapore (2)	\$54,068	\$65,900	\$42,237
United Kingdom (20)	\$47,630	\$146,999	\$26,334
Denmark (2)	\$47,170	\$75,402	\$30,165
Taiwan (1)	\$39,772	\$39,772	\$39,772
Switzerland (7)	\$36,028	\$63,743	\$12,319
Canada(8)	\$34,103	\$43,865	\$24,107
Sweden (5)	\$32,114	\$74,654	\$14,985
Netherlands (7)	\$31,245	\$38,373	\$24,856
Brazil (1)	\$28,705	\$28,705	\$28,705
Australia (10)	\$27,547	\$39,340	\$17,621
Ireland (1)	\$27,277	\$27,277	\$27,277
Finland (1)	\$27,126	\$27,126	\$27,126
Norway (2)	\$25,813	\$29,312	\$22,315
Germany (15)	\$21,364	\$44,870	\$8,041
Italy (1)	\$11,527	\$11,527	\$11,527
Belgium (1)	\$10,531	\$10,531	\$10,531
Austria (2)	\$9,405	\$11,640	\$7,170

(note: the average is represented by total spending at ARWU top-200 institutions divided by total students attending these institutions; it is not an average of institutional values)

Of some interest is the question of how equitably money is distributed across institutions in the same country. The existence of super-specialised/super-rich institutions in the United States obviously exaggerates the differences within the United States (the same is effectively true in Israel, where Weizmann plays the same role). However, even without the top spenders, inequality across institutions in the US remains much larger than that in other countries. Among countries with more than one institution in the ARWU top-200 where data is available, Asian countries tend to have uniformly high

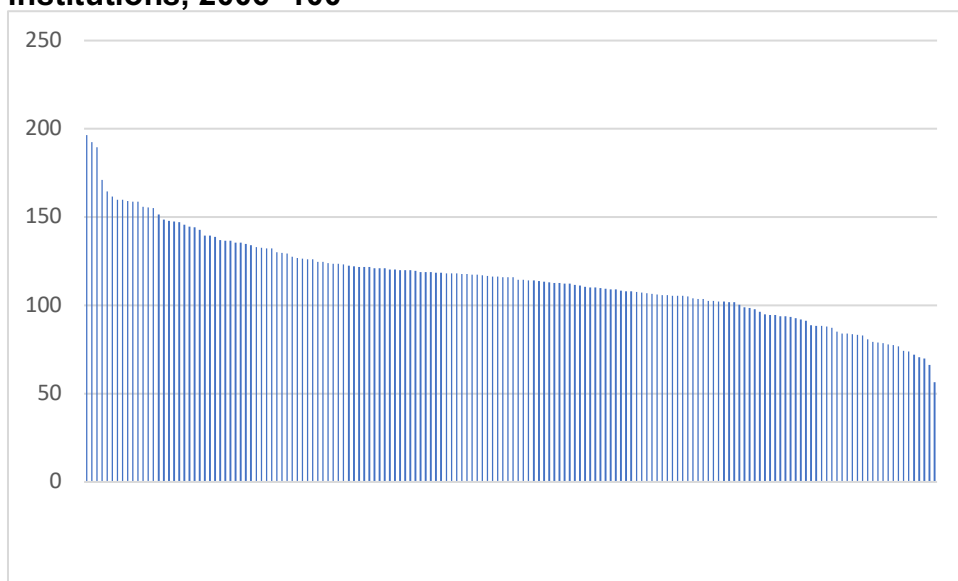
expenditures at top institutions, whereas there are relatively large gaps between top and bottom spenders in Germany, Sweden, Switzerland and the UK. Norway, Austria and the Netherlands stand out as having the most equal distributions of funds.

Question 2: Are WCUs faring better or worse than they were 10 years ago? Which ones are doing better financially?

Of the 174 top-200 ARWU universities for which we have financial data for 2015 or 2016, 155 have data on finances and students going back to 2006. For another 11 institutions, we have data going back to 2008 and can impute figures for the missing years based on comparable institutions in the same countries. We can thus make reasonably confident statements about the evolution of expenditure per student over the past decade for 166 institutions.

Across these institutions, budgets per student increased on average by 15.7%, and at the median by 15.8%. 128 institutions experienced growth in per student spending, and 38 a decline.

Figure 3: Distribution of per-student expenditures in 2016 across all ARWU-200 institutions, 2006=100



The largest increases in per student spending took place in the UK (Cambridge 96.3%, Warwick 64.6%), the United States (particularly at the super-rich/super-specialised schools such as UT Southwestern Medical Centre 92.6%, Icahn College 89.6%), and among a few major central European schools (Munich 59.8%, Leipzig, 59%, Bern 58.8%). In total, 48 institutions saw real per-student increases of 25% or more, while another 39 saw increases of between 15% and 25%. 31 institutions saw decreases of 5% or more, including at the very bottom of the distribution, six institutions with per-

student funding decreases of 25% or more, including two from the Netherlands (Wageningen, Delft) and two from the United States (Case Western and UT MD Anderson Cancer Centre, though the latter may be an issue of a change in reporting practices).

In short, most world-class universities have improved their financial position over the last decade, but not all. For every four institutions that have increased per student expenditure by 5% or more, one has experienced a decline of 5% or more.

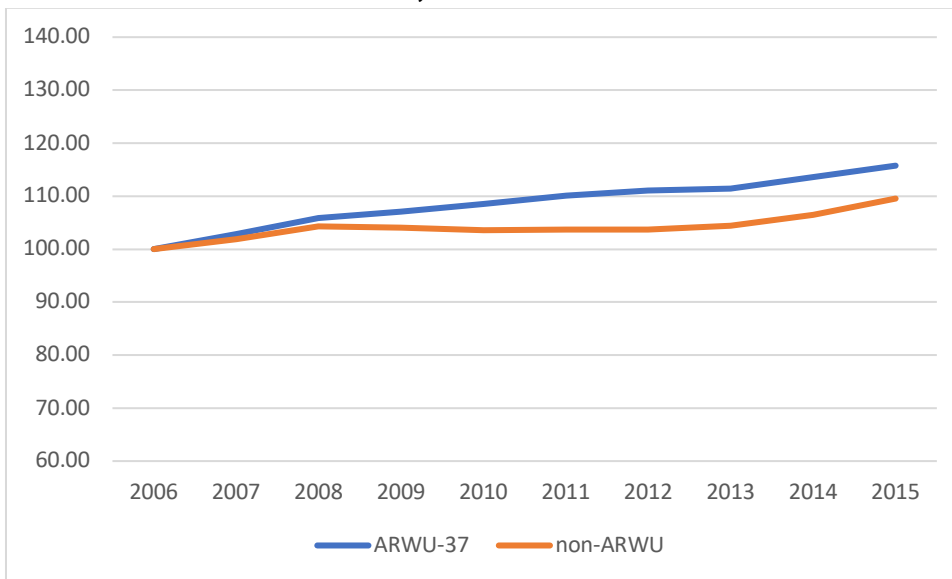
Question 3: Are WCUs faring better than non-WCUs in the same countries? Is there an obvious policy – stated or tacit – which is giving special attention to these institutions?

