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# What's Behind Multiple Institutional Affiliations in Academia?

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# What's behind multiple institutional affiliations in academia?

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**Abstract**

Multiple institutional affiliations occur when an academic belongs to more than one organisation. Recent research shows an increase in multiple affiliations, but evidence on roles and motivations is mainly anecdotal. We develop in this study a typology of co-affiliations which identifies four types based on their purpose and origin. We draw on results from a unique international survey on academics in three major science nations (the UK, Germany and Japan) to study the different drivers for the four types of co-affiliations. The analyses show that researchers' motivations (access to networks, prestige, resources, funding, or personal income) explain the type of the observed co-affiliations. Self-initiated and research-focused co-affiliations are often motivated by networking and resource access while co-affiliations that serve other than research purposes are more often income motivated. The results contribute to the understanding of the organisation of science and we discuss implications for science and higher education policy.

*Keywords:* Institutional affiliations, academic labour market, resource access, k-means clustering

*JEL codes: L3, O3, O5*

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## 1. Introduction

Recent studies report a significant increase in the intensity of collaboration in academic research at the individual as well as the institutional level (Jones et al., 2008; Youtie et al., 2017). This rise is likely a reflection of increasing scientific complexity and increasing specialization and cooperation. It is also a reflection of global competition where governments across the globe incentivise universities and academics to collaborate and to internationalise. An example are the so-called "excellence initiatives" which explicitly aim to improve the research capacity and performance of science systems (Civera et al., 2020; Froumin and Lisyutkin, 2015; Salmi, 2016). Shifting organisational structures of the science system thus shape research incentives and define how science is done, and, by extension, why and how academics collaborate (Beaver and Rosen, 1978).

In addition to co-authorship and institutional collaboration, affiliations to multiple institutions (or co-affiliations), may be linked to such policy shifts (Hottenrott et al., 2020; Matveeva and Ferligoj, 2020) and could offer opportunities for knowledge exchange. While it is generally undebated that knowledge exchange between institutions is important in knowledge-based societies, multiple affiliations have so far received little attention, despite their growing prevalence (Hottenrott et al., 2020). Different types of collaborative mechanisms have different capacity to both generate and transfer knowledge, and multiple affiliations may play a unique role for institutions and academics alike. Moreover, how these co-affiliations are organised, such as their purpose and how they came to be, is likely important. Such different organisational forms may enable different kinds of motivations for knowledge generation and exchange to take hold (Osterloh and Frey, 2000).

To explore this relationship between motivations and affiliation types, we build on the literature that explores the factors that motivate academic scientists in their work (Lam, 2011), building on the differences between intrinsic and extrinsic motivations (Gagné and Deci, 2005; Ryan and Deci, 2000), and investigate how these motivations correspond to differently organised co-affiliations. It has in particular been argued, that science largely relies on the intrinsic motivation of researchers to do research, emphasising intellectual challenge and freedom (Janger and Nowotny, 2016; Roach and Sauermann, 2010; Stern, 2004). Yet, co-affiliations may use extrinsic incentives which could undermine intrinsic motivations[1] with consequences for knowledge generation and diffusion as shown in the context of firms (Osterloh and Frey, 2000).

This study investigates multiple affiliations and how these are organised, something that cannot be inferred from bibliometric data, and examines how different forms of co-affiliations correspond to motivations. The analysis builds on unique survey data on multiple institutional

[1] Recent prominent examples include US researchers' links to China's Thousand Talent Plan, some of which now face prosecution in the US (Kang, 2020; Mallapaty, 2018), and the case of Stefan Schaal who held two full-time employments in the US and Germany concurrently for 6 years (Dalton, 2018).

affiliations in four fields (biology, chemistry, engineering and social sciences & humanities (SSH)) and three countries (Germany, Japan and the United Kingdom). The results illustrate that co-affiliations are very common with 26 percent of respondents indicating that they are (or have been) simultaneously affiliated to more than one institution. We derive four main types of co-affiliations along the dimensions of purpose and origin and show that these are associated with different motivations. We find that researcher-initiated and research-focused co-affiliations are more likely motivated by networking and resource access while co-affiliations that serve other than research purposes are more often income motivated. In addition, researchers' career stage and their individual as well as their home institutions' prestige predict the type of co-affiliation that researchers engage in. Shedding light on multiple affiliations and their role in science, these findings contribute to our knowledge of cross-institutional collaborations and, more generally, of how research is organised (Beaver and Rosen, 1978; Jones et al., 2008; Katz and Martin, 1997), and to our understanding of the role of motivations in scientific research (Gustin, 1973; Stern, 2004).

The remainder of the paper is organised as follows: Section 2 discusses the literature on individual motives that could drive co-affiliations. Section 3 and 4 present the research context, data and findings. Section 5 finally discusses the findings and draws conclusions for scholarship and for organisations seeking or regulating multiple affiliations for their staff.

## 2. Background and theoretical framework

### 2.1. Multiple affiliations and the organisation of science

Recent years have seen a shift in science policy towards encouraging commercialisation, competition and internationalisation of science systems (Etzkowitz, 2003; Hamann and Zimmer, 2017; Krücken, 2019). These policies designed on one hand to promote greater collaboration between sectors, and on the other hand to create elite institutions and stratification in science, have changed the academic research landscape (Hamann, 2016; Krücken, 2014).

Universities have willingly accepted these calls for transformation in response to public funding constraints and are adapting to the increasingly competitive environment. In this context, institutions are experimenting with different organisational practices to engage in commercialisation and create 'impact' (Lam, 2011), and to increase their position in international rankings (Salmi, 2016).

These policy shifts also provide incentives for seeking additional roles, motivating their engagement in commercial and externally paid research and consulting activities. Prior literature has for instance discussed the part-time positions that academics hold in businesses as a founder or consultant (Fudickar et al., 2018; Toole and Czarnitzki, 2010; Zucker et al., 2002). As such, policy shifts likely contribute to researchers holding multiple positions and roles outside of their home universities or academic research organisations. The buy-in of international research talent on a part-time basis can be considered a short-cut for institutions to increase research capacity but is also attractive for academics to expand resources, visibility

and reputation beyond the home institution (Bhattacharjee, 2011; Matveeva and Ferligoj, 2020; Tourish et al., 2017).

Yet, co-affiliations can take different forms as they serve different core objectives and differ in how they originate. Such organisational forms determine how people interact and thus how knowledge is generated and transferred. A typology of these different forms of co-affiliation can thus help to shed light on their function as well as intended and unintended consequences. Here we consider the organisation of these affiliations at the level of the individual academic, exploring the different individual motives to engage in certain types of co-affiliations.

### 2.2. A typology of multiple affiliations

Co-affiliations of researchers with multiple institutions or organisations differ substantially with regard to their form and function. While no prior typology exists, a system architecture approach used to examine the global partnerships of the Massachusetts Institute of Technology (MIT) (Pfotenhauer et al., 2016), can serve as a point of reference. It is based on the idea that a function can be served by several organisational forms. In the case of co-affiliations, these serve, for instance, the function of knowledge exchange, yet, they can originate in different ways, ranging from researcher to institution initiated. This in turn is determined by a number of factors, such as the institutional context, researcher and institution preferences, as well as prior experiences both at the individual and institutional level. In addition, co-affiliations serve specific purposes, which may be more or less well integrated with specific origins of co-affiliations. In their analysis, Pfotenhauer et al. (2016) differentiate between research, education, innovation and institution building purposes of institutional partnerships. Guimon (2016), building on the third mission literature (Etzkowitz et al., 2000), also differs between research, education and third mission purposes of transnational university campuses. In our typology we reconfigure these as co-affiliations having either a low- (i.e. education and third mission) or a high-research *purpose*.

This differentiation is of course not clear-cut as affiliations can serve multiple purposes or the purpose of an affiliation can change over time. Similarly, affiliations typically need to be agreed between researchers and institutions (or two institutions) and thus the *origin*, as researcher-initiated or externally led, may not always be clearly apparent. Despite these overlaying boundaries, this classification to define organisational forms of co-affiliations offers a first step towards their analysis. In what follows we discuss the dimensions of origin and purpose.

#### *Origin.*

We indicated above that policies to increase competitiveness of science systems have created incentives for institutions to offer co-affiliations. In numerous countries excellence initiatives and performance-based funding were introduced to facilitate the moving up in international rankings. In France, where research and teaching had traditionally been separated, a closer integration of universities and Centre National de la Recherche Scientifique (CNRS) research

institutes resulted in multiple affiliations (Paradeise, 2018). Leading universities also entered into international partnerships to strategize research collaboration and funding acquisition (Hird and Pfotenhauer, 2017; Youtie et al., 2017). Similarly, following the Brexit vote, UK universities partner with European institutions by offering dual appointments that will enable UK academics to retain access to EU research funding (Coughlan, 2018). Motives for these institutional partnerships are maintained or new access to knowledge, networks, funding, and resources (Guimon, 2016). Co-affiliations are often one of the elements of such institutional partnerships.

Yet, the majority of multiple affiliations are at present not believed to be the result of institutional partnerships, but to be initiated unilaterally by a single institution or by individual academics themselves. For instance, some universities offer posts to star scientists in the form of part-time or adjunct positions to 'boost' their position in national and international rankings (Matveeva and Ferligoj, 2020; Xin and Normile, 2006). Affiliations are also offered by leading learned societies, as is the case for the Chinese Academy of Science with more than 50,000 members making it the most prolifically publishing institution worldwide (Li, 2016). Moreover, past employers and alumni employees, in an attempt to maintain links, may connect through co-affiliations, often linked to continuing research projects. Researchers may also seek co-affiliation actively if these benefit their research work through resource access or increase visibility in the research community. Further, the entrepreneurial university has encouraged academics to start or join firms (Fini et al., 2020; Slaughter and Rhoades, 1996). In other cases, precarious employment may encourage researchers to seek out supplementary income and hold multiple positions at the same time (Enders and Musselin, 2008).

Affiliations that emerge from agreements between an individual academic and an institution, or from a researcher's own initiative will be very different from those that are the result of institutional partnerships even where they serve the same function of knowledge exchange. In addition, agreements between individuals and institutions are not all alike. We consider whether they originated in the institution or the individual researchers, i.e. whether the co-affiliation is the result of an institution actively recruiting or is self-initiated by the affiliated individual.

