What is behind multiple institutional affiliations in academia?

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Abstract

Multiple institutional affiliations (or co-affiliations) occur when an academic belongs to more than one organisation. Recent research shows an increase in academics with multiple affiliations, but evidence on how these are organised and on academics' motivations is mainly anecdotal. In this study we develop a typology of co-affiliations, which identifies four types based on their purpose and origin. We draw on results from a unique international survey of academics in three major science nations (the UK, Germany, and Japan) to study the different factors that could explain the four types of co-affiliations. The analysis shows that academics' motivations (networking/prestige, resources, teaching, or personal income) correlate with the observed co-affiliation type. Researcher-initiated and research-focussed co-affiliations are often motivated by networking and resource access while co-affiliations that serve other than research purposes are more often income-motivated.

Keywords: multiple institutional affiliations; academic labour market; resource access; *k*-means clustering; science policy.

1. Introduction

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 2021). These policies and associated funding changes are designed to transform universities and other academic institutions, but also provide incentives for academic staff to seek additional work roles, and to engage in commercial and externally paid research and consulting activities. These policy shifts may also contribute to researchers holding multiple positions and roles outside of their home universities or academic research organisations, which has recently been termed 'multiple' or co-affiliation (Hottenrott and Lawson 2017; Yegros-Yegros et al. 2021). Prior literature has for instance discussed the part-time positions that academics hold in businesses as founders or consultants (Fudickar et al. 2018; Toole and Czarnitzki 2010; Zucker et al. 2002). A recent bibliometric study by Hottenrott et al. (2021) further shows a significant increase over the past 15 years in the proportion of academics simultaneously affiliated to multiple institutions. Using difference-in-difference analysis, the authors show that the timing of the increase can be linked to the introduction of 'excellence initiatives'. Such funding initiatives explicitly aim to improve the research capacity and performance of science systems (Civera et al. 2020; Froumin and Lisyutkin 2015; Salmi 2016). They may also have enabled the buy-in of domestic and international research talent on a part-time basis (Bhattacharjee 2011; Matveeva and Ferligoj 2020; Tourish et al. 2017), which can be attractive for academics to expand resources, visibility, and reputation beyond the home institution.

Yet, despite their growing prevalence and the concerns this has raised with regard to, for instance, conflicts of interests[1] and manipulation of publication-based university rankings (Bhattacharjee 2011), multiple affiliations have so far received little attention in the literature. Studies that analyse affiliation data on publications showed the diverse nature of multiple affiliations in terms of sectoral and geographical distribution (Hottenrott et al. 2021; Yegros-Yegros et al. 2021), but a typology that considers other, organisational dimensions has not yet been developed. Such a typology is needed as it helps to understand whether and how academics use multiple affiliations and thus how knowledge is generated and transferred through these. Specifically, multiple affiliations can take different organisational forms because they serve different core objectives and differ in how they originate. A classification along the dimensions of 'purpose' and 'origin' helps to understand the function of multiple affiliations in science, individual academics' considerations, the possible beneficiaries, as well as the possible range of intended and unintended consequences.

Prior studies have also not been able to shed light on the diverse motivations that lead academics to take up co-affiliations. It has been argued that science largely relies on a 'taste for science', the motivation of academics to do research, emphasising intellectual challenge and freedom (Janger and Nowotny 2016; Roach and Sauermann 2010; Stern 2004). Yet, the literature has further shown that academics are driven by other types of motives, in particular prestige, but also economic incentives (Stephan 2012), the latter having been emphasised in the anecdotal evidence on multiple affiliations in academia (Bhattacharjee 2011; Xin and Normile 2006). Different types of multiple affiliations may

respond to these different motives, resulting in a diverse set of affiliation types that serve different purposes and originate from different sources. Thus, a closer investigation of academics' personal motivations to engage in different types of multiple affiliations can shed light on their individual beliefs and expectations with regard to these arrangements.

The empirical study presented here investigates how multiple affiliations are organised in terms of purpose and origin, and academics' motivations to co-affiliate, something that cannot be inferred from bibliometric data. The analysis builds on unique survey data on multiple institutional affiliations of 2,222 academics in different scientific domains (biology/chemistry, engineering, business/economics, and history) and three countries (Germany, Japan, and the UK). The results illustrate that multiple affiliations are very common with 26 per cent 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 co-affiliations that are research-focussed are more likely motivated by resource access. Income, however, is not found to be a significant motivational factor even for co-affiliations that serve other than research purposes and even if they are paid. In addition, other affiliation characteristics, academics' career stage, and their individual as well as their home institutions' prestige predict the type of co-affiliation they 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 derives a typology of co-affiliations based on purpose and origin, and discusses the literature and derives expectations on individual motives that could drive co-affiliations. Sections 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 conceptual framework

2.1 A typology of multiple affiliations

Multiple affiliations are not alike, and prior research has highlighted this diversity in terms of sectoral and geographical distributions. Hottenrott and Lawson (2017), for instance, classified co-affiliations reported on publications by whether they are domestic or international, and whether they are within a single sector or cross sector boundaries. Other bibliometric studies expanded on this by considering networks of sectors and countries of co-affiliation and the role of proximity (Hottenrott et al. 2021; Yegros-Yegros et al. 2021). However, very little is known about their forms and functions and the role they play in the organisation of scientific research. Specifically, academics' affiliation to multiple institutions or organisations likely differs substantially with regard to the purpose they serve and how they originate. This thus goes beyond the considerations of geographic and sectoral proximity.

Since no prior typology exists, a system architecture approach used to examine the global partnerships of the Massachusetts Institute of Technology (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 academics' co-affiliations, these serve, for instance, the function of knowledge exchange, yet, they can originate in different ways, ranging from the researcher reaching out to other institutions, or institutions actively recruiting individuals. 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 levels. 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.

2.1.1 Origin

Researchers can find themselves in co-affiliations in a number of ways. For instance, some star scientists are offered lucrative posts in the form of part-time or adjunct positions by universities who seek 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), or emerge due to institutional partnerships, as is the case in France, where a closer integration of teaching universities and public research institutes resulted in multiple affiliations for academic staff (Paradeise 2018). In both cases these affiliations facilitate higher visibility in international rankings for participating institutions and lend prestige to the academics involved. Moreover, past employers and alumni employees, in an attempt to maintain links, may connect through co-affiliations, often linked to continuing research projects.

Yet, not all affiliations are based on institutional initiative and academics may also seek co-affiliations actively if these benefit their research work through resource access or increased visibility in the research community. Furthermore, the entrepreneurial university has encouraged academics to start or join firms, which sees academics hold co-affiliations there (Fini et al. 2020; Slaughter and Rhoades 1996). In other cases, precarious employment may encourage researchers to proactively seek out supplementary income and hold multiple

positions at the same time (Enders and Musselin 2008). Individual initiative can thus be considered a relevant origin for co-affiliations.

