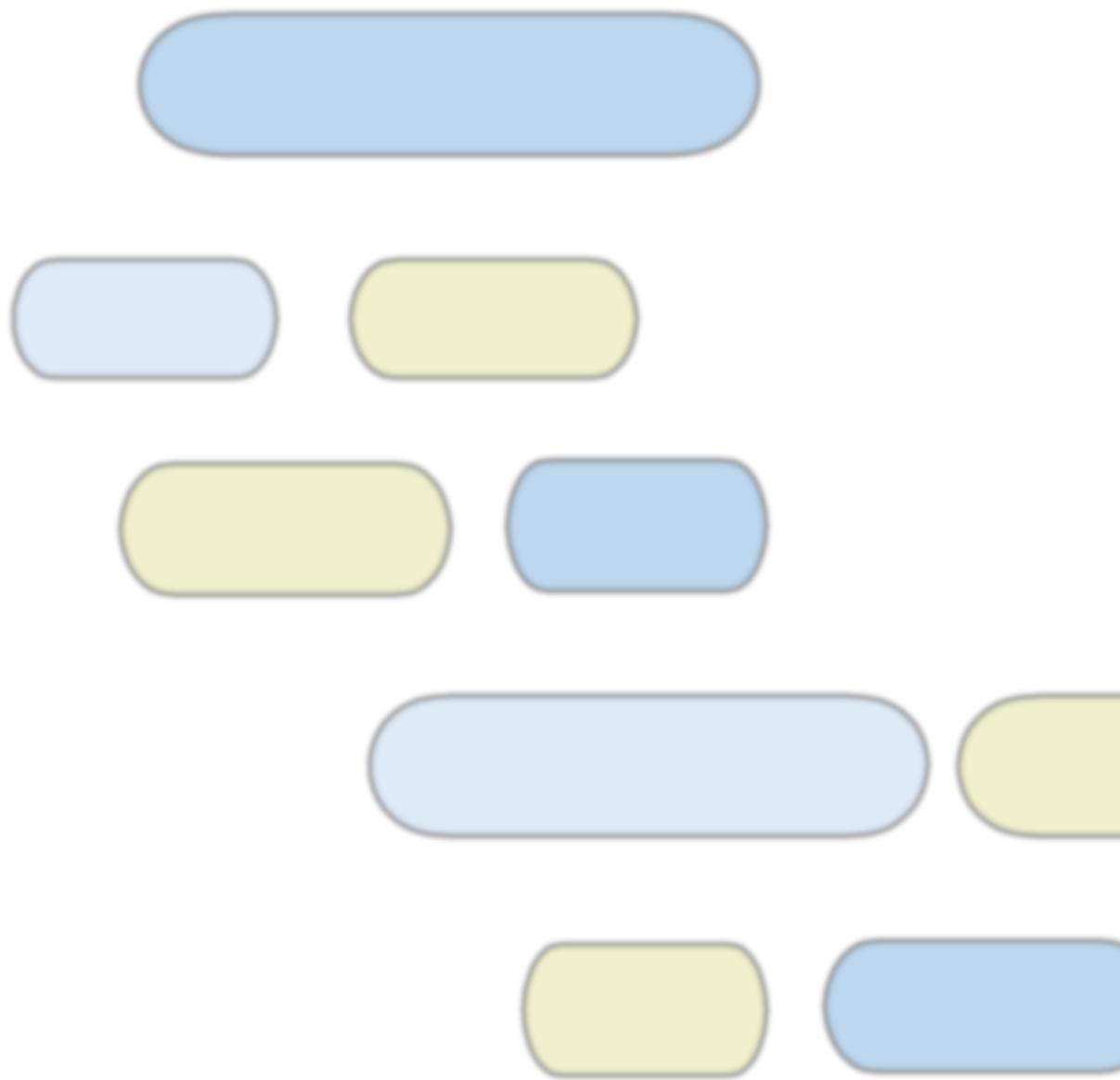


WORKING PAPER

The Third Mission in the Academic Profession: Empirical Insights into Academic Identities

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This version: May 5, 2022

Abstract

In line with the growing relevance of higher education and science for societal development and innovation processes, there has been a steady increase in the salience of interrelations with the extra-academic environment in the context of academics' work. Insights into the status of this so-called third mission in the academic profession remain fragmented, however. We use the concept of an academic identity as an analytical lens to investigate this status empirically based on an original survey among 4,284 professors in Germany across the full range of academic disciplines. The results show that the third mission is firmly included in the academic identities of many, but not all, professors and that the forms of inclusion differ. Specifically, we are able to identify four types of identities: (1) the *dedicated* type who embraces the third mission as a whole; (2) the *idealistic* type who emphasizes responsibility toward society and sociopolitical matters; (3) the *pragmatic* type who emphasizes material work-related and personal benefits; and (4) the *reserved* type, characterized by an overall distanced stance. We furthermore find evidence of a strong impact of disciplinary communities on the specific types of identities that academics develop, whereas the organizational context and the cohorts to which academics belong appear less relevant. In addition, there are indications that individual characteristics shape the identity formation process. Last, there are strong and differential associations between academics' identities and their actual third mission engagement. Overall, it appears that the third mission—at least if its multifaceted nature is considered—is a relevant area of activity for a significant share of the academic profession.

Keywords: third mission; knowledge transfer; continuing education; societal engagement; academic profession; academic identity; professor

JEL Codes: I23; O35; O36

* We gratefully acknowledge financial support from the Ministry of Science and Culture of Lower Saxony (*Niedersächsisches Ministerium für Wissenschaft und Kultur*). The views and opinions expressed are solely those of the authors and do not reflect the official policy or position of the funding institution.

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1 Introduction

As the scope of their work's relevance for societal development and innovation processes has become increasingly apparent, academics have witnessed an increase in the salience of activities outside of their core missions of teaching and research. The contribution of the knowledge created and transmitted by academics to economic development has been widely acknowledged for some time (Etzkowitz et al. 2000). Recently, contributions to societal challenges and transformations more broadly have also received greater recognition (Owen, Macnaghten, and Stilgoe 2012; Trencher et al. 2014). Together, these different forms of academics' engagement with the extra-academic environment amount to a distinct set of activities, which has come to be termed, among other things, the third mission (Laredo 2007; Pinheiro, Langa, and Pausits 2015). Policy-makers and other stakeholders (Grimaldi et al. 2011; Benner and Sandström 2000; Kitagawa and Lightowler 2013) as well as higher education institutions (Geuna and Muscio 2009; Pinheiro, Langa, and Pausits 2015; Kitagawa and Lightowler 2013) increasingly expect and promote academics to intensify their engagement in this area. These efforts target an ever-greater range of activities and the entire spectrum of academic disciplines (Nelles and Vorley 2010). At the same time, notable developments are taking place within academia itself in the form of comprehensive responses to societal challenges (such as climate change and the COVID-19 pandemic) and debates on academics' role in society (see, for instance, Burawoy 2005).

Despite the increase in salience, knowledge about academics' stance on the third mission remains fragmented. Academics' actual engagement has been researched extensively, especially in its more entrepreneurial forms (see, for instance, Rothaermel, Agung, and Jiang 2007) and in the natural and engineering sciences (Lam 2011), yet also more broadly (see, for instance, Abreu and Grinevich 2013; Iorio, Labory, and Rentocchini 2017; Perkmann et al. 2013; 2021; Olmos-Peña, Castro-Martínez, and D'Este 2014; Schneijderberg et al. 2021). Some of these studies consider associations between academics' engagement and their norms and values (see, for instance, Abreu et al. 2016; Bruneel, D'Este, and Salter 2010; Perkmann et al. 2013; Renault 2006) or motives (see, for instance, Tartari and Breschi 2012; D'Este and Perkmann 2011; Lam 2011; Lee 2000; Olaya Escobar et al. 2017). However, only a few empirical studies have thus far addressed matters in this area directly (Freel, Persaud, and Chamberlin 2019; Jain, George, and Maltarich 2009; see also Balven et al. 2018). Those that do tend to focus on the entrepreneurial side of the third mission and the natural and engineering sciences for the most part.

Against this backdrop, we investigate the status of the third mission in its different forms throughout the academic profession. To assess this status, we use the concept of an academic identity as the analytical lens. Drawing on prior research (in particular, Henkel 2000; 2012), we

develop a perspective on academic identities that distinguishes three pertinent facets: 1) academics' value orientations concerning the position of higher education and science in society; 2) their attitudes toward engaging in knowledge and technology transfer, continuing education, and societal engagement; and 3) their perceptions of the benefits associated with a third mission engagement. Based on this perspective, we address three basic questions: first, to what extent and in which forms is the third mission included in academics' identities?; second, do these forms of inclusion differ systematically in conjunction with factors commonly considered key influences on academics' identities?; and third, are differences in identities associated with differences in engagement in third mission activities? We answer each of these questions empirically based on data of 4,284 professors at German higher education institutions across the full range of academic disciplines generated via an original survey conducted in late 2020.

Our investigation contributes to the research and debates on the third mission in three main ways. First, the differentiated account of academics' identities and the comprehensive coverage of both the third mission and the academic profession allow us to extend previous research on the status that academics accord to the third mission. Specifically, we shed light on the multifaceted nature of the third mission and on those parts of the academic profession hitherto widely neglected, which enables us to develop a nuanced typology of identities. Second, our investigation provides insights into the comparative relevance of key influences on academics' identities and the ways in which these shape academics' stance on the third mission. Third, we are able to uncover the complexity of the connection between academics' stance on the third mission and their actual engagement that is associated with the multifaceted nature of the third mission. Taken together, our findings provide a more holistic picture of the academic profession and its role in societal development and innovation processes, whose relevance has become increasingly apparent.