***Purpose.***

We further consider the purpose of co-affiliations. Most multiple affiliations as reported on publications are between academic institutions (Hottenrott et al., 2020) and thus likely high in research focus, given that they result in publishable outputs with authors acknowledging both institutions. Yet the literature has discussed multiple other forms of affiliations which may not result in publishable research and only indirectly serve research. For instance, for researchers who are serving on public committees or are providing business consulting, these roles often come with advisory tasks as academics are called upon as experts (Fudickar et al., 2018). Those involved in private companies as co-founders or directors may further have managerial tasks associated with their work. These affiliations correspond to the innovation or third mission

purpose identified in prior research on transnational campuses (Guimon, 2016; Pfotenhauer et al., 2016) and may only have low-level research focus.

Academics may further engage in affiliations for teaching purposes. These are fairly widespread as universities hire experts to provide specialist education to their students, or part-time teaching assistance to cover for any provision gaps. While teaching by the former group may be largely research-led, it still scores low in research-focus compared to research affiliations, which serve research projects.

Finally, honorary positions have a long tradition and, in the case of Germany, were only explicitly differentiated from paid employment since the 1930s (Waaijer, 2015). With the professionalization of science, such un-paid positions became less common but are still available in many institutions or institutes as titles for adjunct or emeritus professors, which are usually highly distinguished. While some honorary staff may engage in research, others may engage in service provision or in advisory roles, giving lectures or representing the institution at events. This form may thus be considered to have a low-level research focus.

***Typology.***

Figure 1 provides a reduced form depiction of co-affiliations along the dimensions of origin and purpose. The different organisational forms that emerge can be presented as four forms of affiliations:

Q1) Affiliations with rather high research focus and originating from the academic.
Q2) Affiliations with rather high research focus and originating externally from the institution.
Q3) Affiliations with rather low research focus and originating externally from the institution.
Q4) Affiliations with rather low research focus and originating from the academic.


**Figure 1: Organisational forms of co-affiliations**

We expect researchers to locate in one of these four quadrants as a result of their motivations, needs and expected gains associated with co-affiliations. These are likely influenced by other

researcher characteristics such as the career stage. In what follows we discuss motivations and their relevance for the different forms of multiple affiliations.

### 2.3. Multiple affiliations and motivations

The form that co-affiliations take, may enable different kinds of motivations for knowledge generation and exchange to come into effect. The work on intrinsic and extrinsic motivations (Gagné and Deci, 2005; Ryan and Deci, 2000) has provided a useful approach to consider what motivates academic researchers. Prior research has generally argued that academics have a strong taste for science and are motivated by puzzle solving (Stephan and Levin, 1992; Stern, 2004). Science is thus intrinsically motivating to academics, i.e. inherently interesting and satisfying (Gagné and Deci, 2005; Lindenberg, 2001; Ryan and Deci, 2000).

Still, researchers' goal of gaining recognition within the scientific community has been stressed as an underlying logic of academic research (Merton, 1973; Stephan, 2012). In particular, peer recognition or prestige allow other benefits to follow, such as career advancement and prizes (Lam, 2011; Stephan, 2012). Here satisfaction is derived from the consequences of academic activities, rather than the activities themselves, i.e. extrinsically motivating (Gagné and Deci, 2005; Ryan and Deci, 2000). Peer recognition is not only of importance for maintaining the pace of scientific endeavour, but also dictates access to research resources or research freedom. Recognition awarded by peers does not rely exclusively on the work of the researcher, but is closely linked to their institutional affiliation (Higgins and Gulati, 2003; Long and McGinnis, 1981). For instance, the prestige of the institution has been shown to influence job prospects as well as research performance in terms of publications, perhaps through added visibility or access to crucial additional resources (Allison and Long, 1990; Crane, 1965). This includes the access to networks that may provide new opportunities for knowledge exchange or control access to critical research resources. For researchers who are involved in commercial ventures, consulting or collaboration with external sectors (Fudickar et al., 2018; Toole and Czarnitzki, 2010; Zucker et al., 2002), these roles enable knowledge exchange and networking which has been shown to provide ideas for research and access to resources that could further academics' research agendas (Lee, 2000). They may also provide additional extrinsic incentives such as satisfaction derived from involvement in decision-making. Gagné and Deci (2005) call these internalised extrinsic as they are personally valued.

Multiple affiliations address such motivations of academics, offering access to networks and prestige. ***Network or prestige motives*** come into effect when academics initiate research-focused co-affiliations (Q1). Network and prestige motives may also come into effect when academics are invited by external institutions as experts (Q3), but less so if they seek out alternative roles themselves that are also less research-focused (Q4). In the case of externally initiated research affiliations with high research-focus (Q2), it is are rather institutions that seek to benefit from researchers' prestige and knowledge, and it is thus less likely that individual prestige motives come into effect.

Academics are, however, not exclusively guided by intellectual challenge, recognition and prestige (Stephan, 2012). Rather, co-affiliations can offer direct and indirect access to research resources, including funding and equipment. Such access has become even more crucial in a science system that increasingly relies on extensive research infrastructure (Stephan, 2012; Musselin, 2013). Scarce resources that concentrate in few institutions make affiliations particularly attractive to academics in less well-endowed institutions. As such, ***resource motives*** come into effect in affiliations that have research objectives (Q1 and Q2), while they may be less important for co-affiliations that have a low-research focus (Q3 and Q4).

Further, we often underestimate the role of teaching for motivating academic researchers. Teaching is the foremost mission of the university and many academics at universities find teaching rewarding, as it provides a sense of accomplishment (Roth et al., 2007). For academics at research institutes, teaching may also provide access to students, to be recruited as PhDs or for projects, and thus present a means of access to human resources. Those highly motivated by teaching may also use their contacts and co-affiliations to build opportunities for their students, such as through placements. Yet, teaching motivations are generally higher amongst those with low research productivity (Bailey, 1999), who may have tutoring positions and part-time contracts in multiple institutions. ***Teaching and learning motives*** thus are more likely to come into effect when co-affiliations have teaching as their objective, and in particular where they are initiated by the academic. This corresponds to quadrant Q4. Teaching motives may also be important for externally initiated non-research affiliations (Q3) in particular for senior and prominent researchers who may be invited to teach at the host institution. They are however less likely to come into effect in affiliations that serve research purposes (Q1 and Q2), in particular where these are initiated by the academic (Q1).

Further, monetary incentives also play a role, and while they may not be sufficient to motivate researchers on their own (Gagné and Deci, 2005), they will be attractive to more senior academics who seek to monetise on their reputation or expertise (Audretsch and Stephan, 1999; Stephan and Levin, 1992). Indeed, job attributes such as financial income and job security have been shown to guide employment preferences and commercial pursuits of scientists (Lam, 2011; Roach and Sauermann, 2010). Multiple affiliations are able to offer these benefits by, for instance, providing additional personal income and broadening the institutional footing of academics (Stephan, 2012; Xin and Normile, 2006). Further, challenging academic employment markets and the increase in part-time positions in academia (Stephan, 2012) may require younger academics to seek alternative work arrangements including multiple positions for reasons of job security (Enders and Musselin, 2008). More time-intensive managerial or advisory roles in private or public consulting may also provide monetary compensation, and could thus be important in motivating academics to take up appointments at external institutions. ***Income motives*** are therefore more likely to come into effect where researchers monetise their expertise, that is, when they are scouted to join external institutions (Q2 and Q3). In addition, income motives are critical for those initiating non-research affiliations, such as entrepreneurial ventures as start-up founders (Q4).

Table 1 summarises the predicted relationships between motivations and co-affiliation types.

**Table 1: Co-affiliation types and motivations**

| | Q1 | Q2 | Q3 | Q4 |
|---|---|---|---|---|
| | **High Research - Researcher Origin** | **High Research - External Origin** | **Low Research - External Origin** | **Low Research - Researcher Origin** |
| **Network/prestige** | + | - | + | - |
| **Resources** | + | + | - | - |
| **Teaching/learning** | - | - | 0 | + |
| **Income** | 0 | + | + | + |

## 3. Data and Methods

We use a survey of academics active either in Germany, Japan and the UK to test these hypotheses. The survey provides information on the affiliation patterns of a wide range of academics who are listed as corresponding authors on scientific publications between 2013 and 2015. The survey-based measures not only allow us to better capture whether academics have any additional affiliations not listed on publications compared to bibliometric measures, but also how these are organised and academics' motivations to co-affiliate.

### 3.1. The research landscape in Japan, Germany and the UK

Multiple affiliations are in principle not likely to be a country-specific phenomenon. However, country-specific factors may affect the forms of co-affiliations and their motives. For this study, we selected Japan, Germany and the UK since the three countries are comparable in terms of academic output as measured in articles in peer-reviewed journals, but differ in terms of research organisation and internationalisation (Elsevier, 2017). For instance, the UK has a weaker non-university research sector compared to Japan and Germany, but is more international, as evidenced by higher shares of foreign born staff (Scellato et al., 2015) and higher international coauthorship (Elsevier, 2017). These differences are also reflected in multiple affiliations on publications, with academics in the UK more often showing international affiliations, while academics in Japan more often show domestic cross-sector affiliations (Hottenrott and Lawson, 2017; Hottenrott et al., 2020).

All three countries have moreover experienced changes in funding distribution in the 2000s, characterised by a growing importance of third party funding and a performance-based distribution of core-funding. Such changes may be responsible for the increase in multiple affiliations observed globally. Hottenrott et al. (2020) in an analysis of more than 22M articles, for instance, showed that countries experienced an increase in authors with multiple affiliations following the introduction of "excellence initiatives" or other funding schemes.

A comparison is moreover interesting due to differences in terms of governance, e.g. autonomy, staff structures and career trajectories (Teichler et al., 2013). Germany traditionally followed a model where permanent positions are only available to professors who were called to a chair. This leads to a higher proportion of temporary positions compared to the UK and Japan where permanent positions are also made available to junior and mid-level academic staff. Still, in

recent years there have been a growing number of part-time and fixed-term contracts also in the UK and in Japan and more flexible pay schemes. Resulting inequalities over career stages may impact not only the prevalence of multiple affiliations but also how they are organised.