Affiliations that emerge from a researcher's own initiative will be very different from those that are the result of institutional partnerships or from agreements between an individual academic and an institution, even where they serve the same function, e.g. knowledge exchange. To summarise, we consider whether co-affiliations originate in the institution or the individual researchers, i.e. whether the co-affiliation is the result of institutional partnership or institution actively recruiting, or whether it is initiated by the affiliated individual.

2.1.2 Purpose

We further consider the purpose of co-affiliations and, following Pfotenhauer et al. (2016) and Guimon (2016), differentiate between research- and non-research-focussed co-affiliations.

Recent bibliometric analyses show that the share of multiple affiliations reported on publications has increased substantially in the past two decades, and in 2019 they were observed in more than 30 per cent of all articles and for more than 15 per cent of authors (Hottenrott et al. 2021). These co-affiliations are likely high in research focus given that they result in publishable outputs with authors listing two or more institutions. About half of such research-focussed affiliations as reported on publications are between academic institutions, but also non-academic organisations (private firms, governments, and NGOs) are commonly named as co-affiliation. These observations indicate the diverse forms of research in which academics engage with organisations beyond the academic research sector and vice-versa (e.g. Beck et al. 2020; Perkmann et al. 2021).

The literature has discussed multiple other forms of co-affiliations which may not result in publishable outputs and only indirectly serve research purposes. For instance, for academics who are serving on public committees, as external examiners, or are providing business consulting, these roles often come with advisory tasks as they are called upon as experts (Fudickar et al. 2018). Other affiliations may have managerial tasks associated with their work, such as for those involved in private companies as co-founders or as directors of institutes or expert bodies. 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 not necessarily have a high research focus. Academics may further engage in affiliations for teaching purposes. These are fairly widespread as universities and other academic institutions 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 professionalisation of science, such unpaid positions became less common but are still available in many public 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
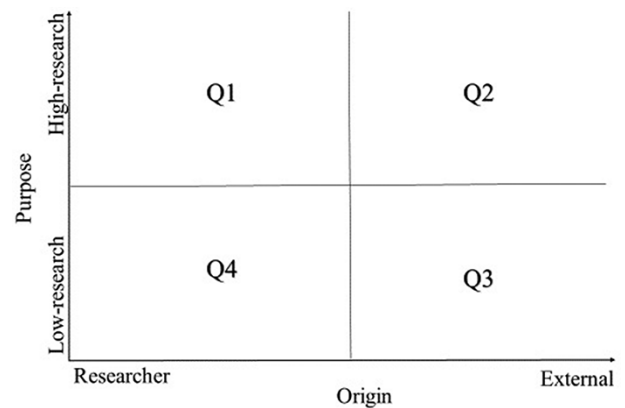

Figure 1. Organisational forms of co-affiliations.

in advisory roles, giving lectures or representing the institution at events. This form may thus be considered to have a rather low research focus.

2.1.3 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 types of affiliations:

Q1) Affiliations with rather high research focus and originating from the individual 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 individual academic.

We expect academics 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 individual characteristics such as career stage. In what follows we discuss motivations and their relevance for the different types of co-affiliations.

2.2 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. In particular, the researchers' goal of gaining recognition within the scientific community has been stressed as an underlying logic of academic research (Merton 1973; Stephan 2012). Peer recognition or prestige allows other benefits to follow, such as career advancement and prizes (Lam 2011; Stephan 2012). They are not only of importance for maintaining the pace of scientific endeavour, but also dictate access to research resources or research freedom. Yet, the 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 entry to networks that may provide new opportunities for knowledge exchange or control access to critical research resources. For academics 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 incentives such as satisfaction derived from involvement in decision-making.

Multiple affiliations address such motivations of academics, offering access to networks and prestige. *Network or prestige motives* come into effect when academics initiate research-focussed co-affiliations (Q1). Network and prestige motives may also come into effect when academics are invited by external institutions as experts (Q3). Yet, if they seek out alternative roles themselves that are also less research-focussed, network or prestige considerations may not be of importance (Q4). In the case of externally initiated affiliations with high research-focus (Q2), they are rather institutions that seek to benefit from researchers' prestige and knowledge, and it is thus unlikely that individual network or prestige motives play a particular role.

Academics are, however, not exclusively guided by recognition and prestige (Stephan 2012). Rather, co-affiliations can also offer direct and indirect access to research resources, including funding and equipment. Such access has become even more critical in a science system that increasingly relies on extensive research infrastructure (Musselin 2013; Stephan 2012). 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).

Furthermore, 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 intrinsically rewarding, as it provides a sense of accomplishment (Roth et al. 2007). For academics at research institutes, teaching may also provide access to human resources, as students may be recruited as PhDs or for projects. 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 are non-research-focussed, 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).

Furthermore, monetary incentives also play a role, and while they may not be sufficient to motivate researchers on their own, they may incentivise 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). Co-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). Furthermore, 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 may be a factor 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.

3. Data and methods

We rely on a survey of academics active either in Germany, Japan, or the UK to test these hypotheses. The survey provides information on the affiliation patterns of 2,222 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.

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	+	0	+	0
Resources	+	+	−	−
Teaching/learning	−	−	0	+
Income	0	+	+	+

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. Therefore, to investigate types of co-affiliations that can be observed across science systems, we select Japan, Germany, and the UK for this study. The three countries are comparable in terms of the size of their science system and academic output as measured in articles in peer-reviewed journals, but are also very distinct and differ in terms of research organisation and internationalisation (Elsevier 2017). Their inclusion will thus help to ensure generalisability but also help to identify any country-specific differences.

In terms of differences we can note that the UK has a weaker non-university research sector compared to Japan and Germany, where in addition to universities, public research organisations play a key role (e.g. Leibniz, the Fraunhofer and Max Planck Societies in Germany). The UK, however, is more international, as evidenced by high shares of foreign born staff (Scellato et al. 2015) and international co-authorship (Elsevier 2017), while Japan is relatively closed to foreign academics and exchanges with the international community are weaker. These differences can also be observed in bibliometric studies investigating multiple affiliations, with academics in the UK more often reporting international co-affiliations, followed by Germany, while academics in Japan more often show domestic cross-sector co-affiliations (Hottenrott and Lawson 2017; Hottenrott et al. 2021).