To answer this question, we focus on nine countries with five or more ARWU top-200 universities for which we have reliable financial data over the past 10 years: the United States, the United Kingdom, Germany, Australia, Japan, Canada, the Netherlands, Switzerland, and Sweden. Depending on the country and the availability of data, these analyses either cover 2006-2015 or 2006-2016. To account for the specific and unique nature of the American system, we have chosen to examine its public and private sectors separately. For each country, we look at how institutions that ranked in the ARWU top 200 in 2017 (referred to here as the ARWU-X, where X is the number of institutions in that country which made the cut) have fared financially for the last decade in comparison to the rest of the country's university sector. As we shall see, trends vary wildly from one country to the next.

US private institutions

Data on students and finances are available for all 37 US private institutions that make the ARWU top-200. It is relatively easy to compare their fortunes with those of the broader sector using the Department of Education's IPEDS system, as shown below in figure 4.

Figure 4: Real expenditures per student at US Private 4-year non-profit colleges, ARWU-37 vs. rest of sector, 2006=100



Despite significant fluctuations in income at some institutions, stemming from big changes in endowment values around the time of the 2008 global financial crisis, expenditure per student among the ARWU-37 has grown slowly and smoothly at around 1.5% per year. The rest of the sector matched this performance from 2006 to 08 and from 2013 onwards, but in the interim the non-ARWU institutions merely held their ground in terms of spending. Given changes in cost structures (most notably the cost of health insurance) it is possible that simply standing still in terms of expenditures would have felt like cuts to many institutions.

In summary: the ARWU-27 have improved their position, and have done so more than comparable institutions outside the ARWU rankings, although the difference is not very large.

US public institutions

Data on students and finances are available for all 33 US public institutions which make the ARWU top-200. The Department of Education's IPEDS system again facilitates the comparison with the broader sector, as shown below in figure 5.

Figure 5: Real expenditures per-student at US Public 4-year colleges, ARWU-33 vs. rest of sector, 2006=100

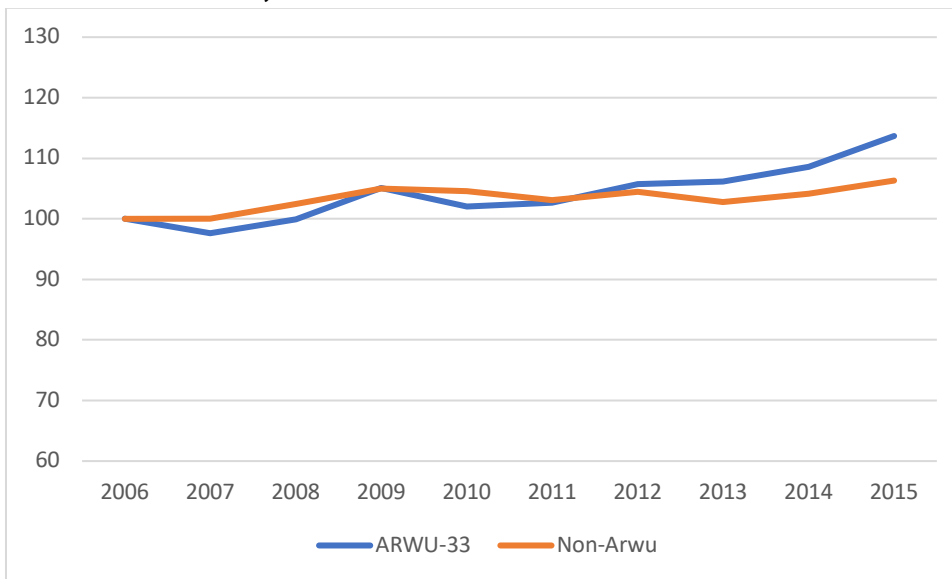


Figure 5 may seem surprising given the well-publicised travails of the US public university system. It shows that expenditures at the ARWU-33 rose by nearly 15% (almost equal to the increase in the 37 ARWU-ranked US private universities in the ARWU), but perhaps more incredibly the rest of the sector also increased expenditures per student. State governments clearly were not the source of income for these rising expenditures, rather funds came from a combination of increased commercial activity and higher fees.

To summarise the pattern: from 2006 to 2012, the ARWU-33 and the rest of the public sector increased their per-student expenditures at roughly the same rate (about 0.5% per year, on average). Since 2012, the broader sector has stayed steady or increased slightly, while the ARWU-33 have grown at something closer to 2% per year.

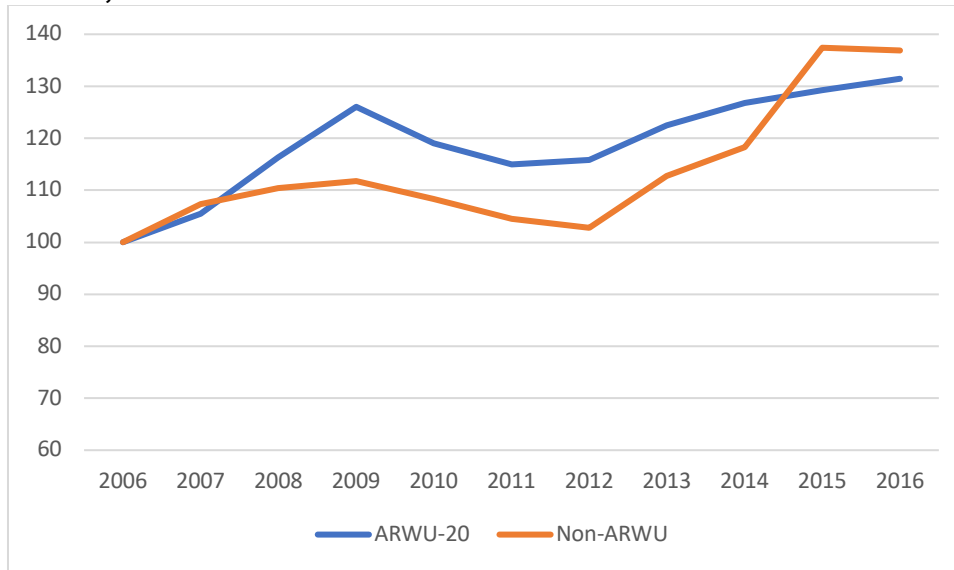
United Kingdom

The United Kingdom has seen the largest real increases in per-student expenditures: however, the timing of the increases varies across the sector in intriguing ways. For ARWU-200 institutions – mainly members of what is called the “Russell Group” – the big increase in per-student expenditures happened from 2006 to 2009: that is, just after annual student fees rose from £1000 to £3000 and there was a large influx of public money from the treasury.³ After that, in part due to post-2009 austerity, per-student expenditures decreased, among both the ARWU-20 and the non-ARWU universities.