The remainder of the paper proceeds as follows. Section 2 presents our analytical perspective and specifies the research questions. Section 3 provides an overview of the data used for the analysis. Section 4 presents the empirical results, followed by a discussion in Section 5. Section 6 concludes the paper with general implications of our results for research on the third mission as well as higher education and science policy and management.

2 Research Perspective and Questions

Several scholars argue that the meaning academics attach to being an academic comprises a set of norms, values and beliefs that together amount to a distinct academic identity (see, for instance, Henkel 2000; Musselin and Becquet 2008; see also Välimäa 1998). Exploring the inclusion of the third mission in these identities, thus, appears suitable for assessing its status within the academic profession in a comprehensive and differentiated manner. The perspective

underlying our investigation draws on the work of Henkel (2000; 2004; 2005; 2009), who conceptualizes academic identities based on social theories of identity. In line with this conceptualization, we first approach academic identities as a multidimensional phenomenon consisting of the "*values, agendas, self-perceptions and sense of self-esteem*" (Henkel 2000, 148) of academics. Second, we consider academic identities the result of a prolonged process of identity formation that stretches across academics' careers and is shaped by both the different communities to which academics belong and their individual characteristics and agency. Third, we assume that academic identities are drivers of academics' behavior (see also Olmos-Peñuela, Benneworth, and Castro-Martínez 2015).

Based on this framework, we address three main research questions. The first question considers the extent to which the third mission is included in academics' identities and the forms this inclusion takes. To this end, we identify different facets of academic identities and ways in which the third mission can be included in these facets. The second question considers potential factors behind differences in identities among academics, for which we revert to the main factors commonly considered key influences during the identity formation process. The third question considers whether and how academics' identities translate into behavior. The conception of the third mission underlying the three questions considers its complexity by distinguishing between the three broad areas of knowledge and technology transfer, continuing education and societal engagement, as well as a number of specific activities from each of these areas. Figure 1 provides an overview of the associations covered by the research questions, which we discuss in greater detail in the following sections.

< Figure 1 >

2.1 *Identity Facets*

Guided by previous research, three facets of academic identities appear pertinent for our purpose: first, academics' value orientations related to the role that higher education and science should assume within society; second, their attitudes toward third mission activities as a part of their academic work; and third, their perceptions of synergies between third mission engagement and their academic work and careers. Furthermore, it appears relevant to account for the different activities and contexts constituting the third mission across the three facets. While analytically distinct, an analysis of the dimensions together should provide a comprehensive, albeit not exhaustive, picture of the inclusion of the third mission in academics' identities.

The third mission's increased salience has brought to the fore the intricate relation between academics' engagement with the extra-academic environment and basic academic norms and values. This is particularly visible with regard to relations between academia and the private sector, for instance, in regard to conflicts between academics' interests in the open

dissemination of knowledge and firms' interests in withholding information from competitors (Tartari and Breschi 2012; Welsh et al. 2008; see also Perkmann et al. 2021). In their studies on the implications of major developments in higher education, Slaughter and Leslie (1999) and Henkel (2000; see also 2005) find clear indications of tensions between academics' norms and values and demands for stronger engagement with the private sector. Even though both studies highlight the persistence of core norms and values, they also observe that academics differ in their perceptions of these and other value conflicts (see Tartari and Breschi 2012; Etzkowitz 1998; Jain, George and Maltarich 2009; Freel, Persaud, and Chamberlin 2019; Renault 2006 for similar findings). This diversity has been shown particularly clearly by Lam's (2010; 2011) investigations of the value orientations of natural and engineering scientists in the United Kingdom. Whereas some academics indeed consider entrepreneurial activities to be irreconcilable with academic values, others are "*entrepreneurial scientists*" (Lam 2011, 1360), who perceive no conflicts in this regard. As suggested by current debates about academia's responsibilities vis-à-vis society more generally, a similar diversity can be assumed to apply to other areas of the third mission as well (see also Iorio, Labory, and Rentocchini 2017; Watermeyer 2015). We, thus, consider academics' value orientations toward the role that higher education and science should assume within society and about the appropriateness of engagement in this area a first relevant facet of academics' identities.

It also appears that academics differ in the priority they assign to engaging in the third mission in general as well as in particular activities. Differences in emphasis among academic positions notwithstanding, academics are tasked with several distinct activities. Whereas teaching, research, academic self-governance and administrative tasks are commonly considered core academic duties, this is not necessarily the case for the third mission. That academics differ in this regard is already suggested by a comparison of disciplines (see also Section 2.2). Engaging with the extra-academic environment is deeply rooted in more application-oriented disciplines such as the engineering sciences but less firmly integrated into disciplines with a stronger orientation toward basic research such as mathematics and physics. Similar differences in integration can also be found among types of higher education institutions; for instance, due to a focus of some institutions on the demands of their local environment or due to the mandate that universities of applied sciences have in systems with a formal binary divide. Given that academics from all parts of the profession have been observed to engage in various third mission activities, there is reason to assume that such differences in priority setting go beyond the boundaries of academic disciplines and institutional types (see also Kenney and Goe 2004; Freel, Persaud, and Chamberlin 2019). We, thus, consider academics' attitudes in the form of the relevance that they ascribe to engaging in different areas of the third mission a second relevant facet of academic identities.

Complementing the general relevance accorded to third mission activities, academics diverge in their perceptions of the synergies of engaging with their work and careers. Studies on third mission activities, including entrepreneurial activities (see D'Este and Perkmann 2011; Lam 2011), research-related collaborations (see D'Este and Perkmann 2011; Lee 2000; Olaya Escobar et al. 2017), science communication (see Besley et al. 2020), and cooperation in the field of teaching (see Orazbayeva et al. 2020), have revealed various benefits that academics associate with an engagement (see also Abreu et al. 2009; Meyer-Krahmer and Schmoch 1998; Schneijderberg et al. 2021 for a third mission engagement more generally). A common finding of these studies is a pronounced difference among academics in their assessment of whether potential benefits such as intellectual stimuli and the acquisition of resources for research and teaching or improved career prospects apply to them or not. The assessment of potential benefits is at least partly related to academics' basic value orientations, as Lam (2011) has shown in the area of entrepreneurial activities. Thus, we include these perceptions as a third relevant facet of academic identities in our analysis.

2.2 *Identity Formation Process*

The factors commonly considered key influences during academics' identity formation process are likely to also shape their stance on the third mission. According to the literature (Henkel 2000; 2005; 2009; Enders and de Weerts 2004; Musselin 2009), the academic discipline and the environment provided by higher education institutions constitute the most important contexts in which academics develop their identities. As the influence of these two contexts might be dynamic, we consider the cohort to which academics belong an additional potentially relevant factor. The influences of these contexts cannot be expected to determine academic identities entirely, however. Rather, it would be expected that they interact with the personal characteristics and agency of individual academics (Henkel 2000; 2009; see also Lam 2010; 2011).

Differences in the interrelations with the extra-academic environment suggest that academic identities vary among disciplines in relation to the third mission. Disciplines are arguably the most important community for socialization in the academic profession. Their specific cultures shape the self-perception and behavior of their members in several regards (Becher 1994; Henkel 2000; Ylijoki 2000). What has been observed for research and teaching (Becher 1994; Moses 1990; Musselin and Becquet 2008) is likely to apply to the third mission as well (Freel, Persaud, and Chamberlin 2019). This is already suggested by the associations between disciplinary affiliation and the levels and forms of third mission engagement (see, for instance, D'Este and Patel 2007; Perkmann et al. 2013; 2021; Bekkers and Bodas Freitas 2008). There is further evidence for similar associations with academics' norms and values (see Abreu et al. 2009; Musselin and Becquet 2008; Philpott et al. 2011). Lam (2010), for instance, observes in a study covering the United Kingdom that academics with more

traditional values with regard to an engagement with the private sector are more prevalent in a discipline such as physics compared to more application-oriented disciplines such as engineering and the computer sciences, whereas the opposite holds true for academics with more entrepreneurial values. It appears likely that, also with regard to the third mission more broadly, a stronger orientation toward the application of knowledge or more well-developed ties with particular areas of the extra-academic environment are associated with a firmer inclusion of the third mission in academic identities.

Not least because of higher education institutions' efforts to promote the third mission, the environment that institutions provide appears potentially relevant. The organizational context of academics' work has generally risen in importance as a complement to the academic discipline as a socializing force (Henkel 2000; 2005; 2009). More or less in parallel with developments related to the third mission, a succession of reforms aimed at strengthening the strategy and management capacities of higher education institutions have been carried out (Musselin 2021; Krücken and Meier 2006). As a result, higher education institutions have become more active in defining their profiles and in directing their members toward contributing to organizational objectives. In the face of broader policy changes, academics' third mission engagement is often among those objectives and has become an object of institutional incentives and support (Grimaldi et al. 2011; Pinheiro, Langa, and Pausits 2015). This has led to some institutions featuring a culture more strongly geared toward exchange relations with the extra-academic environment (see also Geuna and Muscio 2009; Kenney and Goe 2004; Loi and Di Guardo 2015). We would, thus, expect a greater openness toward the third mission of professors at institutions that are themselves more open toward such engagement (see also Freel, Persaud, and Chamberlin 2019) and whose strategic selection processes value such professional activities.¹ However, the available evidence on the impacts of these developments at the organizational level on academics remains ambiguous (see Abreu et al. 2016; Owen-Smith and Powell 2001; D'Este and Patel 2007; Tartari, Perkmann, and Salter 2014; Clarysse, Tartari, and Salter 2011; Watermeyer 2015).