Moreover, calls for more internationalisation, research excellence, and impact could be heard in all three countries and have shaped funding allocation for academic research. The UK saw the earliest transformation with the introduction of the Research Assessment Exercise in the 1980s which relies on research evaluation to distribute parts of its higher education funding, something that has also created a transfer market for staff and is argued to have increased staff mobility (Hare 2003). Unlike in the UK, evaluations by the German states, who provide core funding to universities, traditionally did not influence funding. However, through the implementation of performance-based funding by the federal government via the 'Excellence Initiative' from 2006 (Civera et al. 2020), focus has shifted towards competition and internationalisation (Salmi 2016). In Japan, research resources have traditionally been highly concentrated in leading national universities who conduct most of the PhD training. With a number of reforms Japanese universities have become increasingly reliant on competitive and other external funding. The resource concentration has however remained (Shibayama 2011), which may have resulted in more collaboration and co-affiliations domestically.

The three countries further differ in their career models which may have implications for taking on several affiliations. Germany traditionally follows a model in which permanent positions are only available to professors that were called to a chair and who are supported by doctoral students and post-docs on temporary contracts. This results in a high proportion of temporary positions while academics wait for a chair to become available (Teichler et al. 2013). In Japan, the promotion system for national universities is modelled in the German chair system. However, also entry-level positions could until recently be permanent employment contracts, although academics need to compete for promotion to chair (Geuna and

Shibayama 2015). The UK instead follows a tenure model with permanent positions made available to junior staff (lecturer level) resulting in more autonomy also for entry-level positions, an autonomy that could permit more freedom to determine work arrangements and affiliations. The inclusion of these three countries in the study thus provides relevant variation to allow for our results to be relevant for different science contexts.

3.2 Data collection

In order to construct the survey sample, we selected journals based on a list from the Journal Citation Reports (JCR). We focussed on six scientific disciplines that represent a diverse set of disciplinary cultures and differ in their resource requirements and organisation of research teams (Stephan 2012), and straddle the natural, technical, social sciences and humanities: biology and chemistry, engineering, business and economics, and 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 (PROs). 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 per cent). Accounting for undeliverable email invitations, response rate for the survey is 36.6 per cent in Japan, 31.1 per cent in Germany, and 24.5 per cent in the UK. A detailed response analysis [response rates and (non-)response patterns] can be found in Appendix A.

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 co-affiliation. We only considered those who had an affiliation for at least one year during the 2011–2016 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 survey questions). In addition we collected publication records for the 2010–2016 period from Scopus for all respondents in our sample. Complete information is available for 2,222 respondents which form the basis of this analysis. Of these, 25.6 per cent, or 568 respondents, indicate that they had at least one external additional affiliation during the period 2011–2016. 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 co-affiliations
The focus of the following analysis 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 types of co-affiliations as depicted in Fig. 1.

To assign respondents to each of the four organisational types 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 research affiliation (e.g. research associate), a teaching affiliation (e.g. adjunct/affiliate/sessional lecturer), 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]

To create the measure for organisation type of the co-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 categorisation. 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 Fig. 1. The sensitivity of the cluster method and its optimisation using Calinski–Harabasz (CH) values are discussed in Section 4.3.

3.3.2 Explanatory variables: motivations for co-affiliations
Our key factor of interest is the motivation to take on co-affiliations. In the case of multiple affiliations, 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 corresponding to the four motives on a 4-point scale (1 = not at all important and 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 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, and personal income.

As these factors are conceptually related, we conduct a confirmatory principle component factor analysis on these 11 motivation items. The analysis confirms that there are four latent factors (see Appendix 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 previous or accept new affiliations as a point of entry into higher paid jobs. The factor loadings after rotation (shown in Appendix 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.

In a survey on motivations there may be the additional concern that responses are affected by 'social desirability bias'. This could be particularly the case with regard to monetary incentives as these may be perceived to contradict traditional academic norms (Lam 2011). In an anonymous online survey this bias should be less pronounced, but it cannot be completely ruled out. To test for the presence of such bias, we compare two groups of respondents, those that more closely identified with traditional academic norms (intellectual challenge and independence) and those who do not. This comparison is based on a survey question on the importance of seven job rewards following e.g. Roach and Sauermann (2010). In an auxiliary regression we find that respondents who more closely identify with traditional academic norms are not less likely to report the personal income motive when engaging in multiple affiliations compared to their counterparts ($\beta = -0.112$; $P > 0.1$), controlling for whether payment or salary was received. This suggests that the income motive does not strongly correlate with the individuals' academic norms and the answer to the motivations question is thus not very likely influenced by common norms. Thus, while we cannot entirely rule out social desirability bias, it is likely not a major concern in this study.

3.3.3 Other variables

There are other characteristics of co-affiliations that we need to consider as they are closely linked to co-affiliation type and motivation. Specifically, we asked respondents about the country of the co-affiliation, recoded as dummy that takes the value one if this is with an organisation abroad. The survey further enquired about the sector of the co-affiliation and differentiated between higher education institutions (HEIs), PROs (including not-for-profit or quasi-PROs), public non-research organisations (e.g. government), university start-ups, or other companies. It also asked about the contractual arrangement: contract with salary, contract without salary, or informal. These characteristics likely relate to co-affiliation types, with academic institutions (HEIs and PROs) and companies offering research opportunities (Q1 and Q2) and non-research organisations offering consulting or management opportunities (Q3 and Q4). Unpaid arrangements will also be more likely accepted in the case of research rather than non-research affiliations.

The probability of an academic to have multiple affiliations as well as the type of co-affiliation is also likely determined by individual characteristics. 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 or senior researcher); and junior (postdoc, PhD student, or 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 and Q2). Senior academics instead may seek to 'trade or cash in this reputation for economic return' (Audretsch and Stephan 1999: 101) favouring affiliations that apply their expertise (Q4), including non-research-related externally initiated affiliations (Q3).

We further control for the country of main affiliation, which was identified from the corresponding author address, to account for any differences emerging due to institutional differences between Germany, Japan, and the UK. We also take into account past publication performance (publication count and mean citations) collected from Scopus for the period 2010–2016. In addition, the rank of the respondents' main institution may impact their requirement or opportunity for co-affiliations. Therefore, we control for the home institution status by employing a four-step ranking based on Times Higher Education ranking and national rankings, differentiating between top tier, second tier, other ranked, and unranked. The respondent's overall satisfaction with research resource provision at their home institution is also included as control variable. This indicator is 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 stage variables

Our dependent variables 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), i.e. capture the need and opportunity of researchers to take on additional affiliations. These are the number of previous employers *(# prev.employers)*, since job mobility can be a driver of multiple affiliations where previous affiliations are maintained in addition to new ones and that this applies to co-affiliations of all types; and researchers with their main employment at *PRO*s, who may be more likely to also hold co-affiliations compared to academics at universities, and who more generally differ from academics at universities (Suominen et al. 2021). 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. 2021).