³ The Russell Group represents 24 leading UK universities which are committed to maintaining the very best research, an outstanding teaching and learning experience and unrivalled links with business and the public sector. <http://russellgroup.ac.uk/about/our-universities/>

This was one of the factors that led to the Russell Group (among others) to call for higher fees during the Browne Review.⁴

Figure 6: Real per student expenditures at UK universities, ARWU-20 vs. rest of sector, 2006=100



However, as figure 6 shows, the aftermath of the Browne review in 2012 had very different effects across sectors. Over four years, expenditures per student rose in the ARWU-20 by about 15%, but rose among non-ARWU universities by nearly 35%. The difference has primarily to do with the denominator (student numbers) rather than the numerator (expenditures). Enrolments in the more prestigious ARWU universities expanded more or less continuously throughout the decade, but at non-ARWU universities they declined by 13% between 2012 and 2016. Intriguingly, the coincides with the period in which student number controls were abandoned in 2014.

Over the decade then, both the ARWU and non-ARWU sectors have done extremely well, though not at the same time.

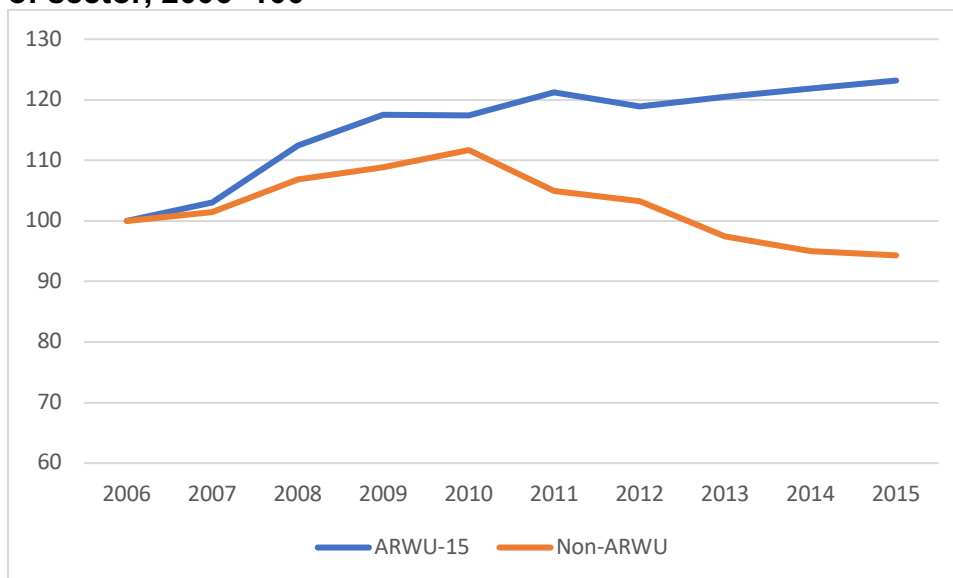
⁴ Independent review by Lord Browne. It makes recommendations to government on the future of fees policy and financial support for full and part-time undergraduate and postgraduate students. <https://www.gov.uk/government/publications/the-browne-report-higher-education-funding-and-student-finance>

Germany

Germany has 15 institutions in the ARWU top-200. Data is complete for the years 2006-2015 for 11 institutions in this group. The other four institutions are missing data for some years either at the beginning or the end of the period, but we can impute values based on average changes across other institutions in the sample. Data for the rest of the country's university system comes from the federal statistical office.

The German case is quite different from those of the United States and the United Kingdom. Since 2010 at least, the ARWU-15 and the rest of the sector have been heading in different directions. It is somewhat difficult to piece together what is happening at a policy level nationally, because of interaction effects between federal and state-level policies, and between the German Excellence Initiative⁵ (which tends to help ARWU universities) and the various versions of the Higher Education Pact (which is meant to distribute support more generally across higher education in order to – among other things – increase the number of university spots available). But the gap seems attributable to two key developments. The first is that the ARWU-15 are receiving more money than the rest of the system, with real funds increasing by 46% over 2006, compared to just 29% in non-ARWU institutions. The second is that the ARWU-15 have limited enrolment growth to just 18.5%, compared to 37.4% among non-ARWU institutions. These two factors combined are what causes the growing gap between different universities in Germany.

Figure 7: Real per student expenditures at German universities, ARWU-15 vs. rest of sector, 2006=100

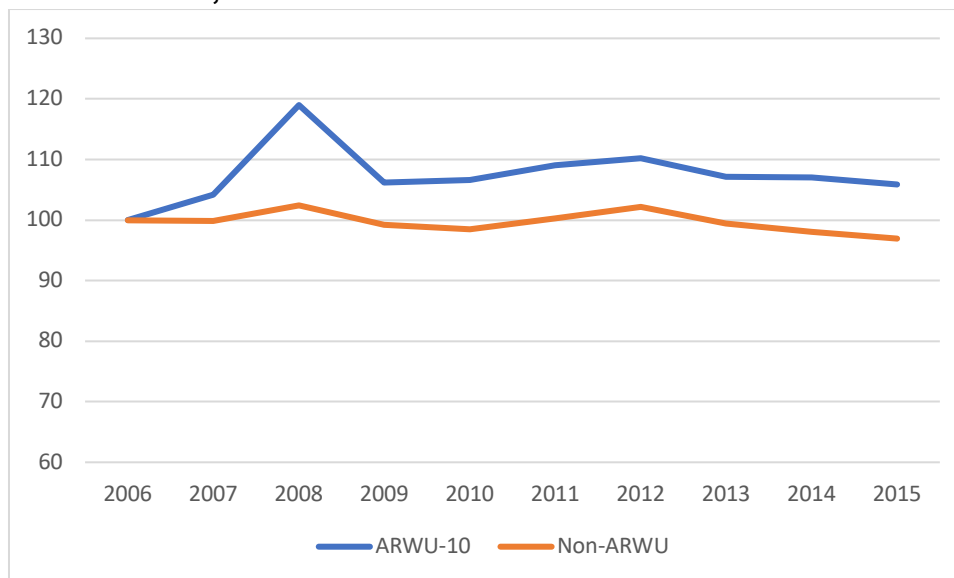


⁵ This is a multi-year, multi-billion euro programme started in 2005 to promote top-level research in general and to promote some level of specialisation in individual German universities. http://www.dfg.de/en/research_funding/programmes/excellence_initiative/index.html

Australia

Australia has 10 institutions in the ARWU top-200: the top research group known as the “G8” plus Macquarie and Curtin universities. The story in Australia is relatively simple. Since 2009 both the ARWU-10 and non-ARWU institutions have been on identical, mostly no-growth trajectories. Prior to this, per-student funding increased somewhat at research institutions, while a 2008 spike appears to have been some kind of one-off incident involving superannuation charges at a number of universities. Since 2006, non-ARWU institutions have seen per-student expenditures fall by 2%, while the ARWU-10 have had spending increase by 6% (though it is off about 3.5% from its 2012 peak). Of note, perhaps, is the fact that 2012 was the year in which student number caps were removed; this event has coincided with a slight drop-off in per-student expenditures.