The constant increase in the third mission's salience is a reason to expect differences in academic identities among cohorts. The various developments that contribute to a greater emphasis on the third mission within the context of academics' work, including the doctoral

¹ The organizational factors considered here, which mainly refer to the central and intermediate organizational levels, cover only parts of the internal complexity of higher education institutions. The actual working context of academics within their academic subunits can be supposed to constitute a relevant influence on academic identities as well. As suggested by research by Bercovitz and Feldman (2008) on academics' entrepreneurial activities, the leadership and peers of a subunit can exert an influence on academics' behavior and norms (see also Haeussler and Colyvas 2011; Kenney and Goe 2004; Perkmann et al. 2013; Tartari, Perkmann, and Salter 2014). As the data on which our empirical analysis is based do not allow us to consider the level of subunits, we refrain from discussing these aspects in greater detail.

and postdoctoral phases crucial for the identity formation process (Enders and de Weerts 2004; Henkel 2004), have intensified over several decades. Different cohorts of academics have been exposed to third mission-related expectations and demands to a different extent. Hence, differences in academic identities are expected among cohorts. However, even though several scholars have conjectured that these differences exist (see Bercovitz and Feldman 2008; Olmos-Peña, Benneworth, and Castro-Martínez 2015; Schneijderberg et al. 2021; Pekşen et al. 2021), empirical evidence for them is thus far mixed. Schneijderberg et al. (2021), for instance, find scant evidence of diverging attitudes toward the third mission in their investigation of academics in the humanities and social sciences in Argentina, Germany, Portugal and Sweden (see also Freel, Persaud, and Chamberlin 2019). Bercovitz and Feldman (2008), in contrast, find cohort differences in entrepreneurial behavior among scientists from the field of medicine in the US that they link to differences in the norms that academics acquired during socialization into the academic profession (see also Pekşen et al. 2021).

With regard to the individual characteristics, academics' gender and career stage emerge as two additional factors worth taking into consideration. Promoted by a diversification of job profiles and potential roles in academia, academics possess some agency in finding and defining their identities (Henkel 2009; 2012; Lam 2011; see also Jain, George, and Maltarich 2009). Individual characteristics and circumstances may influence academics' identities. Two factors are particularly promising in this regard. First, the career stage of academics tends to be associated with their relationship with the extra-academic environment (Freel, Persaud, and Chamberlin 2019). Several studies have found that academics at later career stages are more likely to be engaged in this area (Perkmann et al. 2013; 2021), which might imply that the third mission is less firmly included in the identities of academics at an earlier career stage (see also Jain, George, and Maltarich 2009). Second, extant research has revealed pronounced differences in third mission engagement by gender (Perkmann et al. 2013; 2021; Freel, Persaud, and Chamberlin 2019), which may extend to academic identities as well.

2.3 Influence on Behavior

In addition to providing insights into the state of the academic profession, academic identities are of interest due to their association with academics' behavior. Studies on several parts of the third mission have shown that the values academics adhere to and their attitudes interrelate systematically with their engagement (see, for instance, Lam 2010 and Renault 2006 for entrepreneurial activities; D'Este and Perkmann 2011 for an engagement more broadly). Furthermore, it has been observed that the degree to which third mission activities are considered complementary to other academic activities differs (Perkmann et al. 2013). Thus, we follow up on the extent to which differences in academics' identities are mirrored in their patterns of third mission engagement.

3 Data Collection and Main Variables

3.1 Data Collection

Our empirical analysis is based on the results of an online survey of professors in Germany that we conducted in October and November 2020. The survey covered respondents' perspectives on and engagement in the third mission (Figure A.1 provides an overview of the structure and content of the survey; Appendix B presents details of the survey design). The target population consisted of all professors at German higher education institutions governed by the state (excluding those that cater exclusively to civil servants) or religious institutions. We identified the individuals belonging to the target population and manually compiled their contact details based on two sources: first, the online version of a regularly updated register of professors at universities and some art and music colleges (DHV 2019) and, second, the institutions' websites for professors at institutions not covered by the register. Out of an adjusted gross sample of 42,085 professors identified in this way, the survey yielded 4,726 valid responses. This amounts to a net response rate of 11.2 percent, which is similar to that of two other nationwide scientific surveys of professors in Germany at similar points in time, which obtained response rates of 10.0 percent (Neufeld and Johann 2018) and 12.4 percent (Ambrasat, Heger, and Rucker 2020), respectively. For the purpose of this paper, we restricted the sample to 4,284 professors by excluding all 258 professors working at colleges of art and music due to their specific profiles and by excluding 184 observations with insufficient data quality. We complemented the survey data with information on respondents' higher education institutions based on data from the Federal Statistical Office of Germany (see Appendix B for details).

3.2 Main Variables

We include three main sets of variables in the analysis. Figure 1 provides an overview of all variables, including details of their format, and Appendix Table A.1 presents descriptive statistics.

Each of the three identity facets is covered by a set of variables from the survey to capture the complexity of academics' identities and the third mission (Appendix Figure A.2 presents the exact wording of the survey questions underlying the variables, and Appendix Table A.2 shows detailed descriptive statistics). Four variables cover professors' value orientations in the form of their opinion on the following: the role that higher education should assume within society; the compatibility of sociopolitical engagement with the job of a professor; the need for a strict separation between science and the economy; and the reconcilability of the job of a professor with striving for a high personal income. Three variables cover professors' attitudes in the form of the relevance they ascribe to knowledge and technology transfer, continuing education, and societal engagement. We further include the same assessment of the activities

of basic research, applied research and teaching for a more detailed characterization of the professors in our sample. Eight variables cover the perceptions that professors have of work- and career-related benefits of third mission engagement, such as the interesting challenges that engagement might provide, stimuli for research and teaching activities, improved career prospects, and the generation of personal income.

The potential influences on academic identities are included in the analysis via four sets of variables from either the survey or based on secondary data. One variable covers respondents' disciplinary affiliation. Three variables cover the organizational context in the form of the legal institutional type and the amount of third-party funding for research and teaching acquired by the institution from two sources, which indicate a greater openness toward the third mission and a stronger orientation toward basic research, respectively. The first source is private and public companies, religious institutions and other institutions such as registered associations, and the second source is the *German Research Foundation* (DFG), the main funding body for basic research in Germany. One variable comprises respondents' age group to cover the cohort to which professors belong. With regard to individual characteristics, one variable indicates professors' gender, and one variable indicates whether their first appointment as a professor was less than six years prior to the time of the survey.

The third mission engagement of professors is covered by several variables for each of the three areas of the third mission, that is, knowledge and technology transfer, continuing education, and societal engagement. Each variable indicates whether professors have been or are currently engaged in the activities in question. We further include five variables covering characteristics of respondents and their institutions as control variables when investigating the association between professors' academic identities and their third mission engagement. In the case of the professors, we include a variable indicating whether respondents hold a full professorship (i.e., a professorship at salary grade C4/W3) and the variable of professors' disciplinary affiliation. For the institutions, we include the variable indicating the legal institutional type, a variable for the institutional size, and a variable indicating whether an institution is located in a large city.

3.3 Sample Composition

The sample of our survey comprehensively covers the German higher education system, but there are some differences in distribution between the sample and the population (see Appendix B for details). Overall, the sample has broad coverage of the German higher education system, including professors from the full range of academic disciplines and more than 200 institutions. The most pronounced difference when comparing the sample to the population is the overrepresentation of professors at universities of applied sciences in our sample and the underrepresentation of professors at universities. In addition, assistant

professors are underrepresented, whereas associate professors are overrepresented, and there is an underrepresentation of professors from the fields of medicine and health sciences, nutrition science, sport science, agronomy and forestry. A certain extent of self-selection into the survey based on professors' stance on engagement with the extra-academic environment cannot be ruled out (see Appendix B).

4 Empirical Results

4.1 Types of Identities

Descriptive statistics for the three identity facets show openness toward the third mission by many, but not all, professors in our sample (see Figures 2.1 to 2.3 and Appendix Table A.2). Most respondents exhibit value orientations that ascribe the responsibility of higher education to contribute to societal development, but quite a few are reserved in regard to relations with the private sector and seeking personal monetary benefits (see Figure 2.1). A general openness toward the third mission is evident in respondents' attitudes as well (see Figure 2.2). The majority of professors attach great importance to knowledge and technology transfer and societal engagement, even though research and teaching are still considered more important. Professors, furthermore, see certain benefits of third mission engagement and synergies with other parts of their work, in particular, the interesting challenges related to engaging and new input for research and teaching (see Figure 2.3). They are, however, skeptical in regard to benefits for career advancement and personal income generation.

< Figure 2.1 to 2.3 >

Beyond these general tendencies, there is some variation within the sample, which we analyze via cluster analysis. The mostly positive and significant correlations among the variables covering academic identities (see Appendix Table A.3) suggest that they can be analyzed together to investigate the academic identities of professors as a whole. However, the weak to moderate strength of correlations indicates that there might be patterns in the data that are not immediately visible. We use cluster analysis to derive patterns of similarity and difference among respondents' academic identities inductively from the data with the aim of identifying distinct identity types. Specifically, we use a partitional cluster analysis with the k-means algorithm after having determined the number of clusters and the starting points for the algorithm via agglomerative hierarchical cluster analysis (see Appendix C for details).

We differentiate between four groups of professors based on the results of our cluster analysis. The group means for the variables used for the cluster analysis differ from each other markedly and at a statistically significant level in almost all cases (see Table 1; see also Figure 3.1 and Figure 3.2), which confirms that the professors in the four groups exhibit distinct forms of third mission integration with their academic identities. Furthermore, the four clusters are of

a broadly similar size; that is, the different types of identities are quite equally distributed in our sample.