4. Results

4.1 Descriptive results

We begin with a descriptive analysis to provide an overview of multiple affiliation patterns and the variables included in our regression analysis. As mentioned above, 25.7 per cent 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 affiliations in the same three countries from 5 per cent in 2008 to a share of about 10 per cent in 2014. Shares between 11 and 16 per cent for the three countries are reported for 2016 in a larger bibliometric study that includes all scientific fields and publications (Hottenrott et al. 2021). Both are lower than the 25.7 per cent 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 per cent of respondents with co-affiliations indeed say they only name the main affiliation, 31.0 per cent name selected affiliations, and 26.4 per cent name all affiliations they currently have. The proportion of respondents with multiple affiliations does not differ between countries, institution rank, and gender (see Table 2). Respondents with multiple affiliations also show no difference in terms of publication and citation counts. We do, however, see that the proportion of junior researchers is slightly lower amongst those with co-affiliations. We also see that those with a co-affiliation are slightly more satisfied with resource provision in their home institution. Table 2 further indicates that more than 80 per cent of respondents are men and about 60 per cent are senior academics.

The number of previous employers, employment in PROs, and the business/economics and history research fields are all significantly higher for respondents with multiple affiliations, confirming that these are excellent candidates for the selection stage.

Responses regarding purpose and origin of affiliations are summarised in Table 3. A considerable share of affiliations are research related (54 per cent). Non-research-related activities such as teaching (33 per cent), advisory (14 per cent),

Table 2. Affiliation status by respondent characteristics.

	Co-affiliation = 0 (N = 1,648)		Co-affiliation = 1 (N = 574)			Total sample (N = 2,222)	
	Mean	SD	Mean	SD	Mean difference significance	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(# publications)	2.852	0.986	2.878	1.047	n.s.	0	6.009
ln(citations p.P.)	2.129	0.789	2.134	0.824	n.s.	0	6.253
Top tier unit	0.231	0.422	0.251	0.434	n.s.	0	1
Second tier unit	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 organisation	0.356	0.479	0.375	0.484	n.s.	0	1
Satisfaction	1.729	0.686	1.797	0.663	**	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/Chemistry	0.552	0.497	0.472	0.500	***	0	1
Engineering	0.226	0.418	0.174	0.380	***	0	1
Business/Economics	0.180	0.384	0.274	0.446	***	0	1
History	0.043	0.203	0.080	0.272	***	0	1

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

and managerial posts (7 per cent) are also named by our sample. Few researchers hold honorary appointments (5 per cent). Co-affiliations can originate from the academic through their own active initiative or start-up activity (16 and 4 per cent). Past employment relationships are also frequently named (20 per cent). Co-affiliations can also originate externally, through unilateral initiatives of external institutions (e.g. by invitation) (25 per cent) or existing inter-institutional cooperation (17 per cent). Yet, it is personal contacts that are named most frequently (42 per cent), indicating that academics use their existing networks to source additional affiliations. Making use of *k*-means cluster analysis as per Section 3.3.1, we group affiliations into four organisational types in line with Fig. 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 start-up 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 as 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 Fig. 1.

The different motives for co-affiliations are presented in Fig. 2. A large share of respondents report professional network building (38 per cent) or opportunities for knowledge exchange or transfer (33 per cent) as very important. For about one in four (24 per cent), 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 per cent 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, although 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). These are based on predicted factor scores which mean that each factor has a mean of approximately zero and a standard deviation of 1. Motivations differ significantly by co-affiliation cluster/type as can be seen from the summary statistics presented in Table 4, where the means of the four factors are reported for each cluster. We also report the *F*-value which shows that factor means differ significantly between the four clusters indicating that distinct motives are associated with the different clusters. The network/prestige motive factor is strongest in Q1 (high research and research origin). The resource motive is highest for affiliations in Q2 (high research and external origin) and lowest in Q4 (low research and researcher 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 also reports the mean values for all control variables used in the regressions for the full sample and by co-affiliation cluster. The Analysis of Variance (ANOVA) *F*-statistic reports whether variables differ across the four clusters. Some differences to point out relate to the characteristics of affiliations. Foreign co-affiliations appear more often in Q1, suggesting that cross-border affiliations are linked to research links established by academics themselves. Domestic affiliations are, however, the most common for all cluster types and represent 71.8 per cent of respondents, confirming prior bibliometric research. Fewer than half (41.5 per cent) of all affiliations are paid, which corresponds with the lower

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
	External 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
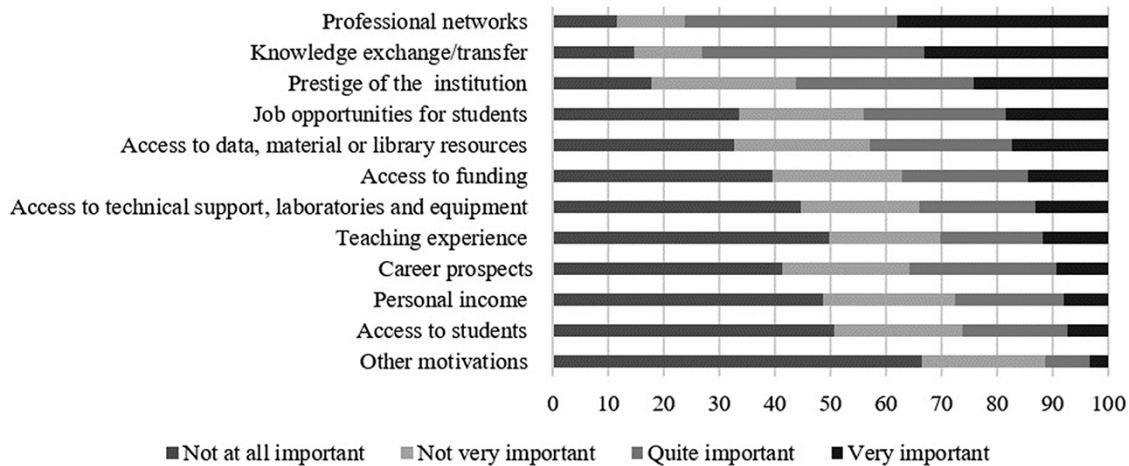
Figure 2. Motivations behind multiple affiliations.

importance of the income motive compared to other affiliation motives. These paid co-affiliations are more often observed in the low-research clusters Q3 and Q4, while high research clusters Q3 and Q4 see more informal and unpaid arrangements. More than half of affiliations in all four clusters are with universities. PROs appear less in Q4, which sees more company or start-up affiliations compared to the other clusters. Different clusters are thus also representing different sector affiliations.