Figure 8: Real per student expenditures at Australian universities, ARWU-10 vs. rest of sector, 2006=100



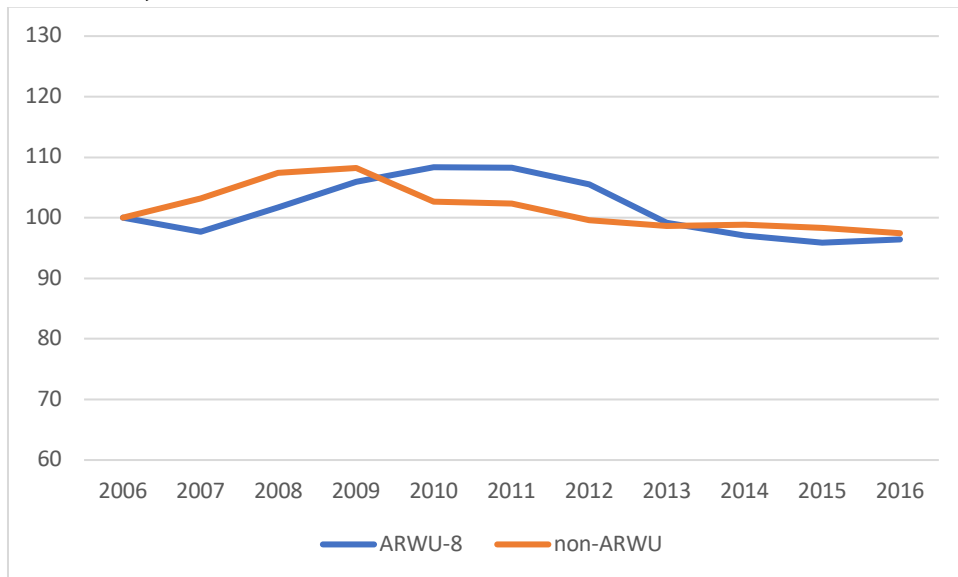
To be clear: this stability per-student funding does not imply stable total funding. Nationally, institutional expenditures are up 42% in real terms over the decade. It is just that student numbers have risen more or less in parallel.

Canada

Canada has eight institutions in the ARWU top-200 and data for all is available through a pair of Statistics Canada surveys (the Financial Information of Universities and Colleges Survey and the Post-Secondary Student Information System). As in Germany, the mix of policies at both the federal and provincial levels can make it sometimes difficult to see how policies are playing out in Canada. That said, both the ARWU-8 and the broader sector saw basically small increases in real per-student funding in the early years of the period, and declines in the latter. A major federal government capital

spending programme announced in the wake of the 2008 global financial crisis seems to explain the slight difference in timing, as it may have benefited the ARWU-8 more than other institutions.

Figure 9: Real per student expenditures at Canadian universities, ARWU-8 vs. rest of sector, 2006=100

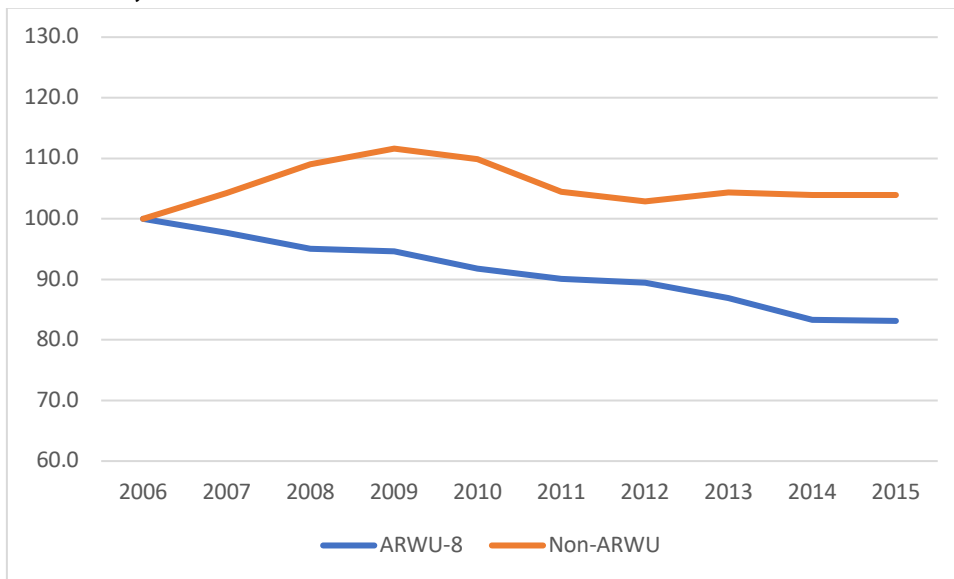


Canada is the only country in this brief survey where both ARWU- and non-ARWU universities are spending less per student in 2016 than they were in 2006. As was the case in Australia, this does not reflect stagnation in raw expenditures, which are up over 20% in real terms over the past decade, but merely the result of similarly rapid growth (24%) in student numbers.

Netherlands

Nine Dutch institutions make the ARWU top-200, but only eight of these publish student and financial data (Vrije Universiteit Amsterdam does not). The overall picture in the Netherlands is quite unique among our case studies in that there is a massive gap opening up between ARWU- and non-ARWU institutions because the non-ARWU institutions are charging ahead. The ARWU- group's expenditures rose by 5% over the decade to 2015, but with enrolments rising by 26% net per-student spending fell to just 83% of its 2006 level. The non-ARWU universities had similar enrolment growth of 24%, but their expenditures rose by over 32%.

Figure 10: Real per student expenditures at Dutch universities, ARWU-8 vs. rest of sector, 2006=100