### 3.2. Data collection

In order to construct the survey sample, we selected journals based on a list from the Thomson Reuters journal citation report (JCR). We focused on four scientific disciplines that represent a diverse set of disciplinary cultures and differ in their resource requirements and organisation of research teams (Stephan, 2012), straddling the natural, technical, social sciences and humanities: biology, chemistry, engineering, and SSH (economics, business studies, history)[2]. Journals were sorted by eigenfactor score, a rating of journal importance based on the number of incoming, journal-weighted citations that enables us to consider journals across all quality spectra. For each field we randomly drew five journals from the upper half of the eigenfactor distribution (20 journals in total). As the number of articles in the selected journals was very low for engineering, economics, business studies, and history, we drew additional journals in these fields resulting in 40 journals in each respectively. The process resulted in six samples of journals by field, stratified by eigenfactor score.

All articles appearing in the selected journals between 2013 and 2015 were downloaded from the Web of Science database (WoS). We retained all articles with their corresponding address in Germany, Japan or the UK. In cases where more than one corresponding author was stated we picked the first. If there was more than one article per author, we picked the latest article. We then excluded all emails that did not belong to authors at universities or public research organisations. Entries were checked manually to assure that email addresses and corresponding author names matched. This process resulted in a final list of 9,056 corresponding authors, 140 of which were used for a pilot and are therefore not included in the final survey run. The survey was conducted from June to August 2016.[3] We received at least partial responses from 2,389 academics (response rate 26.8%). Accounting for undeliverable email invitations, response rate for the survey is 36.6 percent in Japan, 31.1 percent in Germany and 24.5 percent in the UK. A detailed response analysis (response rates and (non-)response patterns) can be found in Appendix A.

[2] Business studies and economics were selected as broad fields within the social sciences and are of particularly interest to the innovation studies community. History was selected as it is distinct from the social sciences and is represents the humanities and is better represented in WoS. However, historians were not surveyed in the case of Japan due to the low number of articles in JCR listed journals.

[3] The questionnaire was originally written in German and English and then translated into Japanese. Through back translation and in discussions with Japanese experts the three questionnaires were finalised. The survey was conducted through the platform LimeSurvey. Authors were invited to participate by email and two reminders were sent.

The survey asked respondents for details on affiliations outside their main employment, past and present: "*Are you, or were you previously, simultaneously affiliated to more than one institution, organisation, or employer? This can include other higher education institutions, research institutes, research units (not within the same institution), other non-research institutions or companies." [Help: These include long-term connections with formal as well as informal contractual basis, e.g. honorary/adjunct professor, research associate, scientific fellow (shorter residencies or sabbatical leave do not count)]*

Respondents who held multiple affiliations were asked to provide details for up to three of their affiliations and we treat each of these affiliations as a separate observation. Those with additional affiliations in the past only, were asked to provide details about the most recent external affiliation. We only considered those who had an affiliation for at least one year during the 2011 to 2016 period. The questionnaire further covered topics such as motivations for multiple affiliations, affiliation period, place, sector and organisation; and demographics of the respondents (see Appendix D for details of questions). In addition we collected publication records for the 2010 to 2016 period from Scopus for all respondents in our sample. Complete information is available for 2,213 respondents which form the basis of this analysis. Of these, 25.7%, or 571 respondents, indicate that they had at least one external additional affiliation during the period 2011 to 2016. The number of observations, including up to three observations for respondents with more than one co-affiliation, is 2,381 (733 with co-affiliations).

### 3.3. Measures

#### 3.3.1. Dependent variables: organisation of multiple affiliations

The focus of this paper is on organisational forms of multiple affiliations according to the typology suggested in section 2. Specifically this typology considers two dimensions, purpose and origin, resulting in four forms of multiple affiliations as depicted in Figure 1.

To assign respondents to each of the four organisational forms and to test the appropriateness of the typology, we rely on two questions within the questionnaire. To determine purpose we asked respondents to indicate the purpose (work arrangement or role) of their additional affiliation, distinguishing between a teaching affiliation (e.g. adjunct/affiliate/sessional lecturer), a research affiliation (e.g. research associate), an advisory role, a managerial (business) role, or the acceptance for honour. Respondents could indicate more than one role. We further asked where each additional affiliation originated, distinguishing between prior employment, entrepreneurial ventures, and personal initiative on one side, and institutional collaborations and institutional initiative on the other side. Again, respondents could indicate multiple answers.[4]

[4] Questions are listed in Appendix D.

To create the measure for the organisation type of the additional affiliation, we rely on a cluster analysis to determine the natural groupings (or clusters) of observations (Everitt et al., 2011) along the dimensions of purpose and origin of co-affiliations. We use a partition method (k means) that breaks the observations into a distinct number of non-overlapping groups. Here, each observation is assigned to the group whose mean is closest to its own value. Subsequently, new group means are determined based on this categorization. This process continues until no observation changes groups anymore. The process starts at *k* seed values as initial *k* group means. We use the simple matching coefficient which is suitable for binary data and is the proportion of matches between variables (Everitt et al., 2011). Observations are clustered into four clusters in line with our framework and mapped onto the quadrants in Figure 1. The sensitivity of the cluster method and its optimisation using Calinski-Harabasz values are discussed in section 4.3.

### 3.3.2. Explanatory variables: motivations for multiple affiliations

Our key factor of interest is the motivation to take on additional affiliations. While academics are overall said to be driven by intrinsic rewards, they also respond to extrinsic incentives (Stephan, 2012). In the case of motivations we identified a number of motivations based on prior literature: network and prestige, resource, teaching and learning, and income motives. Our survey asked respondents who held multiple affiliations "*How important are the following motivations for your affiliation with additional institutions?*", with respondents rating 11 items on a 4-point scale (1 = not at all important, 4 = very important). The 11 items were chosen in line with prior work on motivating factors in academia (Lam, 2011; Roach and Sauermann, 2010) and through interviews with academic colleagues. They include: personal income, prestige of the additional institution, building professional networks, opportunities for knowledge exchange/transfer, access to funding, access to data and material, access to technical support, labs or equipment, access to students, gaining teaching experience, creating job opportunities for students, creating career prospects for themselves.

As these factors are conceptually related we conduct a confirmatory principle component factor analysis on these eleven motivation items. The analysis confirms that there are four latent factors (see Table B.1 for details). The first factor, corresponding to *network/prestige*, includes the items relating to institutional prestige, network building and knowledge exchange; the second factor, corresponding to a *resource* motive, includes access to research resources and funding; the third factor, corresponding to a *teaching and learning* motive, includes teaching experience and student concerns; and the fourth factor, *income* motive, includes income and own career prospect. The inclusion of own career prospects in income may not be immediately apparent. Some scientists may look at careers as an enabler of research, however, this does not preclude a more pragmatic requirement for job offers. Indeed many scientists may keep affiliations as a point of entry into higher paid jobs. The factor loadings after rotation (shown in Table B.2) suggest that these four motives are indeed distinct from each other. We use the predicted factor scores, i.e. the weighted sums of the observed item values, as our four motivation variables.

### 3.3.3. Control variables

The probability of a researcher to be co-affiliated as well as the type of co-affiliation is likely determined by individual characteristics. A researcher's career stage, for instance, may relate to whether we observe a co-affiliation and also to its purpose as well as origin. In particular we asked respondents about their current position, and gender. Where responses were missing, position titles and gender were identified through a web search. Responses for seniority were then combined into three categories: senior (professor or associate professor); mid-career (assistant professor; senior researcher); junior (postdoc; PhD student; research assistant). The career level is expected to be particularly critical. Incentives for research have been shown to favour research activities that lead to publications, especially at early career stages. This could mean that junior researchers favour affiliations for research purposes (Q1). Senior academics instead may seek to "trade or cash in this reputation for economic return" (Audretsch and Stephan, 1999: 101) favouring affiliations that rely on their expertise (Q4), including non-research related externally initiated affiliations (Q3).

We further control for the country of residence, which was identified from the corresponding author address. We also control for publication performance (publication count and mean citations) collected from Scopus for the period 2010-2016. Because the rank of the respondents' main institution may impact their requirement or opportunity for co-affiliations, we also control for these calculating a four-step ranking based on Times Higher Education ranking and national rankings, with rank 0 corresponding to lowest ranks and rank 3 to the highest. Public Research Organisations (PROs) are not assigned an institution rank. The respondent's overall satisfaction with research resource provision at their home institution is also included as control. This was based on the question "Please evaluate each of the following facilities at your main institution" which asked respondents to score 12 items on a 4-point scale (1 = poor and 4 = excellent). We average the rating for the four items describing research facilities only, which include quality of labs, research equipment, availability of data and research funding, to reflect satisfaction with home research resources.

### 3.3.4. Selection variables

Our dependent and the main independent variables capturing motivations can only be observed for those respondents who have multiple affiliations. We account for this with a selection variable (*co-affiliation*) that takes the value of 1 if a co-affiliation is reported. We consider three variables that may impact the probability to observe multiple affiliations (exclusion restrictions). These are the number of previous employers *(# prev.employers)*, since we hypothesized that job mobility can be a driver of multiple affiliations where previous affiliations are maintained in addition to new ones; and researchers at *PRO*s, who may be more likely to seek co-affiliations at universities, for instance to gain teaching experience or connect to university researchers. In addition we consider scientific field, which was identified from the WoS journal classification of the sampled article, as prior research has found differences in the incident rate of multiple affiliations by subject area (Hottenrott et al., 2020).

## 4. Results

### 4.1. Descriptive results

We begin with a descriptive analysis to provide an overview of multiple affiliation patterns and our regression variables. As mentioned above, 25.7 percent of respondents reported multiple affiliations. This is significantly higher than what we know from bibliometric data. Hottenrott and Lawson (2017) reported an increase of authors with multiple affiliation in the same three countries from 5 percent in 2008 to a share of about 10 percent in 2014. Shares between 10 and 15 percent for the three countries are reported in a larger bibliometric studies that includes all scientific fields and publications between 1996 and 2019 (Hottenrott et al., 2020). Both are lower than the 25.7 percent observed in the survey, which indicates that bibliometric data may understate the phenomenon[5]. Asked in complementary questions whether they list all their affiliations on their publications, 42.6 percent of respondents with co-affiliations indeed say they only name the main affiliation, 31.0 percent name selected affiliations and 26.4 percent name all affiliations they currently have. The proportion of respondents with multiple affiliations differs between countries, disciplines, seniority levels, institution rank and gender (see Table 1). Respondents with multiple affiliations, however, show no difference in terms of publication and citation counts. Table 2 also indicates that more than 80 percent of respondents are men and about 60 percent are senior academics.