< Table 1, Figure 3.1 and Figure 3.2 >

Two of the four identity types identified mark the extremes of a spectrum of academic identities. The first type, which we label the *dedicated* type, is exhibited by 1,115 professors in our sample, in whose academic identities the third mission is firmly included. These professors show a degree of commitment to and positive assessment of the third mission that is high both in absolute terms and in relation to the other groups across all three identity facets considered. This difference is particularly pronounced for the appreciation of the intellectual challenges and joy associated with engaging and the related reputational and career benefits. Beyond the third mission, professors in this group ascribe a comparatively high importance to applied research and, to a lesser extent, teaching.

The identity type at the other extreme, labeled the *reserved* type, is the opposite of the first identity type. The most distinctive features of this slightly smaller group of 789 professors are that they are more inclined to see a need for clear boundaries between science and the economy, that they ascribe a comparatively low importance to all three areas of the third mission as part of their job, and that they associate hardly any benefits with engagement. Furthermore, they ascribe the highest importance to basic research and the lowest importance to applied research compared with the other three groups.

One of the identity types between the two extremes stands out due to its emphasis on the responsibility of higher education vis-à-vis society, especially in the form of sociopolitical engagement. The 1,196 professors exhibiting this identity type, labeled the *idealistic* type, are somewhat reserved or outright skeptical with regard to some parts of the third mission. This concerns the ties between higher education and the private sector and, in particular, personal income generation via the third mission. In terms of the perception of the benefits of engaging, this identity type occupies the middle ground between the *dedicated* and the *reserved* types. In contrast to this overall more reserved stance on the third mission, the *idealistic* type features a strong commitment to the social responsibility of higher education. The professors in this group consider societal engagement to have a similar degree of importance as the *dedicated* type and see little conflict, if any, between sociopolitical engagement and being an academic. They also ascribe a comparatively high level of importance to basic research and teaching.

The fourth identity type is characterized by an overall weaker inclusion of the third mission combined with greater openness toward its material benefits. Compared with both the *dedicated* and *idealistic* types, the *pragmatic* identity type, exhibited by 1,184 professors in this group, generally features less commitment to the third mission in terms of the basic value orientations and the importance attached to engaging, although its commitment is higher than

that of professors with the *reserved* identity type. This does not apply to certain benefits of the third mission, however. Professors with the *pragmatic* type are the least concerned about value conflicts between the academic role and personal income generation and consider this a relevant benefit of engagement. They also consider synergies with research, especially access to resources for this purpose, and teaching relevant benefits but do not perceive major reputational and career benefits.

4.2 Potential Influencing Factors

None of the factors that were considered a potential influence on academic identities outright determines the identity type that professors exhibit. All identity types are represented in each category of the variables of academic discipline, organizational characteristics, cohort, gender and career stage to a nonnegligible degree (see Table 2). Nevertheless, differences in the distribution of the identity types across the categories indicate that there are systematic associations.

< Table 2 >

To analyze the associations between the identity types and the potential influences, we estimate a multinomial logit model. The dependent variable entails the four identity types, and the independent variables are the potential influences (see Section 3.2 and Figure 1 for details). We add an interaction term between the institutional type and third-party funding from companies and other organizations to account for differences in income structures among universities and universities of applied sciences.² The key advantage of the multinomial logit model is to identify the association between each of the potential influencing factors and the probability with which professors exhibit each of the four identity types in an integrated approach. We report marginal effects throughout the following discussion for ease of interpretation (Appendix Table A.4 reports exponentiated coefficients).

The disciplinary affiliation has a particularly strong association with the identity type that professors exhibit (see Table 3). The social sciences, which serve as the reference group in the analysis, have a similar profile as mathematics and the natural sciences, except for a higher probability of professors from the latter group of exhibiting a *reserved* identity type. Professors from the humanities and arts, by contrast, have a higher probability of exhibiting the *idealistic*

² Standard errors are cluster-robust at the level of the higher education institution as the specific conditions provided by the institutions at which professors are employed can be supposed to yield relevant influences not accounted for in our model. Information on the exact institution at which respondents are employed is not available for 420 of the 4,284 observations in our sample. Thus, we use additional information such as the state where respondents work to assign the 420 observations to synthetic institutions. As this procedure merely approximates true institutional affiliations, we estimate our main model separately for the subsample of observations for which information on the institution is available as a robustness check (see Appendix D). The results of the two estimations barely differ, which shows that the use of synthetic institutions does not distort the results of the main analysis.

identity type and a lower probability of exhibiting the *pragmatic* identity type. The three remaining groups of law and economics, medical sciences and others, and the engineering sciences have yet another profile. By and large, professors from these disciplines are more likely to exhibit a *dedicated* or a *pragmatic* identity type, whereas the opposite holds true for both the *idealistic* and *reserved* types.

< Table 3 >

Associations between the organizational context and professors' academic identities are less pronounced except for the basic difference between legal institutional types (see Table 3). Professors at universities of applied sciences are more likely to exhibit a *dedicated* identity type and less likely to exhibit a *reserved* one. Differences between institutions in line with their orientation as measured via the amount of third-party funding acquired are less pronounced. The amount of third-party funding from companies and similar organizations, which should generally indicate a greater openness toward the extra-academic environment, is merely positively associated with the probability of exhibiting a *dedicated* identity type at universities and a *reserved* identity type at universities of applied sciences. Furthermore, there are no clear associations between funding from the *German Research Foundation* (DFG), which should generally indicate a stronger orientation toward genuine scientific merit, and the identity types of professors at universities.

The cohort of professors and the career stage are only weakly associated with the identity types, but there are strong associations with professors' gender (see Table 3).³ Female professors have a markedly higher probability of exhibiting an *idealistic* identity type but a markedly lower probability of exhibiting a *pragmatic* identity type.

4.3 Association with Engagement

To gauge the relation between professors' identity types and engagement with the third mission, we estimate several linear probability models. Each of the models regresses a dummy variable indicating an engagement in a specific third mission activity on the identity type and a set of control variables (see Section 3.2 and Figure 1 for details). The control variables cover the characteristics of professors (gender, discipline and level of seniority) and of the institutions (legal type, size and whether they are located in one of the 20 largest German cities) at which they are employed. The estimated effects identify the change in the probability that professors engage in the third mission activity in question associated with exhibiting one of the four identity types, controlling for factors that might distort these associations.

³ The only two differences among cohorts are that, in reference to the cohort of those aged 45 to 54 years, professors in the youngest cohort have a higher probability of exhibiting a *pragmatic* and professors from the oldest cohort have a lower probability of exhibiting a *reserved* type. The associations between being at an early career stage and identity types are all weak and marginally significant, at most.

The estimated results reveal systematic and pronounced differences in engagement among professors in line with their identity type (see Table 4). In all but two cases, professors exhibiting the *reserved* type are less likely to engage in the third mission activities considered than the three other types of professors. These differences in the probability of engaging are substantial in many cases. For instance, professors exhibiting the *reserved* type are less than half as likely as the other professors to conduct contract research and to establish a company. The opposite more or less holds true for the *dedicated* type. Professors in this group are among those most likely to engage in all third mission activities considered, even though the probability of engaging is close to or even on par with that of other types in several cases. The *idealistic* and the *pragmatic* types are located between these two extremes, with a tendency toward greater engagement for the *idealistic*.

< Table 4 >

There are two notable exceptions to this pattern that point toward a differential impact of academics' identities on their engagement. First, the tendency toward a higher probability of engaging among the *idealistic* compared to the *pragmatic* type does not hold for activities that are entrepreneurial in nature. The two groups of professors do not differ with regard to contract research, consulting and company foundation activities. In regard to activities related to intellectual property rights, the *pragmatic* is even more likely to engage than the *idealistic* type, on par with the *dedicated* type. Second, the generally higher probability of engaging by the *dedicated* type does not hold for societal engagement activities.⁴ Instead, professors exhibiting the *idealistic* type tend to be more likely to be active in the context of voluntary engagement initiatives, participate in citizen science projects and provide service learning courses, even though this difference is statistically significant only for citizen science projects.

5 Discussion

Our empirical analysis reveals that many members of the academic profession accord high status to the third mission but that there is considerable heterogeneity. Approximately eight out of ten professors in our sample exhibit value orientations, attitudes and perceptions that, in one way or another, ascribe a nontrivial relevance to the third mission as part of their academic identities. Whereas this applies to the third mission across the board for one group of professors (*dedicated*), two groups exhibit identities that place a focus on specific aspects: a concern for sociopolitical matters combined with a critical stance on relations with the economy in the one case (*idealistic*) and an emphasis on work-related and personal material benefits in the other case (*pragmatic*). These two types of academic identities account for over a quarter

⁴ The small number of professors in our sample who were involved in social entrepreneurship implies a very low probability to engage among all four groups. We thus refrain from an interpretation of the statistical results and present them merely for illustrative purposes.

of our sample each, which suggests that they are more than rare exceptions, even if the potential for self-selection by professors with a more positive stance on the third mission into our survey is considered. Our consideration of the third mission as a whole, thus, reveals that its status within the academic profession has multiple dimensions. This contrasts with the one-dimensional continuum that studies on academics' norms and values focusing on selected parts of the third mission have been suspecting or observed (Olmos-Peña, Benneworth, and Castro-Martínez 2015; Jain, George, and Maltarich 2009; Lam 2010; 2011).