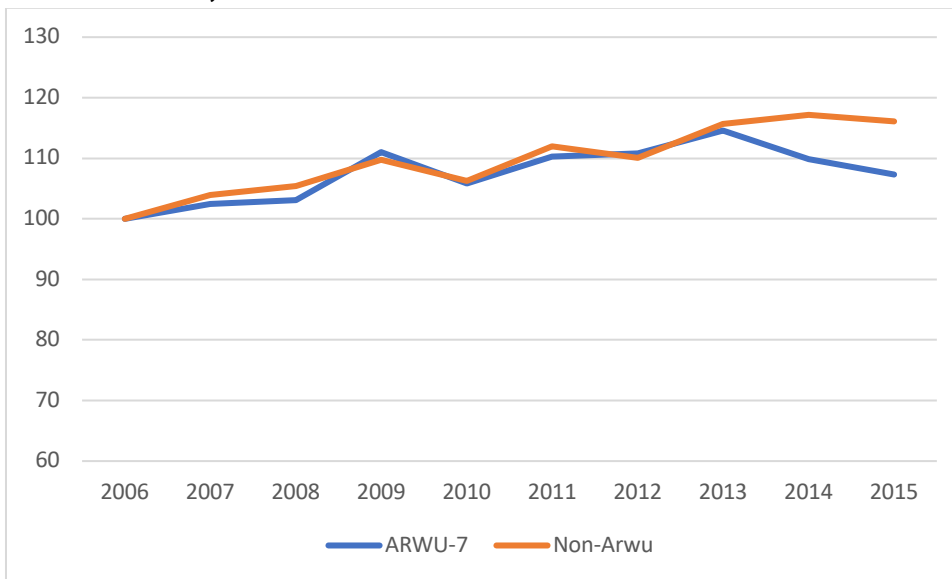


There are two specific peculiarities of the Dutch system worth mentioning. The first is that over three-quarters of its students attend an institution in the ARWU top-200, which is by far the highest of any country. The second is that the Netherlands is the only country where non-ARWU universities have higher per-student expenditures than ARWU ones (25,166 €/student vs. 24,390 €/student as of 2015).

Japan

Seven Japanese universities make the ARWU top-200. We pulled data on these institutions from institutional annual reports. Data for the rest of the sector comes from national data provided by the University of Hiroshima's Centre for Higher Education. For most of the last decade, the ARWU- and non-ARWU institutions have followed very similar paths. Student numbers across both sectors have barely moved, and so any new expenditures raised spending per student. From 2006 to 2013, both sectors experienced increases of around 13%. However, since 2013, some of the top Japanese universities have seen major declines in expenditures, most notably at Tohoku (a 17% drop in expenditures) and Osaka (15%), and Todai is the only ARWU-7 university which has increased spending.

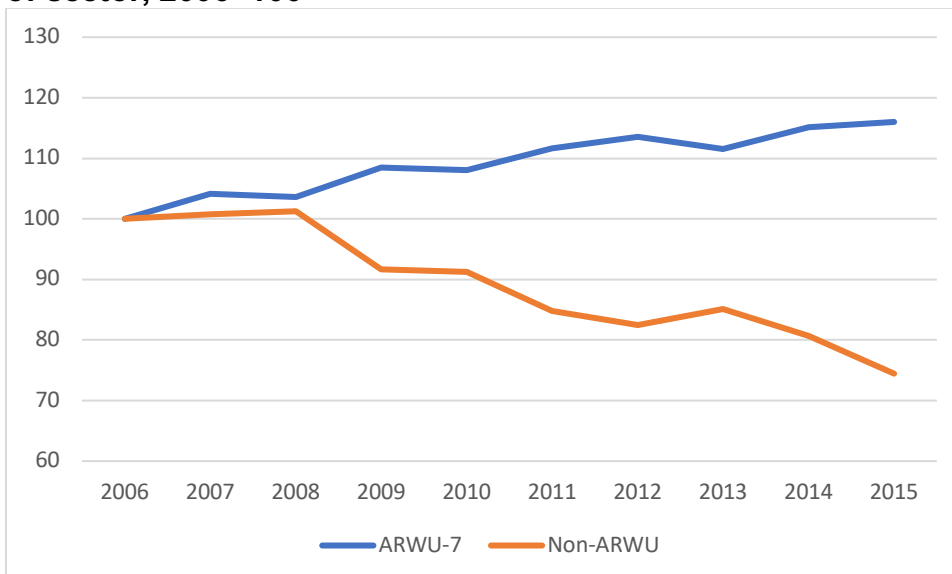
Figure 11: Real per student expenditures at Japanese universities, ARWU-7 vs. rest of sector, 2006=100



Switzerland

Like Japan, Switzerland has seven institutions in the ARWU top-200. We collected data for this country from a mix of institutional and national statistics websites. The pattern in Switzerland very much resembles that of Germany – increased per student spending for ARWU universities and large net decreases for non-ARWU universities. The underlying reasons for this are similar too: a combination of more money going into ARWU universities (39% in growth vs 16%) and much smaller enrolment growth in those same universities (20% vs. 56%).

Figure 12: Real per student expenditures at Swiss universities, ARWU-7 vs. rest of sector, 2006=100



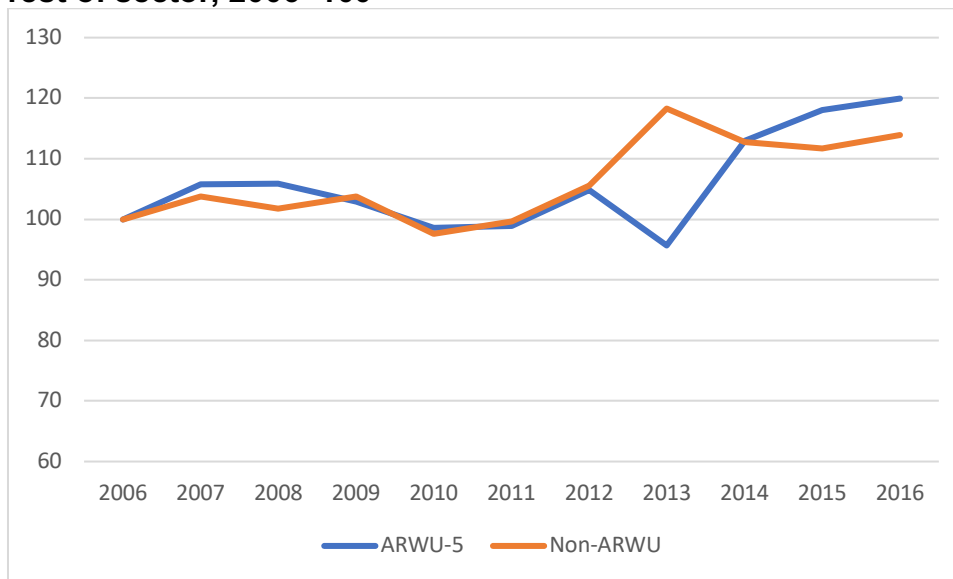
Of course, Switzerland also resembles the Netherlands in that over three-quarters of its students attend a “world-class” university in the ARWU top-200. This again makes the comparison between ARWU and non-ARWU universities more challenging.

Sweden

The final country in this survey is Sweden, which has five universities in the ARWU top-200. Data for the whole system is available through the very informative *Higher Education in Sweden: A Status Report*, which the Swedish government publishes every year.

Swedish institutions overall have done reasonably well in the past decade, with widespread gains in resources. Both the ARWU top-200 and non-ARWU institutions mostly have shared a trajectory of student expenditures rising, falling and then rising again quite sharply in the last five years.

Figure 13: Real per student expenditures at Swedish universities, ARWU-5 vs. rest of sector, 2006=100



But these data conceal something very distinct about Swedish higher education policy. Although *per-student* spending has increased by double-digits since 2011, total expenditure growth was by far the lowest for any system in our comparator group at only 9%. The reason is that for much of this period Sweden also had declining enrolments: of 2.6% in the ARWU institutions and 9.8% in the rest of the system.