The number of previous employers and employment in PRO are both significantly higher for respondents with multiple affiliations, confirming that these are excellent candidates for the selection stage.

[5] Research affiliations, which may be more likely listed on publications, are reported by 15 percent of respondents and thus also above the share reported on publications.

**Table 2: Affiliation status by respondent characteristics**

| | Co-affiliation= 0 (N=1648) | | Co-affiliation = 1 (N=574) | | | Total sample (N=2222) | |
|---|---|---|---|---|---|---|---|
| | mean | sd | Mean | sd | Mean diff sig. | min | max |
| Junior | 0.200 | 0.400 | 0.166 | 0.372 | * | 0 | 1 |
| Mid-Career | 0.213 | 0.410 | 0.218 | 0.413 | n.s. | 0 | 1 |
| Senior | 0.587 | 0.492 | 0.617 | 0.487 | n.s. | 0 | 1 |
| Female | 0.180 | 0.384 | 0.188 | 0.391 | n.s. | 0 | 1 |
| Germany | 0.309 | 0.462 | 0.333 | 0.472 | n.s. | 0 | 1 |
| UK | 0.285 | 0.451 | 0.293 | 0.455 | n.s. | 0 | 1 |
| Japan | 0.407 | 0.491 | 0.375 | 0.484 | n.s. | 0 | 1 |
| ln(# publictions) | 2.852 | 0.986 | 2.878 | 1.047 | n.s. | 0 | 6.009 |
| ln(citations pP) | 2.129 | 0.789 | 2.134 | 0.824 | n.s. | 0 | 6.253 |
| Top tier uni | 0.231 | 0.422 | 0.251 | 0.434 | n.s. | 0 | 1 |
| 2nd tier uni | 0.240 | 0.427 | 0.207 | 0.406 | n.s. | 0 | 1 |
| Other ranked | 0.173 | 0.378 | 0.167 | 0.374 | n.s. | 0 | 1 |
| Unranked org. | 0.356 | 0.479 | 0.375 | 0.484 | n.s. | 0 | 1 |
| Satisfaction | 1.730 | 0.017 | 1.791 | 0.664 | ** | 0 | 3 |
| # prev. employers | 1.765 | 1.282 | 2.092 | 1.355 | *** | 0 | 4 |
| PRO | 0.088 | 0.283 | 0.167 | 0.374 | *** | 0 | 1 |
| Biology | 0.262 | 0.440 | 0.220 | 0.414 | ** | 0 | 1 |
| Chemistry | 0.290 | 0.454 | 0.253 | 0.435 | * | 0 | 1 |
| Engineering | 0.226 | 0.418 | 0.174 | 0.380 | *** | 0 | 1 |
| SSH | 0.223 | 0.416 | 0.354 | 0.479 | *** | 0 | 1 |

Note: * (**, ***) indicate significance at 10% (5%, 1%). One observation per respondent. Test of differences in means based on two-sides t-tests.

#### 4.1.1. Organisation of co-affiliations

Responses regarding purpose and origin of affiliations are summarized in in Table 3. A considerable share of affiliations are research related (54 percent). Non-research related activities such as teaching (33 percent), advisory (14 percent) and managerial posts (7 percent) are also named by our sample. Few researchers hold honorary appointments (5 percent). Additional affiliations can be self-initiated by the academic through their own active initiative or start-up activity (16 and 4 percent). Past employment relationships are also frequently named (20 percent). Co-affiliations can also originate externally, through unilateral initiatives of external institutions (e.g. by invitation) (25 percent) or existing inter-institutional cooperation (17 percent). Yet, it is personal contacts that are named most frequently (42 percent), indicating that academics use their existing networks to source additional affiliations. Making use of cluster analysis we group affiliations into four organisational types in line with Figure 1 and report them in Table 3. The table shows the number of observations per cluster and reports the means for each respective group. A group mean larger (smaller) than the sample mean indicates that the characteristic does (does not) belong to the respective cluster. Means larger than the sample mean are indicated in bold. The first cluster (Q1) is formed of research activities which have prior employment in addition to personal contacts and initiative as primary origins. Cluster 4 instead represents all non-research purposes and has entrepreneurial activities as primary origin in addition to personal contacts and own initiative. Looking at differences between types with external origin, we see that cluster 2 is largely based on existing

institutional cooperation which appear important for research, while Q3 relates to the unilateral initiative of an external institution such as for teaching purposes or advisory tasks. They thus map well onto the four quadrants in Figure 1.

**Table 3: Clusters determined by k-means cluster analysis on origins and purpose**

| | | Full sample | | [Q1] **High Research - Researcher Origin** | [Q2] **High Research - External Origin** | [Q3] **Low Research - External Origin** | [Q4] **Low Research - Researcher Origin** |
|---|---|---|---|---|---|---|---|
| | | **mean** | **sd** | **mean** | **mean** | **mean** | **mean** |
| Purpose | Research | 0.537 | 0.499 | **1.000** | **0.735** | 0.373 | 0.005 |
| | Teaching | 0.333 | 0.472 | 0.102 | 0.291 | **0.452** | **0.537** |
| | Advisory | 0.142 | 0.349 | 0.025 | 0.128 | **0.229** | **0.220** |
| | Managerial | 0.072 | 0.259 | 0.025 | 0.051 | 0.066 | **0.146** |
| | Honorary | 0.048 | 0.214 | 0.012 | 0.017 | **0.054** | **0.102** |
| Origin | Personal Contacts | 0.415 | 0.493 | **0.496** | 0.282 | 0.223 | **0.551** |
| | Prior employment | 0.204 | 0.403 | **0.336** | 0.128 | 0.072 | 0.195 |
| | Own Initiative | 0.156 | 0.363 | **0.279** | 0.085 | 0.018 | **0.161** |
| | Entrepreneurial activity | 0.040 | 0.195 | 0.016 | 0.026 | 0.006 | **0.102** |
| | Institutional Cooperation | 0.173 | 0.379 | 0.004 | **1.000** | 0.054 | 0.000 |
| | Ext. Institutional Initiative | 0.246 | 0.431 | 0.016 | 0.085 | **1.000** | 0.000 |
| | Frequency | 733 | | 244 | 118 | 166 | 205 |
| | Cumulative % | 100 | | 33.29 | 16.10 | 22.65 | 27.97 |

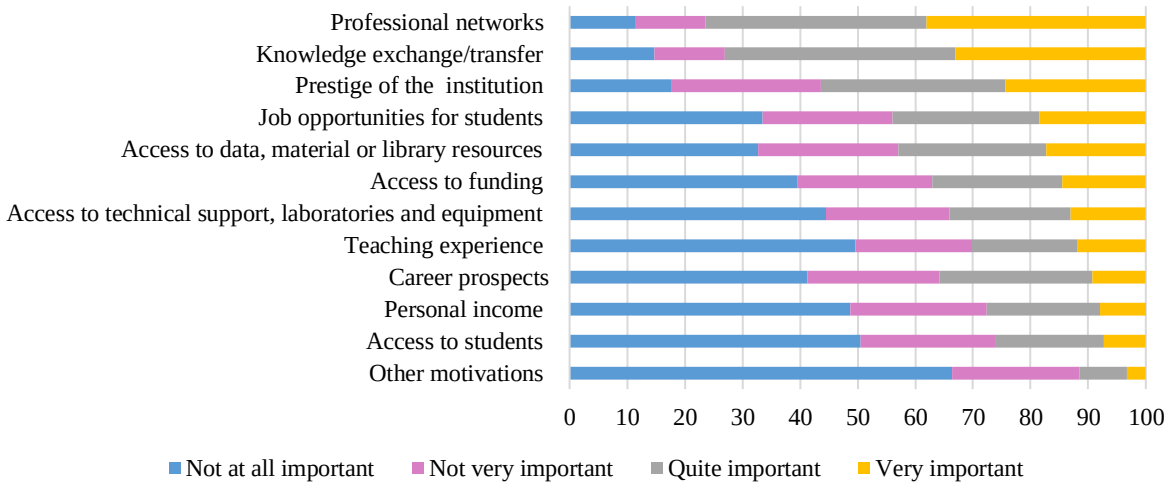


**Figure 2: Motivations behind multiple affiliation**.
Answers to: *"How important are the following motivations for your affiliation with additional institutions or companies?"*

### 4.1.2. Motivations for different types of co-affiliations

The different motives to co-affiliate are presented in Figure 2. A large share of respondents report professional network building (38 percent) or opportunities for knowledge exchange or transfer (33 percent) as very important. For about one in four (24 percent), the prestige of the institution is also very important. Access to technical support staff, laboratories and equipment

and funding, as well as data, material or library resources also turn out to be important or very important motivations for more than 30 percent of respondents. These responses suggest that most affiliation decisions are driven by research considerations and associated rewards such as reputation and priority. Motivations that relate to monetary rewards are still important for more than a quarter of respondents, though less likely to be named as being of high importance.

Following a factor analysis we consider four factors (see Tables B.1 and B.2 in Appendix B for details). As these are based on predicted factor scores each has a mean of approximately zero and a standard deviation of 1. Motivations differ significantly by cluster as can be seen from the summary statistics presented in Table 4, where means of the four factors are reported for each cluster. We also report the F value which shows that the factor means differ significantly between the four clusters indicating that distinct motives are associated with the different clusters. The resource motive factor is highest for affiliations in Q2 (high research and external origin) and lowest in Q4 (low research and researcher origin). The network/prestige motive is strongest in Q1 (high research and research origin). Teaching motive is high for cluster Q4, which includes many teaching affiliations, but also for Q2 (high research). The income motive is also strongest for Q4 which amongst others shows start-up activity as a strong origin.