We further see that a 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 set-ups 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 are even more dominant in 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. It also confirms a positive correlation of income motive with paid contracts and with non-academic affiliations. A positive—albeit weaker—correlation is also observed between the network/prestige motive and affiliations abroad.

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 co-affiliation type as a function of motivations as well as other variables likely explaining co-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. As we have more than one observation for individuals with more than one co-affiliation, we cluster standard errors at the individual level. Both stages are jointly estimated via a conditional mixed process estimator using probit models which account for the binary nature of the dependent variables in both stages (Roodman 2011). We present

Table 4. Means of main variables by cluster.

	Full sample—co-affiliation = 1	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	ANOVA *F*
Network/prestige	0.052	0.233	0.060	0.071	−0.183	6.70***
Resource motive	0.006	0.143	0.412	−0.088	−0.315	16.23***
Teaching motive	0.000	−0.307	0.230	0.011	0.224	14.43***
Income motive	0.005	−0.021	0.081	−0.234	0.187	5.88***
Affiliation abroad	0.282	0.455	0.203	0.223	0.171	19.71***
Affiliation paid contract	0.415	0.316	0.322	0.506	0.512	9.57***
Affiliation unpaid contract	0.364	0.402	0.449	0.331	0.298	3.31**
Affiliation informal	0.221	0.283	0.229	0.163	0.190	3.31**
Affiliation HEI	0.568	0.611	0.534	0.530	0.566	1.10
Affiliation PRO	0.217	0.279	0.259	0.259	0.081	10.38***
Affiliation government	0.117	0.086	0.086	0.151	0.146	2.27*
Affiliation start-up	0.040	0.012	0.043	0.006	0.101	10.30***
Affiliation company	0.058	0.012	0.078	0.054	0.106	6.31***
Junior	0.153	0.189	0.237	0.060	0.137	6.93***
Mid-career	0.203	0.217	0.229	0.151	0.215	1.26
Senior	0.644	0.594	0.534	0.789	0.649	8.28***
Female	0.186	0.230	0.254	0.157	0.117	4.76***
Germany	0.314	0.357	0.432	0.265	0.234	5.99***
UK	0.312	0.361	0.280	0.235	0.337	2.83**
Japan	0.374	0.283	0.288	0.500	0.429	9.05***
ln(#publications)	2.938	2.730	2.960	3.074	3.062	5.28***
ln(citations p.P.)	2.136	2.100	2.292	2.136	2.088	1.96
Top tier unit	0.248	0.283	0.212	0.229	0.244	0.91
Second Tier unit	0.201	0.242	0.178	0.217	0.151	2.12*
Other ranked	0.160	0.143	0.153	0.181	0.166	0.38
Unranked organisation	0.392	0.332	0.458	0.373	0.439	2.67**
Satisfaction	1.792	1.838	1.804	1.760	1.755	0.720

Note: ANOVA reports differences across cluster groups.
*(**, ***) indicate significance at 10 per cent (5 per cent, 1 per cent). 733 observations/co-affiliations.

the regression results in two sets: The first set of models (Table 5) only considers motives and demographic variables as independent variables. The second set of models (Table 6) further includes the other affiliation characteristics in the second stage: affiliation abroad, sector of affiliation, and contract type which are only observed conditional on having multiple affiliations.

Table 5 shows the results of the first set of 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* confirms that in each case there is a correlation between the errors in the two stages in all four models. The number of previous employers, employment at a PRO, and subject area act as exclusion restrictions. The number of previous employers, PRO, and business/economics and history 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 higher 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. The network/prestige motive, however, loses statistical significance when we include other co-affiliation characteristics in Table 6. Specifically, an affiliation location abroad, which is positively linked to Q1, renders the network/prestige motive insignificant. Co-affiliations in academia (HEI or PROs) and those that are unpaid are linked to Q1. Where the resource motive plays an important role, the respondent is more likely to be in a co-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.

Table 5. Regression results—Probit models with selection (average marginal effects reported).

	Selection stage				Cluster type			
	Multiple affiliations = no/yes				Q1	Q2	Q3	Q4
					High research—researcher origin	High research—external origin	Low research—external origin	Low research—researcher origin
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
# prev.employers	0.038*** [0.009]	0.040*** [0.009]	0.036*** [0.009]	0.035*** [0.010]				
PRO	0.192*** [0.041]	0.178*** [0.047]	0.210*** [0.039]	0.218*** [0.039]				
Biology/Chemistry (omitted)								
Engineering	0.017 [0.031]	0.012 [0.032]	0.020 [0.032]	0.024 [0.032]				
Business/Economics	0.215*** [0.033]	0.218*** [0.033]	0.215*** [0.033]	0.211*** [0.034]				
History	0.267*** [0.054]	0.263*** [0.054]	0.261*** [0.055]	0.266*** [0.055]				
Network/prestige					0.044** [0.018]	−0.004 [0.007]	0.025 [0.020]	−0.037** [0.015]
Resources					0.067*** [0.018]	0.025** [0.011]	−0.024 [0.021]	−0.071*** [0.019]
Teaching					−0.095*** [0.022]	0.013 [0.008]	0.011 [0.021]	0.042** [0.017]
Income					−0.014 [0.019]	0.003 [0.006]	−0.054*** [0.020]	0.031** [0.014]
Junior	0.010 [0.034]	0.016 [0.035]	0.003 [0.035]	−0.001 [0.036]	0.076 [0.059]	0.032 [0.026]	−0.209*** [0.070]	−0.002 [0.036]
Mid-career	−0.004 [0.030]	0.000 [0.030]	−0.010 [0.030]	−0.013 [0.030]	0.068 [0.048]	0.008 [0.016]	−0.117** [0.053]	0.008 [0.031]
Senior (omitted)								
Female	0.004 [0.030]	0.005 [0.030]	0.004 [0.030]	0.004 [0.030]	0.029 [0.049]	0.027 [0.019]	0.015 [0.058]	−0.073* [0.038]
Germany (omitted)								
UK	0.015 [0.030]	0.014 [0.030]	0.016 [0.030]	0.016 [0.030]	−0.027 [0.049]	−0.020 [0.017]	−0.065 [0.053]	0.113*** [0.040]
Japan	0.050* [0.030]	0.051* [0.030]	0.047 [0.030]	0.047 [0.031]	−0.064 [0.048]	−0.035* [0.018]	0.120** [0.051]	0.045 [0.035]
ln(publications)	0.053*** [0.015]	0.054*** [0.015]	0.052*** [0.015]	0.051*** [0.015]	−0.056** [0.024]	0.004 [0.007]	−0.001 [0.026]	0.039** [0.016]
ln(citations p.P.)	0.003 [0.018]	0.002 [0.018]	0.002 [0.018]	0.003 [0.018]	0.020 [0.031]	0.010 [0.010]	−0.016 [0.031]	−0.025 [0.020]
Top tier unit	0.048 [0.034]	0.043 [0.034]	0.055* [0.033]	0.057* [0.033]	0.068 [0.049]	−0.024 [0.019]	0.045 [0.056]	−0.026 [0.033]
Second tier unit	−0.010 [0.033]	−0.015 [0.034]	−0.005 [0.033]	−0.002 [0.033]	0.126** [0.052]	−0.020 [0.017]	0.076 [0.060]	−0.090*** [0.034]
Other ranked	0.017 [0.035]	0.013 [0.035]	0.024 [0.035]	0.026 [0.035]	0.050 [0.056]	−0.011 [0.018]	0.086 [0.060]	−0.056 [0.035]
Unranked (omitted)								
Satisfaction	−0.004 [0.019]	−0.003 [0.018]	−0.005 [0.019]	−0.005 [0.019]	−0.025 [0.032]	0.002 [0.010]	0.010 [0.033]	0.009 [0.021]
Rho	−0.525**	0.732**	−0.475*	0.496*				
Log-likelihood	−1817.7	−1687.6	−1759.3	−1775.8				