Nine-country comparative analysis

Table 2 summarises the data from this section in tabular and graphic fashion, breaking up the decade into two distinct periods: one immediately before and after the global financial crisis, and the second from 2011 to 2015/16. On the whole, institutions tended to do better in the earlier period than the latter. This is not so much because institutions first experienced expansion and then cuts (although this was more or less the case for Canada, Australia, and to some extent Japan), but because resource growth simply slowed as governments sought to recover their fiscal position once the immediate crisis had ended.

Table 2: Changes in financial position, ARWU-200 and non-ARWU universities, nine selected countries, 2006-2015/6.

	2006-2011		2011-2015/6		2006-15/6	
	ARWU	non-ARWU	ARWU	non-ARWU	ARWU	non-ARWU
US Private	10.1%	3.7%	5.2%	5.6%	15.8%	9.5%
US Public	2.7%	3.1%	10.7%	3.1%	13.7%	6.3%
UK	14.9%	4.4%	14.4%	31.1%	31.4%	36.9%
Germany	21.3%	4.9%	1.6%	-10.1%	23.2%	-5.7%
Australia	9.0%	0.2%	-2.8%	-3.3%	5.9%	-3.1%
Japan	10.3%	12.0%	-2.7%	3.7%	7.3%	16.1%
Canada	8.3%	2.4%	-10.9%	-4.8%	-3.5%	-2.5%
Netherlands	-9.9%	4.5%	-7.7%	-0.5%	-16.9%	4%
Switzerland	11.6%	-15.2%	3.9%	-12.2%	16.0%	-25.6%
Sweden	-1.0%	-0.4%	21.2%	14.3%	19.9%	13.9%

On the whole, it is fair to say the following:

- i) In roughly half the jurisdictions, ARWU top-200 universities fared better than non-ARWU universities, and in most of the remaining cases they fared no worse. The Netherlands is the only significant exception to this pattern, with the caveat again that ARWU top-200 universities comprise most of their system.
- ii) In several cases (Germany, Sweden, Switzerland) ARWU institutions do better than comparators principally due to slower rates of growth – or even declines – in enrolment.
- iii) Outside of Sweden and Japan, ARWU-200 institutions are growing in size, but usually more slowly than other institutions in their jurisdictions.
- iv) In general, ARWU universities fared less well in the period 2011-2016 than they did in the prior five years. This may suggest shaky commitment to this type of institution among funders.

Question 4: Is there a relationship between “improved financial conditions” and changes in research output and rankings?

The ultimate question for policy-makers, of course, is whether increased financial investment actually matters in terms of improving outputs. This section considers the relationship between changes in expenditures and research outputs or outcomes in terms of the Shanghai rankings.

Publications

To track research output, we use publicly available data from the Leiden rankings on scientific publications over specific four-year periods (a few multi-year periods are preferred to a larger number of single-year observations because the latter are likely to be more volatile). The Leiden methodology is a straight count of publications in Clarivate’s Web of Science, subject to the following conditions:

- The publication is written in English
- The publication has one or more clearly identified authors
- The publication has not been retracted
- The publication is in a “core journal”, meaning:
 - its scope is international (i.e. authors come from a variety of countries)
 - it has a sufficiently large number of references to other core journals (which excludes a number of publications in Arts and Humanities, as well as trade journals and popular magazines).⁶

To examine *growth* in output, we used Leiden Ranking data for the periods 2006-2009 and 2012-2015, for 163 institutions that both offered sufficient data on income per student and carried a Leiden ranking (the Leiden ranking does not consider all of the specialised medical schools included as “institutions” in the ARWU). Across the two periods, ARWU institutions increased their number of publications by roughly 40%. This likely is not a simple function of increased research intensity: the number of indexed journals increased substantially over the period in question, most importantly due to the increase in Open Access journals but in part also due to expanded geographic coverage. Therefore, to correct for this shift in publication coverage and culture, we assigned a Leiden index score to each institution based on its change in publications between 2006-2009 and 2012-2015 *relative to the change across all ARWU top-200 institutions*. A score of less than 1 on this index therefore does not mean that publications decreased at a given institution (in fact, publications increased at every

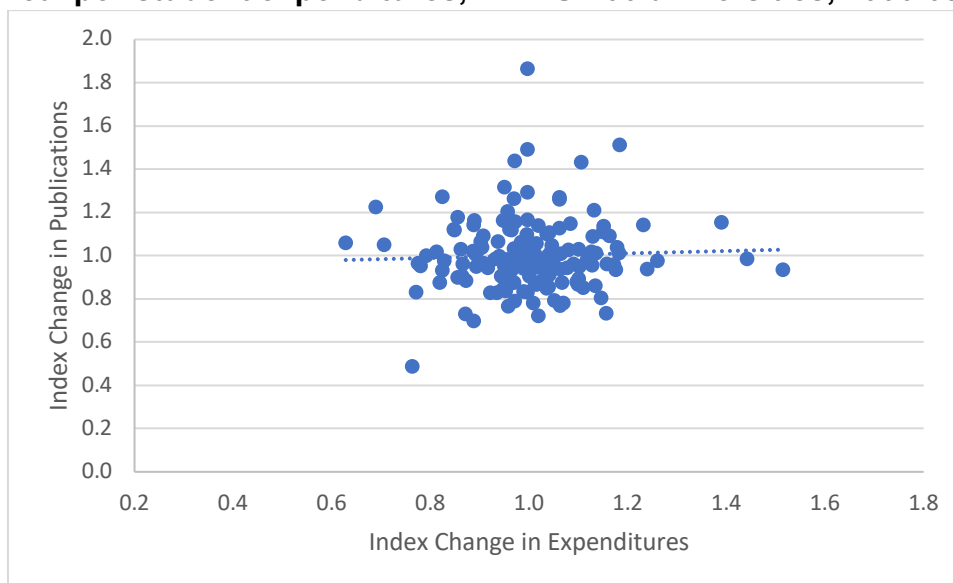
⁶ Taken from the Leiden Ranking’s methodology page, downloaded on October 5th 2017 at: <http://www.leidenranking.com/information/indicators#publications>

institution in our sample except Tokyo Tech), but rather that they increased more slowly than the average. Conversely, an index score over 1 means that publications increased more quickly than average.

To examine the effect of funding changes on publications, we linked this change in publications to the change in institutional funding across the two identical periods (2006-09 and 2012-15). Changes in funding across these multi-year periods are more muted than those across individual years that we examined in above in relation to questions 2 and 3: across all institutions, per-student expenditures increased on average by 16% from one period to another, with only 40 institutions experiencing a decline. We then converted this change in funding to a function of the average increase, the same measure as used for publications. At institutions with an expenditure index of less than 1, spending increased by less than the ARWU-200 average, while spending increased by more than the average for institutions with scores above 1.

Figure 14 shows the results of this exercise.