**Table 4: Means of main variables by cluster**

| | [Q1] **High Research - Researcher Origin** | [Q2] **High Research - External Origin** | [Q3] **Low Research - External Origin** | [Q4] **Low Research - Researcher Origin** | |
|---|---|---|---|---|---|
| | mean | mean | mean | mean | ANOVA F |
| Resources | 0.143 | 0.411 | -0.087 | -0.315 | 16.21*** |
| Network/prestige | 0.236 | 0.066 | 0.069 | -0.184 | 6.81*** |
| Teaching Motive | -0.306 | 0.234 | 0.012 | 0.223 | 14.43*** |
| Income | -0.023 | 0.081 | -0.234 | 0.188 | 5.94*** |
| Germany | 0.357 | 0.432 | 0.265 | 0.234 | 5.99*** |
| UK | 0.361 | 0.280 | 0.235 | 0.337 | 2.83** |
| Japan | 0.283 | 0.288 | 0.500 | 0.429 | 9.05*** |
| Female | 0.230 | 0.254 | 0.157 | 0.117 | 4.76*** |
| Junior | 0.189 | 0.237 | 0.060 | 0.137 | 6.93*** |
| Mid-Career | 0.217 | 0.229 | 0.151 | 0.215 | 1.26 |
| Senior | 0.594 | 0.534 | 0.789 | 0.649 | 8.28*** |
| Top tier uni | 0.283 | 0.212 | 0.229 | 0.244 | 0.91 |
| 2nd Tier uni | 0.242 | 0.178 | 0.217 | 0.151 | 2.12* |
| Other ranked | 0.143 | 0.153 | 0.181 | 0.166 | 0.38 |
| Unranked org. | 0.332 | 0.458 | 0.373 | 0.439 | 2.67** |
| ln(# publictions) | 2.730 | 2.960 | 3.074 | 3.062 | 5.28*** |
| ln(citations pP) | 2.100 | 2.292 | 2.136 | 2.088 | 1.96 |
| satisfaction | 1.837 | 1.803 | 1.760 | 1.755 | 0.72 |

Note: * (**, ***) indicate significance at 10% (5%, 1%). 733 observations/co-affiliations.

Table 4 also reports the mean values for all control variables used in the regressions by cluster. Some differences to point out are the higher share of respondents from Germany in Q2 and the

higher share of respondents from Japan in the low research clusters Q3 and Q4. This suggests that respondents in different countries may experience different organisational setups of multiple affiliations. Yet, as we will see later, most of these differences are due to differences observed in other variables. Significant differences are also observed by seniority, with junior researchers appearing more often in Q2 compared to other clusters, while senior researchers dominate the low research clusters Q3 and Q4. For this reason publication numbers may also be higher in these two low research clusters.

A correlation matrix with all explanatory variables can be found in Appendix C (Table C.1). It shows that motivations correlate weakly with a number of demographic characteristics.

### 4.2. Regression results: Organisation and motivation

We investigate the role of motivational factors for the observed organisational types of co-affiliation (Q1-Q4) by modelling the affiliation type as a function of motivations as well as other variables likely explaining affiliation type. To account for selection into co-affiliation, we estimate a two-stage selection model where the probability to have any co-affiliation is estimated in the first stage and the respective types of co-affiliations in the second conditional on having one. Both stages are jointly estimated via a conditional mixed process estimator using probit specifications which account for the binary nature of the dependent variables in both stages (Roodman, 2011).

Table 5 shows the results of the selection models. The selection stage captures the probability that an individual currently has (or recently had) at least one co-affiliation. The second stage estimates the probability of an individual to belong to cluster quadrant 1, 2, 3 or 4. A selection stage needs to be estimated for each outcome cluster. The significant parameter *rho* further confirms that in each case that there is a correlation between the errors in the two stages. The number of previous employers, affiliation to a PRO and subject area act as exclusion restrictions. The number of previous employers, PRO and SSH variables show positive and statistically significant coefficient estimates in the first stage (while they do not predict the cluster type in the second stage[6]). Other than these, it is research activity (as measures by the logged number of publications) that predicts co-affiliation, confirming bibliometric findings in Hottenrott and Lawson (2017). Other variables are all insignificant at conventional levels of statistical significance.

In the second stage, we find respondents' motivations to be significantly associated with the type of co-affiliation. In particular, the more important the network and prestige motive, the more likely the academic can be located in Q1, i.e. in a highly research-related co-affiliation that originated from academics' personal contacts and initiative. In contrast, a network/prestige-motivated academic is less likely to be in Q4, i.e. in a low-research co-affiliation with personal contacts and entrepreneurial activity as origin. Where resource motive

[6] Confirmed in unreported auxiliary regressions.

plays an important role, the respondent is more likely to be in an affiliation of type Q1 or Q2 (and again less likely Q4) which are both high in research focus, but Q2 is rather externally initiated. This indicates that academics may seek co-affiliations that help them secure access to research resources, or may benefit from institutional cooperation that provide resource access for research purposes.

Teaching motives, instead, are related to a higher likelihood to be in Q4 and a lower likelihood to be in Q1. Academics may thus seek out teaching opportunities elsewhere, possibly to increase income or career prospects, as suggested by the positive correlation between the income motive and Q4. This positive correlation may also relate to the entrepreneurial activities of academics, who may join start-ups to gain additional personal income. The income motive, however, is negatively linked to Q3, i.e. low-research affiliations that originate largely from external institutions. This suggest that the role of monetary incentives used by some institutions to attract top academics are not an important motive for academics to affiliate.

Looking at control variables, we find small country differences in the organisational type of co-affiliations, with Q3 more often observed in Japan and Q4 in the UK. We also find that academics at second-tier institutions (but not in the top-tier) are more likely to seek out affiliation with high-research purpose compared to academics at lower ranked places (and less likely to seek out affiliations that are low in research focus). More senior academics are more likely to be found in Q3, i.e. affiliations with low research purpose and originating externally, compared to academics at earlier stages of their career. Interestingly, publications are positively associated with Q4 (low research), and negatively with Q1 (high research). This could suggest that those with an established publication record are "cashing in" on their prestige, while those with a less well established record are still working to build up such reputation. Finally, the satisfaction with resource provision in the home institution shows no significant correlation with multiple affiliation occurrence or type.

**Table 5: Regression results – Probit models with selection (marginal effects reported)**

| | Selection Stage Multiple Affiliation = no/yes | | | | Cluster-type Q1 High research – Researcher origin | Q2 High research – External origin | Q3 Low research – External origin | Q4 Low research – Researcher origin |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (1) | (2) | (3) | (4) |
| # prev.employers | 0.039*** | 0.041*** | 0.037*** | 0.036*** | | | | |
| | [0.009] | [0.009] | [0.009] | [0.009] | | | | |
| PRO | 0.196*** | 0.180*** | 0.213*** | 0.220*** | | | | |
| | [0.041] | [0.047] | [0.039] | [0.039] | | | | |
| Chemistry | 0.025 | 0.027 | 0.019 | 0.018 | | | | |
| | [0.031] | [0.030] | [0.031] | [0.031] | | | | |
| Engineering | 0.029 | 0.026 | 0.029 | 0.031 | | | | |
| | [0.035] | [0.035] | [0.036] | [0.036] | | | | |
| SSH | 0.234*** | 0.237*** | 0.230*** | 0.227*** | | | | |
| | [0.035] | [0.035] | [0.036] | [0.036] | | | | |
| **Network/prestige** | | | | | **0.044**** | **-0.003** | **0.025** | **-0.038**** |
| | | | | | **[0.019]** | **[0.007]** | **[0.020]** | **[0.016]** |
| **Resources** | | | | | **0.067***** | **0.025**** | **-0.024** | **-0.073***** |
| | | | | | **[0.018]** | **[0.011]** | **[0.021]** | **[0.019]** |
| **Teaching** | | | | | **-0.095***** | **0.012** | **0.011** | **0.044**** |
| | | | | | **[0.022]** | **[0.008]** | **[0.021]** | **[0.017]** |
| **Income** | | | | | **-0.015** | **0.003** | **-0.055***** | **0.033**** |
| | | | | | **[0.019]** | **[0.006]** | **[0.020]** | **[0.015]** |
| UK | 0.015 | 0.014 | 0.015 | 0.016 | -0.027 | -0.020 | -0.065 | 0.113*** |
| | [0.030] | [0.030] | [0.030] | [0.030] | [0.049] | [0.017] | [0.053] | [0.040] |
| Japan | 0.049 | 0.050 | 0.046 | 0.045 | -0.064 | -0.035* | 0.120** | 0.045 |
| | [0.030] | [0.030] | [0.030] | [0.031] | [0.048] | [0.018] | [0.051] | [0.035] |
| Female | 0.005 | 0.006 | 0.005 | 0.005 | 0.029 | 0.027 | 0.015 | -0.073* |
| | [0.030] | [0.030] | [0.030] | [0.030] | [0.049] | [0.019] | [0.058] | [0.038] |
| Junior | 0.008 | 0.015 | 0.002 | -0.001 | 0.076 | 0.032 | -0.209*** | -0.002 |
| | [0.035] | [0.035] | [0.035] | [0.035] | [0.059] | [0.026] | [0.070] | [0.036] |
| Mid-Career | -0.006 | -0.002 | -0.012 | -0.014 | 0.068 | 0.008 | -0.117** | 0.008 |
| | [0.030] | [0.030] | [0.030] | [0.030] | [0.048] | [0.016] | [0.053] | [0.031] |
| Top tier uni | 0.049 | 0.044 | 0.055* | 0.058* | 0.068 | -0.024 | 0.045 | -0.027 |
| | [0.034] | [0.034] | [0.033] | [0.033] | [0.049] | [0.018] | [0.056] | [0.034] |
| 2nd tier uni | -0.011 | -0.016 | -0.005 | -0.003 | 0.126** | -0.020 | 0.075 | -0.092*** |
| | [0.033] | [0.034] | [0.033] | [0.033] | [0.052] | [0.017] | [0.060] | [0.035] |
| Other ranked | 0.016 | 0.011 | 0.023 | 0.025 | 0.049 | -0.011 | 0.085 | -0.057 |
| | [0.035] | [0.035] | [0.035] | [0.035] | [0.056] | [0.018] | [0.060] | [0.037] |
| ln(publications) | 0.050*** | 0.051*** | 0.050*** | 0.049*** | -0.056** | 0.004 | -0.001 | 0.040** |
| | [0.015] | [0.015] | [0.015] | [0.015] | [0.024] | [0.007] | [0.026] | [0.016] |
| ln(citations p.P.) | -0.000 | -0.001 | -0.001 | -0.001 | 0.020 | 0.010 | -0.016 | -0.025 |
| | [0.018] | [0.018] | [0.018] | [0.018] | [0.031] | [0.010] | [0.031] | [0.020] |
| Satisfaction | -0.005 | -0.005 | -0.006 | -0.006 | -0.026 | 0.002 | 0.011 | 0.010 |
| | [0.018] | [0.018] | [0.019] | [0.019] | [0.032] | [0.009] | [0.033] | [0.022] |
| rho | -0.524** | 0.766** | -0.465* | 0.449* | | | | |

Note: * (**, ***) indicate significance at 10% (5%, 1%). N = 2381; Individuals = 2222; uncensored N = 733. Clustered (individual) standard errors in brackets.