Note: * (**, ***) indicate significance at 10 per cent (5 per cent, 1 per cent). $N = 2381$; individuals = 2,222; uncensored N = 733. Clustered (individual) standard errors in brackets.

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. In Table 6 where we control for the sector of the co-affiliation, the income motive does indeed turn insignificant, while start-up activity is highly correlated with Q4. The income motive, however, is negatively linked to Q3, i.e. low-research affiliations that originate largely from external institutions. This suggests that the role of monetary incentives used by some institutions to attract top academics is not an important motive for academics to affiliate, despite many of these positions providing a salary or fee as indicated by the positive paid contract sign in Table 6.

Looking at control variables in Table 5, 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

Table 6. Second-stage regression results—Probit models with selection (average marginal effects reported)—partial results.

	Cluster type			
	Q1	Q2	Q3	Q4
	High research—researcher origin	High research—external origin	Low research—external origin	Low research—researcher origin
	(1)	(2)	(3)	(4)
Network/prestige	0.026	−0.005	0.036*	−0.033**
	[0.019]	[0.007]	[0.021]	[0.017]
Resources	0.056***	0.025**	−0.020	−0.075***
	[0.020]	[0.012]	[0.020]	[0.020]
Teaching	−0.107***	0.014*	0.012	0.053**
	[0.020]	[0.009]	[0.020]	[0.021]
Income	0.015	0.006	−0.073***	0.024
	[0.019]	[0.007]	[0.021]	[0.015]
Affiliation abroad	0.213***	−0.034*	−0.069	−0.089**
	[0.040]	[0.018]	[0.045]	[0.041]
Affiliation paid contract	−0.088*	−0.011	0.138**	−0.006
	[0.049]	[0.018]	[0.054]	[0.038]
Affiliation unpaid contract	−0.003	0.017	0.014	−0.033
	[0.049]	[0.018]	[0.053]	[0.040]
Affiliation informal (omitted)				
Affiliation HEI (omitted)				
Affiliation PRO	0.019	0.015	0.045	−0.106**
	[0.045]	[0.016]	[0.047]	[0.046]
Affiliation government	−0.127**	−0.017	0.064	0.074
	[0.058]	[0.022]	[0.066]	[0.049]
Affiliation start-up	−0.313***	0.009	−0.358**	0.254***
	[0.105]	[0.036]	[0.149]	[0.096]
Affiliation company	−0.310***	0.019	0.014	0.104
	[0.095]	[0.027]	[0.087]	[0.066]
Controls	YES	YES	YES	YES
Log-likelihood	−1,778.677	−1,674.311	−1,744.730	−1,740.505

Note: * (**, ***) indicate significance at 10 per cent (5 per cent, 1 per cent). $N = 2381$; individuals $= 2,222$; uncensored $N = 733$. Cluster-robust standard errors in brackets. Full results reported in Supplementary Table S1 in online supplement.

not in the top tier) are more likely to seek out co-affiliations 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. co-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 and use co-affiliations to this effect. Finally, the satisfaction with resource provision in the home institution shows no significant correlation with occurrence or type of multiple affiliations.

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 analysis presented in Sections 4.1 and 4.2. 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 co-affiliations to Group 1 if the respondent indicated to have had research as the important

purpose of the affiliation, but said that it did not result from the existing institutional cooperation nor was it initiated by the external institution. Co-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 co-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 co-affiliations to Group 4 if the responded indicated purposes other than research and the affiliation was not the result of the 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 7). The pair-wise correlation between both sets of clusters is also high with a coefficient of 0.604.

The regression results for this alternative clustering method are presented in Table 8. In line with the conclusions from the results presented in Table 6, we find that co-affiliations of type Q1 are more common when researchers are affiliated to a foreign academic institution and are motivated by resource access and less common for those motivated by teaching. For co-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. The latter is again

Table 7. 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	1.000	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	0.000	0.103
	Institutional cooperation	0.246	0.046	0.656	0.185	0.042
	External institutional initiative	0.173	0.099	0.424	0.885	0.000
	Frequency	733	263	126	130	214
	Cumulative %	100	35.88	17.19	17.74	29.20

insignificant as the effect is mediated by the inclusion of the start-up variable. 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 co-affiliations based on external institutional initiative and fewer based on institutional cooperation compared to the analysis presented above. This could explain the negative role of teaching as we no longer capture a large number of co-affiliations resulting from institutional cooperation which often serve a dual research–teaching purpose. As for cluster Q3, the income motive is still negative despite the positive sign for paid contracts. Furthermore, we observe a significant negative effect for resource motive and a significant positive effect for teaching motive. This cluster includes more teaching and managerial co-affiliations compared to the one used in Table 6, which likely explains these differences. The overall results are thus consistent and suggest distinct co-affiliation types associated with different co-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 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 score indicator suggests better cluster assignment, i.e. the score is higher when clusters are dense and distinct from one another. The results presented in the paper are based on the seed value 12 and a CH value of 152 for four clusters. We selected the seed 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.

5. Discussion and conclusion

In an increasingly competitive research sector that has seen a concentration of resources, incentives for collaboration, and the emergence of new roles for academics (Jones et al. 2008; Fini et al. 2020; Hamann and Zimmer 2017), multiple

affiliations have emerged as a noticeable phenomenon (Hottenrott and Lawson 2017; Hottenrott et al. 2021; Yegros-Yegros et al. 2021). This paper aimed at providing first insights into the organisation of multiple affiliations and into academics' motivations 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. The 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 co-affiliation in the previous five years. In all three countries, and independent of the respondent's career stage, co-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 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. Income motives, however, are only listed by few.