A noteworthy characteristic of the different forms of inclusion of the third mission in academics' identities is that they are spread throughout the academic profession. Whether it is academic disciplines, types of institutions or cohorts, each of these groups include professors with the four different identity types identified by us. For instance, professors dedicated to the third mission as a whole account for more than ten percent of professors in the humanities and arts, and almost one-quarter of engineering scientists exhibit an academic identity that is reserved regarding close engagement with the private sector.

Nevertheless, the contexts in which professors develop their identities still seem to affect their stance toward the third mission. Of the major influences on the identity formation process, the disciplinary communities to which academics belong appear to have the broadest impact. The associations between professors' academic disciplines and their identity types are strong and systematic, even though the aggregation of disciplines in our analysis confines our observations to rather general patterns. A firm inclusion of the third mission—in whichever form—is more common within disciplines that either are more applied in nature, such as the engineering sciences, or have well-established ties with specific sectors of the extra-academic environment, such as law and economics. Professors from these disciplines are, furthermore, more prone to exhibit identities that include the third mission comprehensively or emphasize its utility for resource acquisition. Academic identities emphasizing the sociopolitical dimension of the third mission are instead more common among disciplines with more varied relations with the extra-academic environment, that is, the social sciences, humanities and arts. In disciplines where such ties are weaker overall, such as mathematics and the natural sciences, reservations against the third mission are more widespread. Even though this conforms to the assumption that the disciplinary community is a crucial influence on academic identities, it remains an open question to what extent the associations we observe are a result of academics' later socialization and to what extent they are a result of predispositions that influence both academics' engagement and their initial choice of a discipline.

The broad relevance of the academic discipline makes the absence of evidence of a substantial impact of other factors even more striking. The organizational context of academics' work hardly matters for their identities in our analysis beyond the fundamental difference between universities and universities of applied sciences. There is no systematic

relationship between the orientation of institutions toward the third mission and the identity types that academics exhibit, which the selection processes by professors and higher education institutions alone would suggest (see also Owen-Smith and Powell 2001). A possible explanation for this is that the sway institutions have over academics, especially professors, is comparatively weak in Germany (Musselin 2009). Otherwise, the findings could attest to the stability of academics' fundamental convictions over time (see also Renault 2006). Evidence for an impact of the cohort to which academics belong is even weaker, and the associations we observe point in a direction opposite to what would be expected if the continuous increase in the third mission's salience were mirrored in academics' identities. It might be the case that recent influences on academic identities override differences resulting from prior socialization processes (see also Bercovitz and Feldman 2008). However, it might also be the case that the increase in the salience of the third mission, at least if considered in its entirety as in our investigation, is not as strong from the perspective of the academic profession as parts of current discussions focusing on the perturbances of academia through external demands would suggest.

The unexplained heterogeneity among professors further indicates that additional, individual characteristics are relevant factors behind academic identities. The strong association between academics' gender and identity type is particularly striking in this regard. This finding suggests that the gender differences in third mission engagement observed repeatedly (Perkmann et al. 2013; 2021; Freel, Persaud, and Chamberlin 2019) have deeper roots than the mere opportunity to engage. It appears, instead, that there are systematic differences in the fundamental stance on the third mission and its implications (see also Püttmann, Ruhose, and Thomsen 2021). The overall heterogeneity observed could also be interpreted as a corroboration of the assumption that academics are actively involved in shaping their identities (see Henkel 2000; 2012; Lam 2010; 2011) and might even engage in this strategically in the form of a conscious project (Henkel 2004; 2012).

Turning to the relevance that academic identities themselves have, we find strong evidence of their differential impact on academics' behavior. Academics whose identities include the third mission more firmly are generally more strongly engaged in the third mission, even when other determinants are considered. Furthermore, the patterns of engagement correspond to the specificities of academics' identities. This is clearly visible from entrepreneurial activities and societal engagement, where the associations between values and attitudes on the one side and the extent of engagement on the other side are pronounced. This implies that even reservations concerning parts of the third mission, such as exchange relations between science and the economic sector, do not necessarily entail overall lower levels of engagement. In contrast, concern for sociopolitical matters appears to be a strong driver of engagement among professors, even absent perceived reputational and career benefits. Even though the

strength of the associations observed suggests to us that it is academic identities that influence engagement, there is also the possibility that engagement, at least partly, shapes identities.

Three features of our investigation are worth noting with regard to the generalizability of the findings and point toward relevant avenues for further research. First, we use cross-sectional data, which limits the extent to which we can deal with matters of endogeneity. Data tracing academics' identity formation process over time would enable disentangling the influence of, for instance, disciplinary communities and organizational contexts from the self-selection of academics into these communities and contexts. It would furthermore enable a more detailed analysis of the relevance of the cohorts to which academics belong. Second, our study is confined to the situation in Germany. This has the advantage of a more homogenous sample but does not allow us to gauge the relevance of characteristics specific to national higher education systems. Research covering multiple national systems from a comparative perspective would be required to investigate the impact of national policies, organizational practices or local disciplinary traditions. This applies, similarly, to our focus on professors. The homogeneity of this group of academics and the latitude they have made it possible to observe the phenomena of interest in a very concise way. However, assuring the generalizability of findings such as those concerning the relevance of the organizational context would require covering academics at other career stages as well.

6 Conclusion

It appears that the third mission is a genuine aspect of at least parts of the academic profession. The firm inclusion of the third mission in value orientations and attitudes as core facets of academic identities demonstrates the high status that it is accorded by many academics. This is underscored by the differential translation of these identities into distinct patterns of engagement. Equally noteworthy is the visible diversity among academics in regard to different elements of the third mission. Both of these fundamental insights show the value of our approach of providing the, to the best of our knowledge, first comprehensive empirical assessment of the relevance of the third mission for academics that covers both the third mission and the academic profession in their full diversity. Both of the insights further yield more general implications for research in this area as well as reference points for higher education and science policy and management.

Certain tendencies of perspectives on the third mission still prevalent in current debates appear worth revisiting in light of our findings. The focus on the interrelations between higher education and science and the private sector, especially in the form of entrepreneurial activities, has led to a framing of the third mission in terms of external demands directed at academics and a foregrounding of tensions that academics experience related to engagement. As relevant as these two issues are, they merely constitute one side of the coin. There also

appears to be a dimension of the third mission that is deeply ingrained in the academic profession, be it in the form of interrelations with the private sector or, in particular, other parts of society. Paying greater attention to and further elucidating this dimension of the third mission could greatly enhance our understanding of the role that higher education and science are and could play within society. This seems all the more important, as this side of the third mission includes forms of engagement whose relevance for societal development and innovation processes has become increasingly apparent in recent times. Knowledge about the third mission could, furthermore, benefit from greater attentiveness to the diversity within the academic profession. Given the wide range of their contributions to societal development, grasping the impact that higher education and science have requires a consideration of the system as a whole, including the interplay of its different, heterogeneous parts. This includes a better understanding of the reasons behind academics' development of a specific stance on the third mission, which appears to be the result of a complex process involving the communities to which academics belong and their individual characteristics and agency.

The embeddedness of the third mission in parts of the academic profession and the related diversity among academics are worth considering by policy-makers as well as higher education and science managers. The fact that a nonnegligible share of academics consider the third mission a genuine part of their professional duties suggests that there is some potential available for efforts to promote interrelations between higher education and science and the extra-academic environment. To fully tap this potential, it appears key to devise policies and management instruments in a way that they tie in with the self-perceptions and related motives of academics and not counteract them. This seems particularly relevant with regard to the differences in emphasis that academics place on certain elements of the third mission. As our empirical findings show, academics have different reasons for engaging in the third mission, or for refraining from doing so. Hence, one-size-fits-all solutions for assessing the extent of and promoting academics' engagement appear likely to fall short. What appears more promising are sets of policies and management instruments that provide differential incentives and support.

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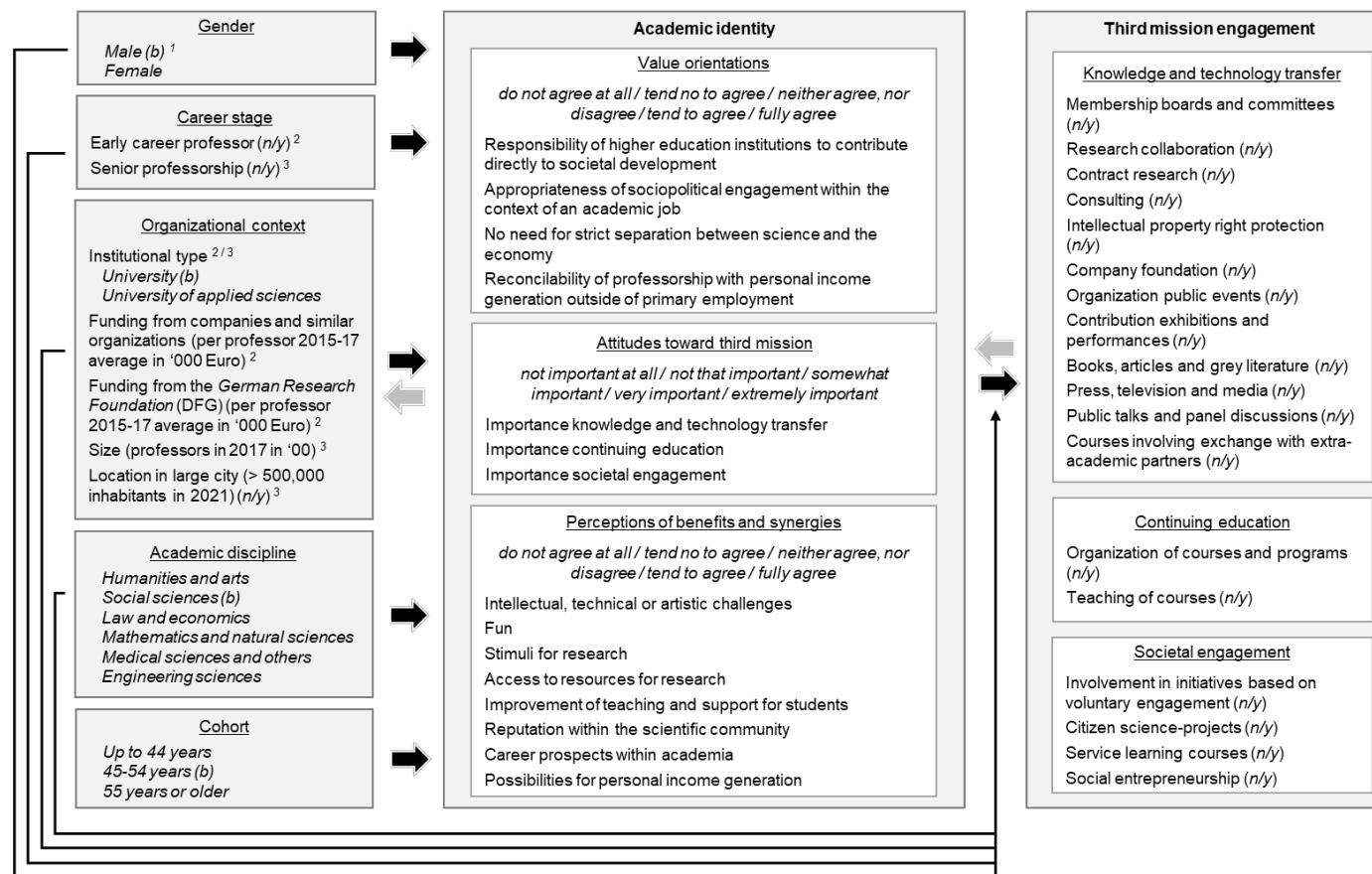
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Figures and Tables