Figure 14: Change in research publication intensity as a function of change in real per-student expenditures, ARWU-200 universities, 2006-09 to 2012-15.

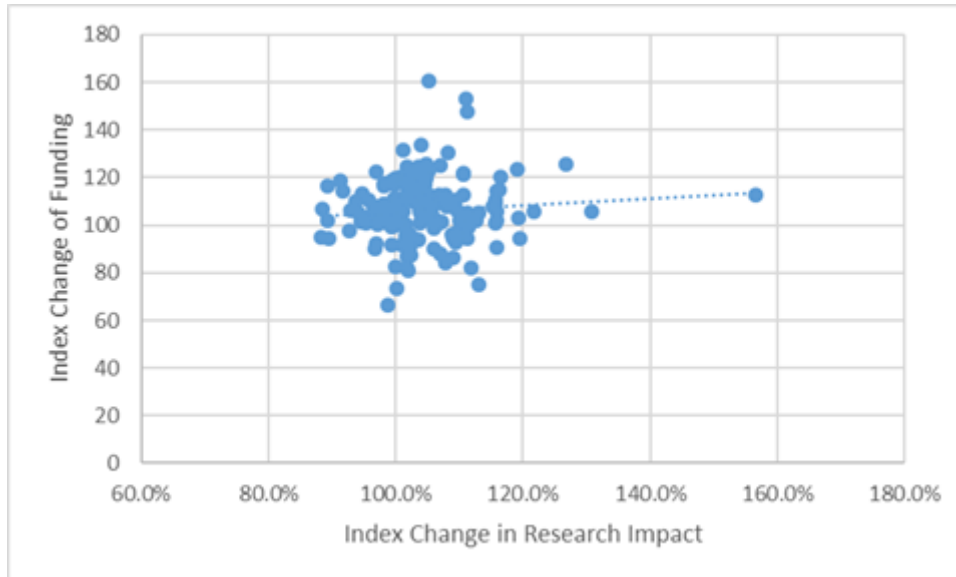


Briefly, Figure 14 shows that changes in per-student spending among ARWU-200 institutions were completely uncorrelated with changes in relative research publication intensity at these same institutions between the 2006-09 and 2012-15 quadrennia. Institutions that had experienced falling per-student expenditures (and hence presumably falls in income as well) were as likely to experience increases in publications as institutions where expenditures had risen.

It could of course be argued that number of publications is not an appropriate measure here, and that the true effect of extra funds in the system likely has to do with its quality not its quantity. If this were true, then one would expect that institutions which received

more money over time would see a greater increase in measures like the percentage of papers which make the global top 10% in terms of citations (after normalisation for field of study), another measure available through the Leiden Rankings. However, as figure 15 shows, this does not appear to be the case.

Figure 15: Change in research publication impact (% of paper making the global top 10%) as a function of change in real per-student expenditures, ARWU-200 universities, 2006-09 to 2012-15.

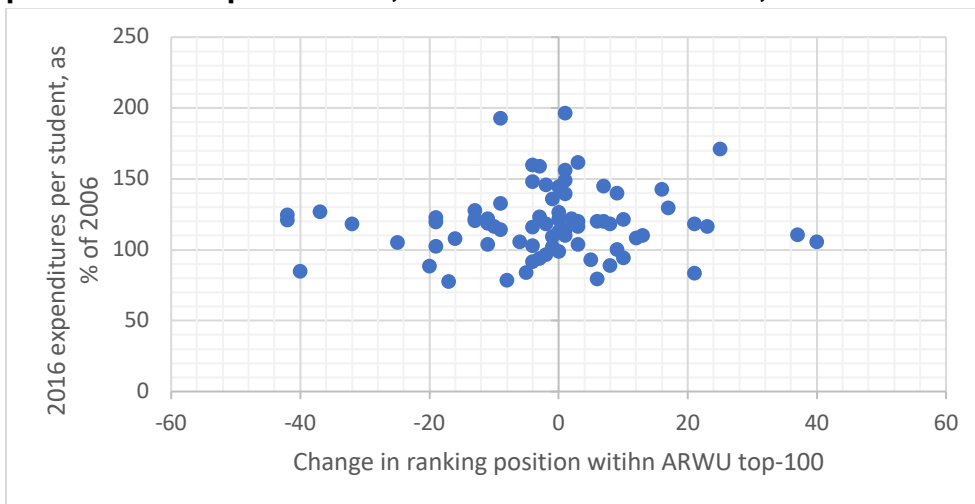


One caveat to these findings about funding and research output is that they exclude China. We know that top Chinese institutions have seen major gains in both quantity and impact of their research over the past decade. However, because we only have financial data for these institutions back to 2012, we cannot include them in the analysis. Were they to be included, these results might look somewhat different.

Rankings

In a similar fashion, we examined whether changes in funding affected ARWU ranking position. To do this, we mapped the changes in funding from 2006 to 2016 to the change in ranking position from 2007 to 2017. Because the ARWU only provides ordinal ranks for the top 100, we can only scatter plot for those institutions in the top 100. The result, shown below in figure 16, mimics the previous figures in that there is no observable relationship between changes in real funding per student and changes in top-100 ranking position.

Figure 16: Change in ranking position within ARWU top-100, by change in the real per-student expenditures, ARWU-200 universities, 2006 to 2017



To explore changes slightly lower down the ranking scale (that is, within the 101-150 and 151-200 bands in the ARWU rankings), we compared average changes in income over the decade for those institutions that fell into the category from a higher ranking, institutions that maintained their position within the bands, and those that rose into the band from a lower ranking. Table 3 shows the results, which again indicate no clear observable relationship between expenditures and changes in rank.

Table 3: Per-student expenditure (2006=100) across ARWU Universities Ranked 101-200 in 2017, by change in ranking band

Band in 2017	Fell into Band from Above	Stayed in Band	Rose into Band from Below
101-150	117.7	109.8	108.4
151-200	107.7	100	115.8

Conclusion and further research

In this brief paper on funding of world-class universities over the past 10 years, we have been able to demonstrate the following:

- World-class universities are very diverse in their levels of overall funding. All institutions in the top 50 or so have per-student funding of \$50,000 or more, but universities in the 51-200 range have much lower rates of funding.
- The per-student expenditures of world-class universities are increasing over time. Across all ARWU-200 institutions, spending rose by 15.7% from 2006 to 2016.
- More often than not, world-class universities are increasing their spending faster than the rest of their national university systems, but the gap is not particularly large except in Germany and Switzerland.
- There is no observable relationship between changes in per student spending and relative publication output or impact or on ARWU ranking.

Based on these findings, we would suggest that two traditional generalisations about world-class universities need to be re-thought. The first generalisation is that the focus on world-class universities is creating a two-tiered system, with some institutions racing ahead and others being left behind. While governments may talk about more competitive funding and concentrating resources and various higher education groups may fret about “two-tier systems”, the data suggest it is not actually happening anywhere outside of Germany and Switzerland. The second generalisation is that institutions can get ahead by spending more. The near-total absence of observable relationships between expenditures per student and either changes in relative publication rates or publication impact or rankings suggests that more money does not guarantee better results. Instead, far more attention should be paid to exactly how money is spent and how institutions are managed.