The results from our analysis further show that academics' individual motivations are a key determinant of the types of co-affiliations reported by study participants. We find that the more important the network and prestige motives, the more likely the academic can be located in a research-focussed 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.

Table 8. Regression results with alternative clustering method—probit models with selection (marginal effects reported)—partial results.

	Cluster type			
	Q1	Q2	Q3	Q4
	High research—researcher origin	High research—external origin	Low research—external origin	Low research—researcher origin
	(1)	(2)	(3)	(4)
Network/prestige	0.026	0.016	0.004	−0.034**
	[0.018]	[0.015]	[0.018]	[0.017]
Resources	0.073***	0.064**	−0.050***	−0.071***
	[0.019]	[0.027]	[0.018]	[0.019]
Teaching	−0.103***	−0.036**	0.068***	0.062***
	[0.019]	[0.017]	[0.022]	[0.021]
Income	0.009	0.004	−0.045**	0.023
	[0.019]	[0.015]	[0.022]	[0.015]
Affiliation abroad	0.210***	−0.099**	−0.027	−0.078**
	[0.040]	[0.047]	[0.039]	[0.039]
Affiliation paid contract	−0.085*	0.006	0.092*	−0.008
	[0.049]	[0.037]	[0.051]	[0.037]
Affiliation unpaid contract	0.009	0.001	0.037	−0.033
	[0.049]	[0.036]	[0.045]	[0.039]
Affiliation informal (omitted)				
Affiliation HEI (omitted)				
Affiliation PRO	0.040	0.080*	−0.058	−0.103**
	[0.044]	[0.041]	[0.047]	[0.044]
Affiliation government	−0.125**	−0.023	0.081	0.065
	[0.058]	[0.045]	[0.056]	[0.046]
Affiliation start-up	−0.330***	−0.062	−0.230*	0.296***
	[0.103]	[0.078]	[0.123]	[0.101]
Affiliation company	−0.337***	0.064	−0.017	0.112*
	[0.093]	[0.061]	[0.069]	[0.065]
Controls	Yes	Yes	Yes	Yes
Log-likelihood	−1,777.733	−1,740.633	−1,687.484	−1,690.950

Note: *(**, ***) indicate significance at 10 per cent (5 per cent, 1 per cent). $N = 2,381$; uncensored $N = 733$. Cluster-robust standard errors in brackets. Full results reported in Supplementary Table S2 in Online Supplement.

Teaching and learning motives are also found to play a role, but these affiliations tend to be low in research focus as academics seek out teaching opportunities elsewhere. It is possible that this can help to increase income or career prospects; however, the income motive is, contrary to our expectations, not linked to low-research affiliations.

Overall these results largely confirm the relationships predicted in Table 1. In particular, we confirm the 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 suggests that, contrary to our expectation, the role of monetary incentives used by some institutions to attract academics is not an important motive for academics to affiliate. We do, however, confirm the positive effect of income motive and find a negative effect of network/prestige for low-research affiliations that originate with the academic and include entrepreneurial and managerial purposes. We further find that other affiliation characteristics, such as country, sector, and contract type correlate with co-affiliation type and mediate some of the effect of motivation. For instance, the network/prestige effect for high-research affiliations is mediated by co-affiliations that involve international institutions. Table 9 summarises our findings with regard to expected relationships.

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). This highlights the higher level of autonomy for UK academics, allowing them to determine their work arrangements individually. These affiliations are also linked to the extensive efforts of UK policy to encourage the commercialisation of academic research. Japanese researchers, on the other hand, rely on institutional mechanisms, which may be demonstrative of the lower autonomy enjoyed and the need for institutional sanctioning of co-affiliations.

Overall our findings show that motivations such as resource access are an important driver of multiple affiliations. Affiliation types that involve research could support academic activities and thus satisfy their intellectual ambition. Low-research affiliations are largely driven by teaching/learning motives, including student support, which could support future science. 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 the scientific endeavour. Importantly, it is associated with higher research performance, which gives rise to

Table 9. 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	(+) 0	(0) −
Resources	+	+	−	−
Teaching/learning	−	−	(0) 0/+	+
Income	0	(+) 0	(+) -	(+) 0/+

Note: Parentheses indicate predicted correlations that were not or only partially confirmed.

concerns that it may distract academics from research in the future.

The results also show that multiple affiliations serve purposes that cannot be achieved solely through 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 co-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 per cent of respondents. Whether the motivations of individual academics reported in this research are in line with goals of institutions that enter institutional partnerships is a question for future research. Motivations such as networking and resource access may likely create positive externalities for academic institutions that may 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 USA 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 are only a first step to a better understanding of the role of multiple institutional affiliations in the organisation of science. They contribute to the literature on cross-institutional collaborations (Beaver and Rosen 1978; Jones et al. 2008; Katz and Martin 1997) by showing that multiple affiliations are a significant part of academic life, but heterogeneous in nature. We hope that our findings will encourage more research into the contractual and organisational nature of multiple affiliations. We also still 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.

Supplementary data

Supplementary data is available at *SCIPOL* online.

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Notes

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

2. Historians were not surveyed in the case of Japan due to the low number of articles by Japanese authors in JCR listed journals.

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

4. Survey questions are listed in Appendix D.

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

6. Confirmed in unreported auxiliary regressions.

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Appendix A. Response analysis

Table A.1 reports detailed survey response rates by country. Approximately 12.1 per cent 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 per cent) but still 7.2 per cent for 2015 publications. The 'email decay rate' is highest for the UK at 14.3 per cent and in engineering with 19.3 per cent. These rates are in line with a survey undertaken by the Organisation for Economic Co-operation and Development (OECD) which reports an average bounce rate of 12 per cent (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 per cent after taking into account undeliverable emails. The corrected response rate for the survey is 36.6 per cent in Japan, 31.1 per cent in Germany, and 24.5 per cent in the UK (see Table A.1). The response rate is lowest in biology with 29 per cent and highest in history with 35 per cent. 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

Table A.1. 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 A.2. Survey response by country and journal field.