Figures

Figure 1: Main associations of interest



Notes: The figure shows the potential associations between the characteristics of academics and their employment, their academic identity, and their third mission engagement. The thick black arrows indicate the main associations of interest that are in the focus of our analysis; the thin black arrows indicate potential associations that we control for in the analysis of the main associations; and the thick grey arrows indicate potential associations that are not in the focus of our analysis. Italics denote the categories of categorical variables, with the base category indicated by (b), and the points of response scales; (n/y) indicates a dummy variable with no = 0 and yes = 1. ¹ In addition to the categories of male and female, respondents could state that they are unable or unwilling to assign themselves to one of these two genders. As only 90 respondents chose this category, which does not allow for a meaningful analysis, such a selection was recoded as a missing value. ² Variables covering the career stage and organizational context included in the analysis of the associations between the characteristics of academics and their employment and their academic identity; ³ Variables covering the career stage and organizational context included in the analysis of the associations between academics' identities and their third mission engagement. The variable comprising the amount of funding from the German Research Foundation covers exclusively universities.

Figure 2.1: Overview on academics' value orientations: distribution of professors by response category for (in percent)

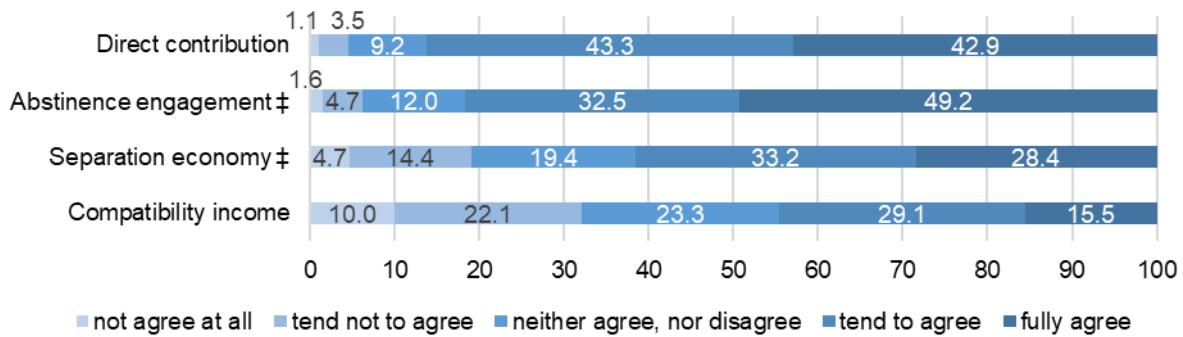


Figure 2.2: Overview on academics' attitudes: distribution of professors by response category for (in percent)

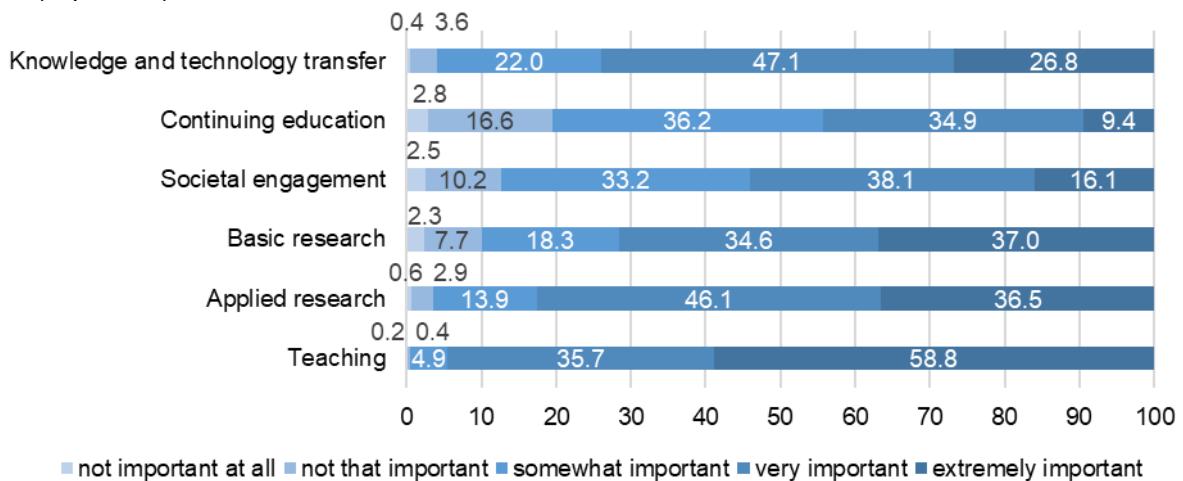
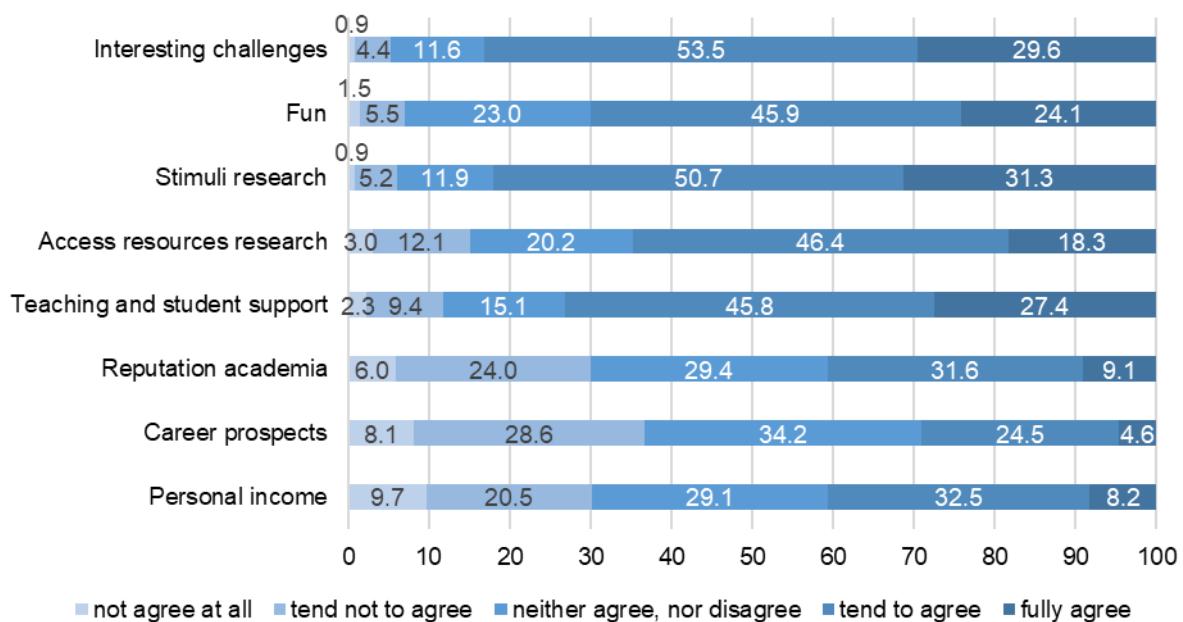


Figure 2.3: Overview on academics' perceptions: distribution of professors by response category for (in percent)



Notes: The figures show the share of professors in the respective response categories for the variables covering academic identities (see Section 3.2 and Figure 1 for details). Number of observations = 4,284, except for *basic research* = 4,258, *applied research* = 4,258, and *teaching* = 4,272. ‡ Variable is reverse coded.