### 4.3. Sensitivity and robustness analyses

We test the robustness of these conclusions to variations in the chosen clustering method which determined the dependent variables in the presented analyses. Since statistical clustering methods rely on initial values, we test the sensitivity of the results to an alternative method of determining the initial groups. Specifically, rather than relying solely on a statistical clustering

approach, we can also group the observations into groups based on a heuristic that relies on the logic that was applied when designing the questionnaire. By doing so, we assign affiliations to group 1 if the respondent indicated to have had research as important purpose of the affiliation, but said that it did not the result from existing institutional cooperation nor was it initiated by the external institution. Affiliations are assigned to group 2 if research was the main objective, but the affiliation came indeed into existence as a result of existing institutional cooperation or was initiated by the external institution. Following this logic, we assign affiliations to group 3 if they were not mainly aimed at research and a result of existing institutional cooperation or were initiated by the external institution. And finally, we assign affiliations to group 4 if the responded indicated purposes other than research and the affiliation was not the result of existing institutional cooperation and also not initiated by the external institution. We then perform a k-means cluster analysis using these assigned groupings as starting groups. This results in four clusters with a slightly different frequency distribution across clusters, but a very similar cluster structure (see Table 6). The pairwise correlation between both sets of clusters is also high with a coefficient of 0.604.

**Table 6: Clusters determined by k-means cluster analysis with initial fixed grouping**

| | | Full sample | [Q1] **High Research - Researcher Origin** | [Q2] **High Research - External Origin** | [Q3] **Low Research - External Origin** | [Q4] **Low Research - Researcher Origin** |
|---|---|---|---|---|---|---|
| | | **mean** | **mean** | **mean** | **mean** | **mean** |
| Purpose | Research | 0.537 | **1** | **0.944** | 0.085 | 0.005 |
| | Teaching | 0.333 | 0.099 | 0.104 | **0.692** | **0.537** |
| | Advisory | 0.142 | 0.046 | 0.104 | **0.246** | **0.220** |
| | Managerial | 0.072 | 0.023 | 0.024 | **0.085** | **0.154** |
| | Honorary | 0.048 | 0.011 | 0.040 | 0.046 | **0.098** |
| Origin | Personal Contacts | 0.415 | **0.544** | 0.120 | 0.200 | **0.561** |
| | Prior employment | 0.204 | **0.335** | 0.072 | 0.085 | 0.192 |
| | Own Initiative | 0.156 | 0.270 | 0.024 | 0.023 | **0.173** |
| | Entrepreneurial activity | 0.040 | 0.015 | 0.024 | 0 | **0.103** |
| | Institutional Cooperation | 0.246 | 0.046 | **0.656** | 0.185 | 0.042 |
| | Ext. Institutional Initiative | 0.173 | 0.099 | **0.424** | **0.885** | 0 |
| | Frequency | 733 | 263 | 126 | 130 | 214 |
| | Cumulative % | 100 | 35.88 | 17.19 | 17.74 | 29.20 |

The regression results for this alternative clustering method are presented in Table 7. In line with the conclusions from the results presented in Table 5, we find affiliations of type Q1 are more common when researchers are motivated by networking opportunities, prestige of the institution or resource access, and less common for those motivated by teaching. For affiliations of type Q4 the negative association with network/prestige and resource motives is also confirmed, as is the positive sign for teaching and income. Some differences are noticeable for Q2 and Q3, however. In the case of Q2, we observe a stronger effect for resource access and a

significant negative teaching motive. This cluster includes more affiliations based on external institutional initiative and fewer based on institutional cooperation. This could explain the negative role of teaching as institutional cooperation often involves teaching and research exchanges. As for cluster Q3, the income motive is still negative, but no longer significant. Instead we observe significant negative effect for resource motive and a significant positive effect for teaching motive. This cluster includes more teaching and managerial affiliations compared to the one used in Table 5, which likely explains these differences. The overall results are thus consistent and suggest distinct affiliation types associated with different affiliation motives.

We further test the sensitivity of the cluster assignment quality to the starting value used in the k-means clustering. We base this analysis on the Calinski-Harabasz (CH) index also known as the Variance Ratio Criterion. The CH-Index is the ratio of the sum of between-clusters dispersion and inter-cluster dispersion for all clusters. A higher the score indicators better cluster assignment, i.e. the score is higher when clusters are dense and distinct from each other. The results presented in the paper are based on the seed value 12 and a CH value of 152 for four clusters. We selected this value randomly and then compared the CH value to those using different seed values. We ran the clustering 200 times using different random seed values and obtain the CH value each time. The average CH value of these random draws is 144.8. The selected seed value of 12 with its CH value of 152 is thus preferable over other random seeds.

**Table 7: Regression results with alternative clustering method– Probit models with selection (marginal effects reported)**

| | Cluster-type | | | |
|---|---|---|---|---|
| | Q1<br>High research –<br>Researcher origin | Q2<br>High research –<br>External origin | Q3<br>Low research –<br>External origin | Q4<br>Low research –<br>Researcher origin |
| | (1) | (2) | (3) | (4) |
| **Network/prestige** | 0.045** | 0.021 | -0.003 | -0.040** |
| | [0.018] | [0.018] | [0.016] | [0.018] |
| **Resources** | 0.091*** | 0.064** | -0.051** | -0.072** |
| | [0.020] | [0.031] | [0.024] | [0.029] |
| **Teaching** | -0.093*** | -0.045* | 0.064** | 0.052** |
| | [0.021] | [0.025] | [0.028] | [0.022] |
| **Income** | -0.021 | -0.001 | -0.029 | 0.033* |
| | [0.019] | [0.015] | [0.020] | [0.018] |

Note: * (**, ***) indicate significance at 10% (5%, 1%). N = 2381; uncensored N = 733.
Cluster-robust standard errors in brackets. Only main variables presented.

## 5. Discussion and conclusion

In an increasingly competitive research sector that has seen a concentration of resources, the encouragement of multiple affiliations or appointments by external institutions seems to be an emerging prospect (Coughlan, 2018). This paper offered first insights into the organisation of multiple affiliations and researchers' motivation to engage with institutions outside their main employer. Based on unique data from a survey of academic authors at universities and PROs in Germany, Japan and the UK, our analysis showed the multitude of co-affiliations available to and sought by academics. Our typology of co-affiliations, based on their purpose and origin, is a first step into the direction of understanding this phenomenon and what is behind the recently documented surge in multiple affiliations.

The results suggest that multiple affiliations are widespread, with more than a quarter of respondents reporting at least one additional affiliation in the previous five years. In all three countries and independent of the respondent's career stage, additional affiliations predominantly serve research purposes and rely on personal contacts. Questions about motivations suggest that prestige and reputation gains are important, in line with research on career decisions of academics (Sauermann and Stephan, 2013). Nevertheless, networking and knowledge exchange gains are singled out as primary motivations. Wider professional networks can open the pathway to additional resources and greater research visibility, which may lead to reputation gains in the long-run. Resource and funding access were also indicated as important by about a third of respondents.

The results from our analysis further show that different types of co-affiliations reported by study participants give rise to different kinds of individual motivations. We find that the more important the network and prestige motives, the more likely the academic can be located in a research-focused and self-initiated co-affiliation. Likewise when motivated by access to resources, respondents are more likely found in a research-intensive co-affiliation which can, however, be both based on their own initiative or originate externally. This suggests that academics may seek co-affiliations that help them secure access to research resources, or may be willing to co-affiliate to organisations promising resource access for research purposes.

The teaching motive is also found to play a role, but these affiliations tend to be low in research-focus as academics seek out teaching opportunities elsewhere, possibly to increase income or career prospects. The income motive is, however, not important for research affiliations that originate largely from existing institutional cooperation suggesting that such arrangements are typically not paid extra.

Overall these results largely confirm the relationships predicted in Table 1. In particular, we confirm the predicted relationships between resource and teaching motives and the four quadrants. The positive predicted network/prestige motive for externally initiated affiliations of low-research focus (Q3) is however not confirmed, nor is the positive income motive on this affiliation type. While researchers may well consider these elements when they are approached by external institutions, this does not appear to be a primary driver for engaging in these co-

affiliations. The income motive was also not confirmed for research affiliations that originate externally. This suggest that, contrary to our expectation, the role of monetary incentives used by some institutions to attract academics are not an important motive for academics to affiliate. We do, however, confirm the positive effect of income motive and the negative effect of network/prestige for low-research affiliations that originate with the academic and include entrepreneurial and managerial posts. Table 8 summarises our findings with regard to expected relationships.

**Table 8: Result summary of co-affiliation types and motivations**

| | Q1 | Q2 | Q3 | Q4 |
|---|---|---|---|---|
| | **High Research - Researcher Origin** | **High Research - External Origin** | **Low Research - External Origin** | **Low Research - Researcher Origin** |
| **Network/prestige** | + | (-) 0 | (+) 0 | - |
| **Resources** | + | + | - | - |
| **Teaching/learning** | - | - | (0) 0/+ | + |
| **Income** | 0 | (+) 0 | (+) 0/- | + |

Brackets indicates predicted correlations that were not confirmed.