We see many possibilities to build upon this research. In the future, we expect to be able to update our relatively complete database on the spending of world-class universities more easily, and over time more trends will likely become apparent. We also believe that available data may make it possible to further refine this analysis, notably by trying to normalise data by academic staff numbers (rather than students), by finding ways to focus more closely on operating expenditures and controlling for the presence of hospitals, and finally by finding ways to separate research from teaching expenditures.

Appendix: Data Sources

Data on Finances and Students for institutions were taken from the following sources:

United States (70 institutions): Both financial and student data for ARWU institutions were obtained from IPEDS ([link](#)). Data on higher education more broadly was taken from DoE Digest of Educational Statistics, which is IPEDS based, but a secondary source. Financial and student data is complete for all 70 institutions back to 2006.

United Kingdom (20 institutions): Student data for ARWU institutions were obtained from the UK Higher Education Statistics Agency. Financial data was only available from HESA back to 2006-7; Financial data for 2005-06 was taken from institutions financial statements and indexed to HESA results for 2006-07 for all institutions except Leeds where data was unavailable and a value for 2005-06 imputed by taking the average change for the year for the other 19 institutions.

Germany (15 institutions): Financial and student data for ARWU institutions were obtained directly from institutional websites, either through annual reports, statistical yearbooks, or “Zahlen und Fakten” portions of websites. Financial data for 2016 was available only for Heidelberg, TU Munich, Hamburg, Kiel, Leipzig, Muenster and Tuebingen; Financial data for Erlangen-Nuremburg is not available past 2011; while for Hamburg, Muenster and Wuerzburg is not available prior to 2009. Data for these years is imputed using the same method as that for Leeds mentioned above. National level data is taken from the federal statistical agency, *Statistisches Bundesamt*.

Australia (10 institutions): Both Financial and Student data for all universities (ARWU and non-ARWU) are taken from the Department of Education and Training website.

China (9 institutions): Financial data for ARWU institutions is obtained directly from institutional websites which have since 2012 been required to publish data on institutional income and expenditure. Institutions are not, however, required to report publicly on student numbers and so these are much more inconsistent though larger institutions have begun publishing databooks which include such statistics. Because of the lack of time series data, Chinese institutions are excluded from the analysis in sections 2 and 3 of the paper.

France (9 institutions): French institutions do not publish financial data. They are therefore excluded from this survey.

Netherlands (9 institutions): Financial and student data for ARWU institutions were obtained directly from institutional websites, either through annual reports, financial statements or statistical yearbooks. National-level data is taken from the National Statistical Agency. Data from the Free University of Amsterdam is for the most part unobtainable and so is excluded from analyses.

Canada (8 institutions): Financial data, both national and for ARWU institutions, is taken from Statistics Canada's *Financial Information of Universities and Colleges* survey available from the Canadian Association of University Business Officers. Data on students, both national and for ARWU institutions, is taken from Statistics Canada's *Post-Secondary Student Information System*.

Switzerland (7 institutions): Financial and enrolment data for ARWU institutions are taken from annual reports, statistical yearbooks, or "Zahlen und fakten" portions of institutional websites. National-level data is available from the

Japan (7 institutions): Financial and enrolment data for ARWU-institutions is taken from institutional websites. Data is available up to 2015-16 for all universities except Kyoto and Tohoku where the final year available is 2014-15. Financial data for Nagoya is not available prior to 2008. National-level data is taken from the "Statistic of Japanese higher Education" webpage of the Research Institute of Higher Education at the University of Hiroshima (<http://rihe.hiroshima-u.ac.jp/en/statistics/synthesis/>).

Sweden: (5 institutions): All data, both institutional and national, is taken from annual editions of *Higher Education in Sweden: Status Report* from 2006 to 2016.

Belgium (4 institutions): Of the four Belgian institutions in the ARWU top-200, only one (Universite Libre de Bruxelles) provides reasonably consistent financial and enrollment data on its website through its annual *rapports d'activités*.

Israel (4 institutions): Financial data was not available for Tel Aviv University, which is therefore excluded from this survey. For the other three institutions, financial data was taken from "President's Reports" or institutional "Facts and figures" pages. Data on Enrolments is taken from institutional websites for Technion and Hebrew University; for the Weizmann institute it is taken directly from Israel's Central Bureau of Statistics. National level data on finances and students are also taken from the Central Bureau of Statistics.

Denmark (3 institutions): Data for all Danish universities are taken from *årsrapport* (annual reports) available on institutional websites. The reports from most recent years are published both in English and Danish.

Austria (2 institutions): Data for the University of Vienna is available from annual *Leichtungsberichts* and at Innsbruck from annual "Zahlen und Fakten" documents, all available on institutional websites.

Hong Kong (2 institutions): Data for both Hong Kong universities are available from annual reports available on institutional websites.

Italy (2 institutions): Data on enrolments was taken from the statistics section of the Ministero dell'Istruzione, dell'Università e della Ricerca's website. Financial data for l'Università di Padova is available from annual financial reports on the institutional website. Financial data for Sapienza – l'Università di Roma is posted on its website, but the data is presented in very inconsistent ways across fiscal years, making a single time-series impossible to create. The latter institution is therefore excluded from the analysis.

Norway (2 institutions): Data for both Norwegian universities are taken from *Statistisk sentralbyrå* between the years of 2006 and 2013 inclusive. For the subsequent years, data are from institutional websites, either through annual reports or facts and figures.

Saudi Arabia (2 institutions). Saudi universities do not publish financial data. They are therefore excluded from this survey.

Singapore (2 institutions): Data for both Singaporean universities are available from annual reports available on institutional websites.

Taiwan (2 institutions): Data for both Taiwanese universities are available from annual reports available on institutional websites.

Brazil (1 institution): Financial and undergraduate enrolment data for the University of São Paulo are available from *anuário estatísticos* (annual reports) available on the institution website.

Finland (1 institution): Data on the University of Helsinki is taken from Annual reports/reviews from 2011 onwards. Prior to 2009, it is available from the "key figures" portion of the institutional web site. Data has been imputed for 2010.

Ireland (1 institution): Data from University College Dublin is available from annual financial statements and annual reports on the institutional website.

Portugal (1 institution): Financial data is not available from the University of Lisbon, and so the institution is excluded from this analysis.

Russian Federation (1 institution): Financial data is not available from Lomonosov Moscow State University, and so the institution is excluded from this analysis.

South Korea (1 institution): Financial data is not available from Seoul National University, and so the institution is excluded from this analysis.

Centre for Global Higher Education
UCL Institute of Education
London WC1H 0AL

www.researchcghe.org
[@ResearchCGHE](https://twitter.com/ResearchCGHE)