Figure 3.1: Comparison of the four types of academic identities: Value orientations and attitudes

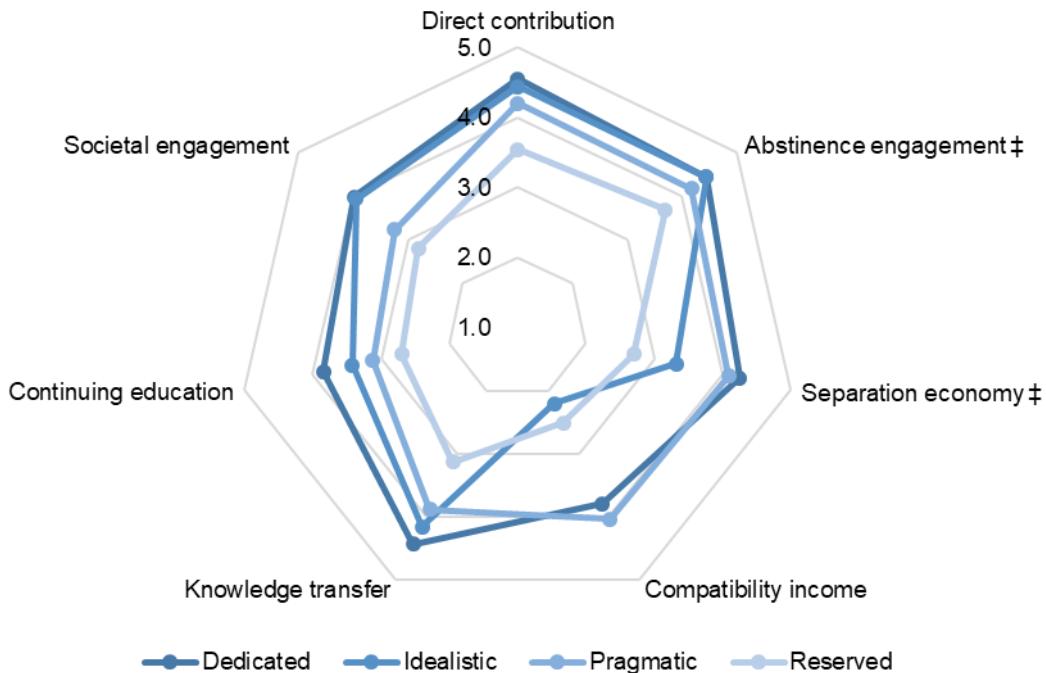
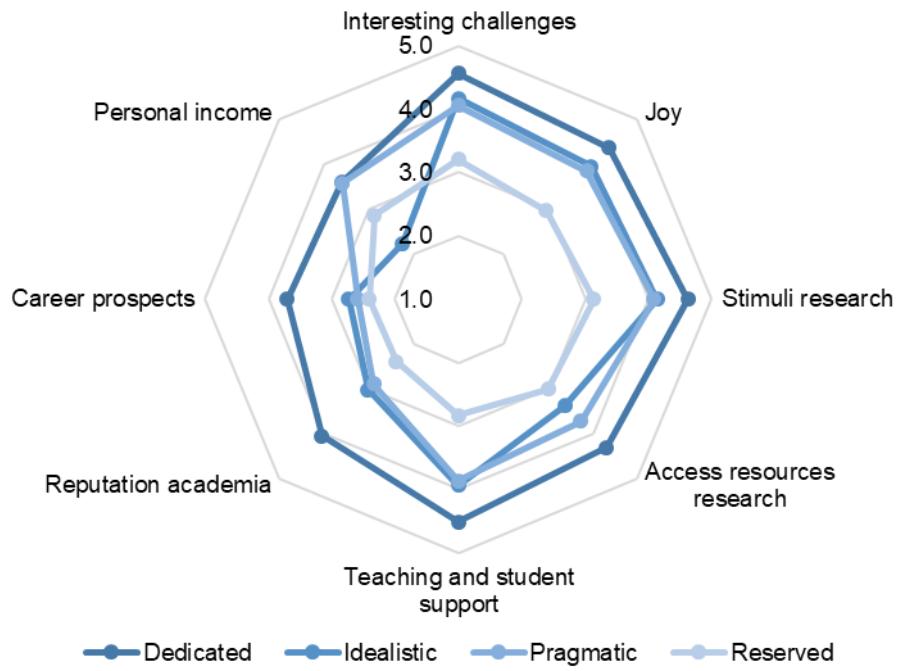


Figure 3.2: Comparison of the four types of academic identities: Perceptions



Notes: The figures show the means of the variables covering academic identities in the four groups of professors identified via a cluster analysis. ‡ Variable is reverse coded.

Tables

Table 1: Descriptive statistics for the four types of academic identities

	Identity type				Full sample
	Dedicated	Idealistic	Pragmatic	Reserved	
	(1)	(2)	(3)	(4)	(5)
Value orientations					
Direct contribution	4.55	4.43	4.20	3.54	4.23
Abstinence engagement ‡	4.44 ⁽²⁾	4.44 ⁽¹⁾	4.17	3.69	4.23
Separation economy ‡	4.25	3.32	4.09	2.70	3.66
Compatibility income	3.79	2.21	4.04	2.51	3.18
Attitudes					
Knowledge transfer	4.43	4.15	3.88	3.13	3.96
Continuing education	3.84	3.42	3.12	2.70	3.31
Societal engagement	3.98 ⁽²⁾	3.94 ⁽¹⁾	3.24	2.81	3.55
Basic research	3.79 ⁽³⁾	3.99	3.86 ⁽¹⁾	4.32	3.96
Applied research	4.46	4.20 ⁽³⁾	4.15 ⁽²⁾	3.63	4.15
Teaching	4.65 ⁽²⁾	4.60 ⁽¹⁾	4.48	4.32	4.53
Perceptions					
Interesting challenges	4.56	4.17	4.06	3.21	4.07
Joy	4.37	3.96	3.86	2.97	3.86
Stimuli research	4.62	4.14 ⁽³⁾	4.09 ⁽²⁾	3.13	4.06
Access resources research	4.30	3.38	3.73	3.00	3.65
Teaching and student support	4.52	3.94 ⁽³⁾	3.86 ⁽²⁾	2.83	3.87
Reputation academia	4.05	3.02	2.89	2.40	3.14
Career prospects	3.71	2.73	2.59	2.41	2.89
Personal income	3.61 ⁽³⁾	2.25	3.59 ⁽¹⁾	2.88	3.09
Observations	1,115	1,196	1,184	789	4,284

Notes: The table shows the means of the variables covering academic identities in the four groups of professors identified via a cluster analysis (columns 1 to 4) and in the full sample (column 5). The superscript numbers indicate that the respective group does not differ from the group referred to in the superscript in a statistically significant way at the 5 percent-level according to Scheffé multiple-comparison tests following a one-way analysis of variance. The means for the variables not included in the cluster analysis include observations for which missing values were imputed with the sample median: basic research = 26, applied research = 26, and teaching = 12. ‡ Variable is reverse coded.

Table 2: Distribution of identity types within selected groups of professors

	Identity type				Observations
	Dedicated	Idealistic	Pragmatic	Reserved	
	%	%	%	%	
	(1)	(2)	(3)	(4)	(5)
Discipline					
Group of disciplines					
<i>Humanities and arts</i>	13.0	41.3	17.2	28.5	576
<i>Social sciences</i>	18.5	38.0	21.7	21.9	585
<i>Law and economics</i>	34.0	16.6	37.2	12.1	709
<i>Mathematics and natural sciences</i>	15.8	28.0	25.0	31.2	651
<i>Medical sciences and others</i>	29.2	29.5	25.3	15.9	383
<i>Engineering science</i>	34.7	23.2	31.5	10.5	1,357
Organizational context					
Institutional type					
<i>University</i>	17.0	28.5	26.2	28.3	1,956
<i>University of applied sciences</i>	34.1	27.2	29.2	9.6	2,173
Income companies and others per professor (in '00,000 euro)					
<i>Universities</i>					
<i>Median or below</i>	15.1	30.8	24.7	29.3	918
<i>Above median</i>	19.3	26.2	28.3	26.3	906
<i>Universities of applied sciences</i>					
<i>Median or below</i>	32.4	29.8	29.5	8.3	1,010
<i>Above median</i>	36.3	24.7	29.1	10.0	1,001
Income DFG per university professor (in '00,000 euro)					
<i>Universities</i>					
<i>Median or below</i>	16.8	27.5	25.0	30.7	923
<i>Above median</i>	17.7	29.5	28.0	24.9	901
<i>Universities of applied sciences</i>	-	-	-	-	2,011
Cohort					
Age group					
< 45 years	24.5	24.4	31.6	19.6	706
45-54 years	25.9	28.5	26.2	19.5	1,589
> 54 years	27.1	28.9	27.3	16.8	1,881
Individual characteristics					
Gender					
<i>Male</i>	27.3	24.1	31.2	17.4	3,074
<i>Female</i>	23.7	38.2	18.0	20.2	1,069
Early career professor					
No	25.4	28.2	27.9	18.6	3,388
Yes	28.7	27.1	26.6	17.7	883
Full sample	26.0	27.9	27.6	18.4	4,284

Notes: The table shows the shares of the four identity types by the variables covering the discipline, the organizational context, the cohort to which academics belong and individual characteristics and within the full sample (columns 1 to 4), and the number of observations in each subgroup (column 5).