We document only small country differences in the organisational type of co-affiliations with academics in Japan being more often found in low-research affiliations that are externally initiated, whereas academics in the UK more often self-initiate such low-research affiliations (compared to individuals working in Germany). Contrary to our expectation, and despite the importance of resource access for research affiliations, we do not find the satisfaction with the quality of resource provision in the home institution to matter for multiple affiliation occurrence or type.

Overall our findings show that extrinsic rewards such as prestige, derived from the consequences of academic activities (Gagné and Deci, 2005; Ryan and Deci, 2000), are an important driver of multiple affiliations. Yet, these motives do not necessarily contradict intrinsic motivations. Affiliation types that involve research are linked to resource motivations that could support academic activities and thus become intrinsically satisfying. Low-research affiliations are largely driven by teaching motives, including student support, which again could offer intrinsic rewards to already established academics. The income motive plays in general a far lesser role, but could determine knowledge generation and sharing of academics involved in start-up activities, which may contradict more intrinsic motivations.

The results also show that multiple affiliations serve purposes that cannot be achieved solely though individual collaboration and co-authorship. For instance, they can help to gain access to networks and resources outside the home institution, beyond the skills and assets offered by co-authors or collaborators. While the motivations behind collaboration are similar to those we observe for multiple affiliations, the latter may open up the possibility for long-term mutual commitments. In our results we showed that the majority of additional affiliations are initiated by individual academics themselves suggesting that individual work requirements are being addressed.

Institutions are also realising that they benefit from the links of their academic staff and institutionalising the process of multiple affiliations could be the next step. Institution level collaborations, for research and for teaching have already proliferated (Guimon, 2016; Kosmützky, 2018; Pfotenhauer et al., 2016; Pohl and Lane, 2018; Youtie et al., 2017) and are reported as an origin of co-affiliations by about 17 percent of respondents. The motivations of individual academics reported in this research are in line with goals of institutions that enter institutional partnerships, such as networking and resource access. Institutions may thus in the future be able to further utilise existing contacts of academics to forge partnerships that benefit funding and research.

The involvement of institutions in the shaping of future multiple affiliations of their staff does not come without costs. For one, when institutions act as brokers the diversity of contacts established through affiliations may decrease, as they may prefer specific strategic partners. As the same institutions collaborate over time, this possible concentration of contacts could lead to a tightly connected community and further elitism. Inequality of funding access has already affected collaboration networks in the US and led to the development of rich clubs (Ma et al., 2015). Looking at co-authorship, Jones et al. (2008), for instance, observed a tendency for elite institutions to collaborate more amongst each other than would be expected. In addition, such top-down initiatives may not be welcomed by the affected researchers, if they establish contacts with people and institutions other than the scientifically most interesting ones (Melin, 2000). The current diversity in multiple affiliations is after all also representative of the multitude of research and career paths that academics embark on.

Our findings contribute to our understanding of the organisation of science, and contribute to the literature on cross-institutional collaborations (Beaver and Rosen, 1978; Jones et al., 2008; Katz and Martin, 1997). We showed that multiple affiliations are a significant part of academic life and hope our findings will encourage more research into the contractual and organisational nature of these multiple affiliations. We also know little about the actual benefits to individual academics and the institutions involved that arise from taking up or offering multiple affiliations. For instance, future research should investigate whether the acquired networks lead to more or better research performance and funding access. Our analysis was limited to three countries and four disciplinary fields. While these represent a cross-cut of institutional and field differences within the academic sector, peripheral or catch-up countries may provide a very different setting for multiple affiliations. Finally, while our analysis includes academics that held additional affiliations in the past, we do not address the question of how and why these cease, which would be an interesting question for future research.

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## Appendix A: Response analysis

Table A.1 reports detailed survey response rates by country. Approximately 12.1 percent of the survey emails were not delivered due to expired email addresses. The bounce rate is highest for emails collected from 2013 publications (17.9 percent) but still 7.2 percent for 2015 publications. The 'email decay rate' is highest for the UK at 14.3 percent and in engineering with 19.3 percent. These rates are in line with an OECD survey which reports an average bounce rate of 12 percent (Boselli and Galindo-Rueda, 2016). The rates found here are therefore within expectations. We received 2,389 responses indicating an overall response rate of 26.8, or 30.5 percent after taking into account undeliverable emails. The corrected response rate for the survey is 36.6 percent in Japan, 31.1 percent in Germany and 24.5 percent in the UK (see Table A.1). The response rate is lowest in biology with 29 percent and highest in history with 35 percent. Table A.2 shows that subject response rates differ significantly by country with Japan having the highest and UK the lowest response rate in all subjects. Table A.2 also reports response rates by field.

The sampling methodology took into account journals from a broad impact spectrum. Therefore, we check for differences in response patterns between the four different quadrants on which the journal selection was based. We further distinguish between high-impact authors and others based on citation counts. As citation counts (as a measure of article impact) are highly field and year sensitive, we consider papers that are in the top 1 percent of citations in their field in each year as papers with high scientific impact. Since – by definition – only few articles match that criterion, we also look at articles within the top 10, 20 and 50 percent of the citation distribution in the field and year. Table A.3 shows that response rates are highest for authors on low impact publications. The response rate differences are small, however, with response rates ranging from 28 percent to 32 percent.

The survey invitation specified that its goal was to investigate institutional affiliations and patterns of collaboration. This could lead to a potential non-response bias if authors that collaborate less or do not have multiple affiliations are less likely to respond. Table A.3 shows that response rates are higher for single authored papers compared to co-authored papers, thus that there is no bias towards more collaboration. There is also a slightly higher response rate amongst those without international co-authors and those with just one author address (i.e. single affiliation authors). Thus, we are confident that our sample is not biased towards authors with more collaborations or affiliations.

In terms of the timing of the response, we find that professors were less likely to respond to the initial invitation than those who are not professors ($p<0.1$). This is in line with the observation that respondents to the initial invitation are significantly younger than respondents to the reminders (average age: 46.0 vs. 47.6, $p<0.01$). Yet, the majority of respondents (59.5 percent) are associate or full professors, and response bias not a concern.

**Table A1: Survey Response by Country**

| | Total | % |
|---|---|---|
| **Total sample** | **8,916** | **100** |
| Japan | 2,806 | 31.47 |
| Germany | 2,803 | 31.44 |
| UK | 3,307 | 37.09 |
| **Undeliverable** | **1,079** | **12.10** |
| Japan | 264 | 9.41 |
| Germany | 343 | 12.24 |
| UK | 472 | 14.27 |
| **Total surveyed sample** | **7,837** | **100** |
| Japan | 2,542 | 32.44 |
| Germany | 2,460 | 31.39 |
| UK | 2,835 | 36.17 |
| **Responses [complete + incomplete]** | **2,389** | **30.48** |
| Japan | 931 | 36.62 |
| Germany | 764 | 31.06 |
| UK | 694 | 24.48 |
| **Complete responses** | **1,974** | **25.19** |
| Japan | 818 | 32.18 |
| Germany | 617 | 25.08 |
| UK | 533 | 18.80 |

**Table A2: Survey Response by Country and Journal Field**

| | Japan | | Germany | | UK | | Total | |
|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % |
| **Total sample [incl. undeliverable]** | **2806** | **100** | **2803** | **100** | **3307** | **100** | **8916** | **100** |
| Biology | 1136 | 44.69 | 566 | 23.01 | 501 | 17.67 | 2203 | 28.11 |
| Chemistry | 833 | 32.77 | 855 | 34.76 | 567 | 20.00 | 2255 | 28.77 |
| Engineering | 600 | 23.60 | 689 | 28.01 | 906 | 31.96 | 2195 | 28.01 |
| Economics/business | 237 | 9.32 | 534 | 21.71 | 1075 | 37.92 | 1846 | 23.55 |
| History | | | 159 | 6.46 | 258 | 9.10 | 417 | 5.32 |
| **Total surveyed sample** | **2542** | **100** | **2460** | **100** | **2835** | **100** | **7837** | **100** |
| Biology | 1066 | 41.94 | 530 | 21.54 | 451 | 15.91 | 2047 | 26.12 |
| Chemistry | 770 | 30.29 | 782 | 31.79 | 505 | 17.81 | 2057 | 26.25 |
| Engineering | 488 | 19.20 | 553 | 22.48 | 724 | 25.54 | 1765 | 22.52 |
| Economics/business | 218 | 8.58 | 448 | 18.21 | 928 | 32.73 | 1594 | 20.34 |
| Eistory | | | 147 | 5.98 | 227 | 8.01 | 374 | 4.77 |
| **Responses** | **931** | **36.62** | **764** | **31.06** | **694** | **24.48** | **2389** | **30.48** |
| Biology | 356 | 33.40 | 133 | 25.09 | 104 | 23.06 | 593 | 28.97 |
| Chemistry | 286 | 37.14 | 255 | 32.61 | 123 | 24.36 | 664 | 32.28 |
| Engineering | 206 | 42.21 | 154 | 27.85 | 160 | 22.10 | 520 | 29.46 |
| Economics/business | 83 | 38.07 | 149 | 33.26 | 251 | 27.05 | 483 | 30.30 |
| History | - | - | 73 | 49.66 | 56 | 24.67 | 129 | 34.49 |

**Table A3: Response Patterns by Article Impact and Authorship**

| | Total surveyed sample | Respondents | Response Rate % |
|---|---|---|---|
| **Journal Impact** | | | |
| Quadrant 1 | 3479 | 1006 | 28.92 |
| Quadrant 2 | 1707 | 528 | 30.93 |
| Quadrant 3 | 1663 | 535 | 32.17 |
| Quadrant 4 | 988 | 320 | 32.39 |
| **Paper impact**[a] | | | |
| 99pct | 269 | 74 | 27.51 |
| 90pct | 1639 | 458 | 27.94 |
| 50pct | 4132 | 1190 | 28.80 |
| <50pct | 3331 | 1070 | 32.12 |
| **Authorship** | | | |
| Single authored | 878 | 300 | 34.17 |
| Co-authored | 6959 | 2089 | 30.02 |
| First-authored | 3388 | 1049 | 30.96 |
| Last-authored | 2710 | 798 | 29.45 |
| Single-address author[b] | 6496 | 2006 | 30.88 |
| Multi-address author[b] | 1307 | 377 | 28.84 |
| Domestic only[b] | 5639 | 1755 | 31.12 |
| International link[b] | 2164 | 628 | 29.02 |

[a] History not included as no field-weighted citation number was provided by Thomson Scientific. [b] 41 entries in WOS had incomplete address information and could therefore not be considered.