	Japan		Germany		UK		Total	
	N	%	N	%	N	%	N	%
Total sample [including undeliverable]	2,806	100	2,803	100	3,307	100	8,916	100
Biology	1,136	44.69	566	23.01	501	17.67	2,203	28.11
Chemistry	833	32.77	855	34.76	567	20.00	2,255	28.77
Engineering	600	23.60	689	28.01	906	31.96	2,195	28.01
Business/Economics	237	9.32	534	21.71	1,075	37.92	1,846	23.55
History			159	6.46	258	9.10	417	5.32
Total surveyed sample	2,542	100	2,460	100	2,835	100	7,837	100
Biology	1,066	41.94	530	21.54	451	15.91	2,047	26.12
Chemistry	770	30.29	782	31.79	505	17.81	2,057	26.25
Engineering	488	19.20	553	22.48	724	25.54	1,765	22.52
Business/Economics	218	8.58	448	18.21	928	32.73	1,594	20.34
History			147	5.98	227	8.01	374	4.77
Responses	931	36.62	764	31.06	694	24.48	2,389	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
Business/Economics	83	38.07	149	33.26	251	27.05	483	30.30
History	-	-	73	49.66	56	24.67	129	34.49

of article impact) are highly field and year sensitive, we consider papers that are in the top 1 per cent 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 per cent 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 per cent to 32 per cent.

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, and 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 per cent) are associate or full professors, and response bias is not a concern.

Table A.3. Response patterns by article impact and authorship.

	Total surveyed sample	Respondents	Response rate %
Journal impact			
Quadrant 1	3,479	1,006	28.92
Quadrant 2	1,707	528	30.93
Quadrant 3	1,663	535	32.17
Quadrant 4	988	320	32.39
Paper impact[a]			
99pct	269	74	27.51
90pct	1,639	458	27.94
50pct	4,132	1,190	28.80
<50pct	3,331	1,070	32.12
Authorship			
Single authored	878	300	34.17
Co-authored	6,959	2,089	30.02
First-authored	3,388	1,049	30.96
Last-authored	2,710	798	29.45
Single-address author[b]	6,496	2,006	30.88
Multi-address author[b]	1,307	377	28.84
Domestic only[b]	5,639	1,755	31.12
International link[b]	2,164	628	29.02

Notes: [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: Likelihood-Ratio (LR) test independent vs. saturated: $chi2(66) = 2{,}029.51$ 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 equipment	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
(1) Resources	1																
(2) Network/prestige	−0.002	1															
(3) Teaching	0.022	0.005	1														
(4) Income	0.013	−0.009	0.002	1													
(5) Affiliation Abroad	−0.003	0.165	−0.055	−0.027	1												
(6) Paid contract	−0.079	−0.177	−0.027	0.298	−0.052	1											
(7) Unpaid contract	0.117	0.067	0.074	−0.19	−0.05	−0.66	1										
(8) Informal affiliation	−0.04	0.14	−0.054	−0.144	0.124	−0.461	−0.363	1									
(9) HEI	−0.12	−0.036	0.241	−0.07	0.172	−0.097	0.025	0.091	1								
(10) PRO	0.178	0.089	−0.166	−0.067	−0.089	−0.046	0.075	−0.031	−0.6	1							
(11) Government	−0.008	0.028	−0.081	0.052	−0.069	0.093	−0.036	−0.072	−0.43	−0.187	1						
(12) Start-up	−0.026	−0.024	−0.1	0.122	−0.08	−0.001	0.005	−0.005	−0.216	−0.094	−0.067	1					
(13) Company	−0.025	−0.097	−0.031	0.096	−0.051	0.151	−0.131	−0.033	−0.303	−0.132	−0.094	−0.047	1				
(14) Junior	−0.035	0.083	−0.053	0.166	−0.042	−0.038	0.006	0.04	0.044	−0.03	−0.057	0.02	0.023	1			
(15) Middle	−0.012	0.044	0.122	0.019	−0.01	−0.027	−0.007	0.041	0.059	−0.032	−0.029	0.005	−0.031	−0.246	1		
(16) Senior	0.036	−0.099	−0.061	−0.14	0.04	0.051	0.001	−0.064	−0.082	0.05	0.067	−0.02	0.008	−0.59	−0.638	1	
(17) Female	−0.013	0.173	−0.04	0.029	0.004	−0.084	0.005	0.098	−0.015	−0.035	0.082	−0.006	−0.015	0.073	0.099	−0.14	1

Variables	−18	−19	−20	−21	−22	−23	−24	−25	−26	−27
(18) Germany	1									
(19) UK	−0.433	1								
(20) Japan	−0.544	−0.521	1							
(21) ln(publ.)	−0.016	−0.117	0.124	1						
(22) ln(citations)	0.022	0.039	−0.057	0.545	1					
(23) Top tier unit	−0.062	0.132	−0.064	0.051	0.116	1				
(24) Second tier unit	0.006	0.038	−0.041	0.021	−0.003	−0.302	1			
(25) Other rank	−0.018	0.029	−0.01	0.014	−0.01	−0.251	−0.245	1		
(26) Unranked	0.063	−0.172	0.1	−0.074	−0.092	−0.423	−0.413	−0.344	1	
(27) Satisfaction	0.207	0.213	−0.395	−0.095	0.001	0.163	0.034	−0.064	−0.123	1

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 HEIs, 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, and scientific fellow (shorter residencies or sabbatical leave do not count)]	• Yes, presently • Yes, in the past • No [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) • Research affiliation (e.g. research associate) • Advisory role • Managerial (business) role • Acceptance for honour • 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 • Through an existing cooperation between my main institution and the additional institution (e.g. spin-off of main institution or shared research facilities) • Through personal contacts • Through start-up activities (e.g. own company) • Following my own initiative (application or request) • Following the initiative of the other institution (invitation) • Other
Do you state your additional affiliation(s) on your research publications?	• Yes, all • Only certain ones • No, only my main affiliation
How important are (were) the following motivations for your affiliation with additional institutions or companies? ○ Very important [4] ○ Quite important [3] ○ Not very important [2] ○ Not at all important [1] ○ Not applicable	• Prestige of the additional institution • To build professional networks • To gain teaching experience • To increase my personal income • To gain access to additional funding • To gain access to additional data, material, or library resources • To gain access to students (e.g. recruitment) • To gain access to technical support staff, laboratories, and equipment • To create job opportunities for myself • To create job opportunities for students and postdocs • To create opportunities for knowledge exchange/transfer • Family or other reasons
What is the country of your external affiliation? [asked for up to three; most recent in case of past affiliation only]	• Country name
What is the contractual arrangement regarding this external affiliation? [asked for up to three; most recent in case of past affiliation only]	• Contract with salary • Contract without salary • Informal agreement
What kind of institution is this additional external affiliation? [asked for up to three; most recent in case of past affiliation only]	• University • Public research organisation (e.g. John Innes Centre) • Non-profit research institute (e.g. Cancer Research UK) • Government institution • Hospital • Business organisation ≥ 250 employees • Own company/University spin-off • Other