## Appendix B: Factor analysis and robustness tests

**Table B.1: Results from principal component factor analysis**

| Factor | Eigenvalue | Difference | Proportion | Cumulative |
|---|---|---|---|---|
| **Factor1** | **3.33528** | **1.79838** | **0.2779** | **0.2779** |
| **Factor2** | **1.53689** | **0.23672** | **0.1281** | **0.406** |
| **Factor3** | **1.30017** | **0.27676** | **0.1083** | **0.5144** |
| **Factor4** | **1.02341** | **0.18217** | **0.0853** | **0.5996** |
| Factor5 | 0.84124 | 0.06008 | 0.0701 | 0.6697 |
| Factor6 | 0.78116 | 0.12057 | 0.0651 | 0.7348 |
| Factor7 | 0.66058 | 0.02484 | 0.055 | 0.7899 |
| Factor8 | 0.63574 | 0.08304 | 0.053 | 0.8429 |
| Factor9 | 0.55271 | 0.04702 | 0.0461 | 0.8889 |
| Factor10 | 0.50569 | 0.0564 | 0.0421 | 0.9311 |
| Factor11 | 0.44929 | 0.07144 | 0.0374 | 0.9685 |
| Factor12 | 0.37785 | . | 0.0315 | 1 |

Notes: LR test independent vs. saturated: chi2(66) = 2029.51 Prob>chi2 = 0.0000

**Table B.2: Factor loadings and unique variances**

| Variable | **Network/Prestige** | **Resources** | **Teaching** | **Income** | Uniqueness |
|---|---|---|---|---|---|
| Prestige | **0.769** | 0.084 | -0.002 | 0.156 | 0.378 |
| Networking | **0.834** | 0.161 | 0.080 | -0.102 | 0.262 |
| Exchange | **0.554** | 0.447 | 0.140 | -0.130 | 0.457 |
| Funding | 0.282 | **0.529** | -0.017 | 0.403 | 0.479 |
| Resources | 0.231 | **0.721** | -0.067 | 0.112 | 0.410 |
| Technical equip. | 0.093 | **0.784** | 0.153 | 0.006 | 0.353 |
| Teaching | 0.032 | -0.195 | **0.832** | 0.070 | 0.264 |
| Students | 0.055 | 0.315 | **0.767** | 0.068 | 0.305 |
| Jobs for students | 0.152 | 0.480 | **0.577** | -0.020 | 0.414 |
| Income | -0.075 | 0.008 | 0.028 | **0.827** | 0.310 |
| Own job/career | 0.399 | 0.061 | 0.173 | **0.525** | 0.532 |
| Family/other | -0.075 | 0.206 | 0.191 | **0.523** | 0.642 |

## Appendix C: Correlation matrix

**Table C.1 Pair-wise correlations of included variables**

| Variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) | (18) | (19) | (20) | (21) | (22) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) Resources | 1.000 | | | | | | | | | | | | | | | | | | | | | |
| (2) Netw/pres | -0.002 | 1.000 | | | | | | | | | | | | | | | | | | | | |
| (3) Teaching | 0.021 | 0.005 | 1.000 | | | | | | | | | | | | | | | | | | | |
| (4) Income | 0.014 | -0.009 | 0.002 | 1.000 | | | | | | | | | | | | | | | | | | |
| (5) Germany | -0.067* | 0.137* | -0.037 | 0.050 | 1.000 | | | | | | | | | | | | | | | | | |
| (6) UK | 0.005 | 0.116* | -0.137* | 0.020 | -0.433* | 1.000 | | | | | | | | | | | | | | | | |
| (7) Japan | 0.058 | -0.234* | 0.160* | -0.065* | -0.544* | -0.521* | 1.000 | | | | | | | | | | | | | | | |
| (8) Biology | 0.088* | -0.143* | 0.095* | -0.056 | -0.113* | -0.154* | 0.251* | 1.000 | | | | | | | | | | | | | | |
| (9) Chemistry | 0.121* | -0.001 | 0.162* | -0.045 | 0.071* | -0.153* | 0.075* | -0.354* | 1.000 | | | | | | | | | | | | | |
| (10) Engineering | 0.005 | -0.009 | 0.037 | 0.023 | -0.023 | 0.022 | 0.001 | -0.293* | -0.321* | 1.000 | | | | | | | | | | | | |
| (11) SSH | -0.202* | 0.139* | -0.274* | 0.076* | 0.059* | 0.285* | -0.321* | -0.342* | -0.376* | -0.310* | 1.000 | | | | | | | | | | | |
| (12) Female | -0.013 | 0.177* | -0.039 | 0.028 | 0.098* | 0.161* | -0.243* | -0.039 | -0.059* | -0.071* | 0.163* | 1.000 | | | | | | | | | | |
| (13) Junior | -0.036 | 0.083* | -0.054 | 0.167* | 0.254* | -0.045* | -0.199* | -0.100* | -0.029 | 0.204* | -0.061* | 0.073* | 1.000 | | | | | | | | | |
| (14) Middle | -0.011 | 0.047 | 0.124* | 0.018 | 0.045* | 0.008 | -0.050* | -0.014 | 0.037 | 0.004 | -0.027 | 0.099* | -0.246* | 1.000 | | | | | | | | |
| (15) Senior | 0.036 | -0.102* | -0.062* | -0.140* | -0.239* | 0.029 | 0.200* | 0.091* | -0.007 | -0.165* | 0.071* | -0.140* | -0.590* | -0.638* | 1.000 | | | | | | | |
| (16) Top tier uni | 0.011 | -0.046 | 0.138* | -0.019 | 0.063* | -0.172* | 0.100* | 0.056* | -0.031 | 0.021 | -0.042* | 0.006 | -0.012 | 0.016 | -0.004 | 1.000 | | | | | | |
| (17) 2nd tier uni | -0.060 | -0.029 | -0.001 | -0.020 | -0.018 | 0.029 | -0.010 | -0.023 | 0.040* | -0.025 | 0.005 | 0.011 | -0.029 | -0.009 | 0.031 | -0.344* | 1.000 | | | | | |
| (18) Other rank | -0.044 | 0.025 | -0.089* | -0.009 | 0.006 | 0.038 | -0.041* | -0.050* | -0.001 | 0.010 | 0.041* | -0.014 | -0.015 | -0.001 | 0.012 | -0.413* | -0.245* | 1.000 | | | | |
| (19) Unranked | 0.080* | 0.052 | -0.070* | 0.046 | -0.062* | 0.132* | -0.064* | 0.007 | 0.001 | -0.011 | 0.003 | -0.003 | 0.054* | -0.009 | -0.035 | -0.423* | -0.251* | -0.302* | 1.000 | | | |
| (20) ln(publ.) | 0.107* | -0.100* | 0.123* | -0.092* | -0.016 | -0.117* | 0.124* | 0.062* | 0.316* | 0.063* | -0.439* | -0.211* | -0.275* | -0.113* | 0.313* | -0.074* | 0.014 | 0.021 | 0.051* | 1.000 | | |
| (21) ln(citations) | 0.180* | 0.004 | 0.071* | -0.098* | 0.022 | 0.039 | -0.057* | 0.211* | 0.290* | -0.153* | -0.358* | -0.026 | -0.130* | -0.018 | 0.118* | -0.092* | -0.010 | -0.003 | 0.116* | 0.545* | 1.000 | |
| (22) Satisfaction | -0.060 | 0.164* | -0.036 | -0.014 | 0.207* | 0.213* | -0.394* | -0.177* | -0.036 | -0.047* | 0.252* | 0.132* | 0.163* | 0.067* | -0.186* | -0.124* | -0.064* | 0.034 | 0.163* | -0.094* | 0.003 | 1.000 |

*shows significance at the 0.05 level

## Appendix D: Survey Questions [Excerpt]

| Question | Response Options |
|---|---|
| Are you, or were you previously, simultaneously affiliated to **more than one** institution, organisation, or employer? This can include other higher education institutions, research institutes, research units (not within the same institution), other non-research institutions or companies. [Help: These include long-term connections with formal as well as informal contractual basis, e.g. honorary/adjunct professor, research associate, scientific fellow (shorter residencies or sabbatical leave do not count)] | • Yes, presently<br>• Yes, in the past<br>• No<br><br>[follow-up on number and year of affiliations] |
| What is the work arrangement in your **external** affiliation? [asked for up to three; most recent in case of past affiliation only] | • Teaching affiliation (e.g. adjunct/affiliate/sessional lecturer)<br>• Research affiliation (e.g. research associate)<br>• Advisory role<br>• Managerial (business) role<br>• Acceptance for honour<br>• Other |
| How did you come to have this **additional external** affiliation? [asked for up to three; most recent in case of past affiliation only] | • Through my prior employment with the institution<br>• Through an existing cooperation between my main institution and the additional institution (e.g. spin-off of main institution, shared research facilities)<br>• Through personal contacts<br>• Through start-up activities (e.g. own company)<br>• Following my own initiative (application, request)<br>• Following the initiative of the other institution (invitation)<br>• Other |
| Do you state your additional affiliation(s) on your research publications? | • Yes, all<br>• Only certain ones<br>• No, only my main affiliation |
| How important are (were) the following motivations for your affiliation with additional institutions or companies?<br><br>o Very important [4]<br>o Quite important [3]<br>o Not very important [2]<br>o Not at all important [1]<br>o Not applicable | • Prestige of the additional institution<br>• To build professional networks<br>• To gain teaching experience<br>• To increase my personal income<br>• To gain access to additional funding<br>• To gain access to additional data, material or library resources<br>• To gain access to students (e.g. recruitment)<br>• To gain access to technical support staff, laboratories and equipment<br>• To create job opportunities for myself<br>• To create job opportunities for students and post-docs<br>• To create opportunities for knowledge exchange/transfer<br>• Family or other reasons |

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