Table 3: Potential influences on academic identities

	Identity type			
	Dedicated	Idealistic	Pragmatic	Reserved
	(1)	(2)	(3)	(4)
Discipline				
Group of disciplines				
<i>Humanities and arts</i>	-0.027 (0.023)	0.060 ** (0.028)	-0.055 ** (0.027)	0.022 (0.022)
[Social sciences]	[0.190]	[0.353]	[0.244]	[0.213]
<i>Law and economics</i>	0.136 *** (0.023)	-0.186 *** (0.023)	0.129 *** (0.025)	-0.079 *** (0.022)
<i>Mathematics and natural sciences</i>	-0.004 (0.022)	-0.050 * (0.028)	-0.001 (0.028)	0.056 ** (0.022)
<i>Medical sciences and others</i>	0.128 *** (0.031)	-0.066 * (0.036)	0.014 (0.029)	-0.076 *** (0.023)
<i>Engineering science</i>	0.121 *** (0.020)	-0.107 *** (0.024)	0.063 *** (0.023)	-0.078 *** (0.020)
Organizational context				
Institutional type				
[University]	[0.188]	[0.268]	[0.269]	[0.274]
<i>University of applied sciences</i>	0.128 *** (0.025)	0.016 (0.029)	0.012 (0.025)	-0.155 *** (0.021)
Income companies and others per professor (in '00,000)				
<i>At universities</i>	0.067 *** (0.016)	-0.022 (0.026)	-0.006 (0.025)	-0.038 (0.030)
<i>At universities of applied sciences</i>	0.063 (0.080)	-0.115 (0.140)	-0.045 (0.089)	0.097 ** (0.048)
Income DFG per university professor (in '00,000)				
<i>At universities</i>	-0.015 (0.016)	0.009 (0.022)	0.034 * (0.020)	-0.028 (0.021)
<i>At universities of applied sciences</i>	-	-	-	-
Cohort				
Age group				
<i>< 45 years</i>	-0.028 (0.019)	-0.038 * (0.021)	0.067 *** (0.023)	-0.001 (0.020)
[45-54 years]	[0.255]	[0.282]	[0.265]	[0.198]
<i>> 54 years</i>	0.024 (0.015)	0.007 (0.015)	0.001 (0.015)	-0.031 ** (0.014)

(continued on next page)

Table 3 (continued)

Identity type

	<i>Dedicated</i>	<i>Idealistic</i>	<i>Pragmatic</i>	<i>Reserved</i>
	(1)	(2)	(3)	(4)
Individual characteristics				
Gender				
[Male]	[0.261]	[0.250]	[0.305]	[0.183]
Female	-0.002 (0.016)	0.114 *** (0.019)	-0.117 *** (0.014)	0.005 (0.015)
Early career professor				
[No]	[0.254]	[0.280]	[0.283]	[0.183]
Yes	0.029 (0.018)	-0.005 (0.020)	-0.031 * (0.017)	0.007 (0.016)

Notes: The table shows the average marginal effects at observed values in the sample and standard errors (cluster-robust at the level of the higher education institution) for the variables covering the discipline, the organizational context, the cohort to which academics belong and individual characteristics (for details see Section 3.2 and Figure 1) estimated following a multinomial logit model regressing the variable containing the four identity types on the variables listed and an interaction term between the variable containing the institutional type and the variable containing the institutional third party income from companies and similar organizations (as we consider funding from the *German Science Foundation* exclusively for universities, no interaction term is required in this case). As the marginal effects of the continuous variables covering the third party income of institutions hardly differ among representative values, we only report their marginal effects at values observed in the sample. For the reference groups of the categorical variables indicated by square brackets, the table shows predictive margins. The coefficients represent the change in the probability of belonging to each of the four identity types deriving from a change of the value of the covariate in question. “others” includes pharmacy, health sciences, nutrition science, sport science, agronomy and forestry. Significance level: * p < 0.1, ** p < 0.05, *** p < 0.01.

Table 4: Relation between academic identities and engagement in third mission activities

Panel A	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Knowledge and technology transfer									
	Boards and committees	Research collaboration	Contract research	Consulting	Activity intellectual property rights	Activity company foundation	Science communication books and grey literature	Science communication media	Science communication talks and discussions
Dedicated	0.069 *** ¹ (0.020)	0.101 *** (0.019)	0.087 *** (0.021)	0.092 *** (0.020)	0.017 (0.014)	0.064 *** (0.017)	0.063 *** ¹ (0.020)	0.079 *** ¹ (0.021)	0.072 *** ¹ (0.018)
Idealistic	0.054 *** ¹ (0.020)	0.051 ** (0.020)	-0.023 (0.021)	-0.008 (0.021)	-0.043 *** ¹ (0.013)	-0.012 (0.015)	0.031 ¹ (0.020)	0.053 ** ¹ (0.021)	0.066 *** ¹ (0.018)
[Pragmatic]	[0.578]	[0.614]	[0.438]	[0.580]	[0.132]	[0.152]	[0.604]	[0.458]	[0.710]
Reserved	-0.133 *** (0.023)	-0.190 *** (0.023)	-0.206 *** (0.022)	-0.222 *** (0.023)	-0.048 *** ¹ (0.015)	-0.079 *** (0.015)	-0.160 *** (0.023)	-0.125 *** (0.023)	-0.124 *** (0.022)
Constant	0.650 *** (0.034)	0.654 *** (0.034)	0.517 *** (0.034)	0.665 *** (0.035)	0.085 *** (0.019)	0.116 *** (0.024)	0.780 *** (0.033)	0.618 *** (0.035)	0.846 *** (0.030)
Controls	x	x	x	x	x	x	x	x	x
Observations	4,257	4,159	4,063	4,073	4,073	3,988	4,230	4,205	4,239
R-squared	0.070	0.087	0.117	0.084	0.121	0.063	0.087	0.065	0.076

(continued on next page)

Table 4 (continued)

Panel B	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	<u>Knowledge and technology transfer</u>			<u>Continuing education</u>			<u>Societal engagement</u>		
	Organization events	Contribution exhibitions and performances	Teaching formats external cooperation	Organization continuing education	Teaching continuing education	Voluntary engagement	Citizen science	Service learning	Social entrepreneurship
Dedicated	0.132 *** (0.021)	0.115 *** ¹ (0.020)	0.103 *** ¹ (0.019)	0.107 *** (0.021)	0.075 *** (0.020)	0.159 *** ¹ (0.021)	0.056 *** (0.014)	0.095 *** ¹ (0.015)	0.015 ** ¹ (0.007)
Idealistic	0.072 *** (0.021)	0.095 *** ¹ (0.020)	0.068 *** ¹ (0.020)	-0.002 (0.020)	0.045 ** (0.020)	0.162 *** ¹ (0.021)	0.098 *** (0.015)	0.117 *** ¹ (0.016)	0.006 ^{1/2} (0.006)
[Pragmatic]	[0.455]	[0.374]	[0.600]	[0.378]	[0.655]	[0.389]	[0.115]	[0.119]	[0.014]
Reserved	-0.161 *** (0.023)	-0.059 *** (0.022)	-0.144 *** (0.023)	-0.098 *** (0.022)	-0.082 *** (0.023)	-0.092 *** (0.022)	-0.044 *** (0.014)	-0.041 *** (0.014)	-0.002 ² (0.006)
Constant	0.539 *** (0.035)	0.316 *** (0.034)	0.627 *** (0.033)	0.466 *** (0.035)	0.753 *** (0.033)	0.468 *** (0.035)	0.171 *** (0.026)	0.174 *** (0.029)	0.018 (0.011)
Controls	x	x	x	x	x	x	x	x	x
Observations	4,256	4,247	4,232	4,251	4,227	4,227	4,222	4,217	3,908
R-squared	0.060	0.065	0.118	0.031	0.028	0.074	0.050	0.077	0.013

Notes: The table shows the coefficients and standard errors (cluster-robust at the level of the higher education institution) estimated from linear probability models regressing the dummy variable indicating whether a professor engaged in the activity in question or not on the variable containing the four identity types and a set of control variables (see Section 3.2, Figure 1 and Section 4.3 for details) and summary statistics for the models estimated. For the reference group of the *pragmatic* identity type, the table shows predictive margins. The coefficients represent the change in the probability of engaging in the activity in question deriving from exhibiting a specific identity type in relation to the *pragmatic* identity type. ^{1/2} Superscript numbers indicate that the coefficients of the respective categories do not differ significantly at the 5 percent-level according to a Wald test for the equality of coefficients. The differences in the number of observations included in the estimations are due to missing values for the dependent variables. Significance level: * p < 0.1, ** p < 0.05, *** p < 0.01.

Online Appendix for

The Third Mission in the Academic Profession:

Empirical Insights into Academic Identities

by Vitus Püttmann and Stephan L. Thomsen

This version: May 5, 2022

Not for publication.

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A. Figures and Tables

Figures

Figure A.1: Structure and content of the survey



Notes: The figure shows the structure and content of the survey, including the number of questions. The number of questions stated includes filtered questions that were shown to a subset of respondents only; some of the questions include multiple items.

Figure A.2: Wording of the questions underlying the variables covering academic identities

To which extent do you agree with the following statements?

*do not agree at all tend no to agree neither agree, nor
disagree tend to agree fully agree*

Higher education institutions should contribute directly to societal, economic and cultural development.

Academics should refrain from sociopolitical engagement within the context of their work at a higher education institution.

Science and the economy should be strictly separated.

Striving for a higher personal income via activities outside of the primary employment is reconcilable with the job of a professor.

Sources: Abreu et al. 2009; Lam 2011.

How important are the following activities within the context of a professorship from your personal perspective?

*not important at all not that important somewhat
important very important extremely
important*

Basic research

Applied / artistic research

Teaching

Knowledge and technology transfer in the direction of society and the economy

Organization and teaching in the area of continuing education

Societal engagement

Sources: -----

If you consider – independent from your actual engagement in this area – exchange relations with society and the economy: To which extent do you agree with the following statements on their implications for the job of a professor?

Activities in this area ...

*do not agree at all tend no to agree neither agree, nor
disagree tend to agree fully agree*

... pose interesting intellectual, technical or artistic challenges.

... are fun.

... yield valuable stimuli for research.

... provide access to funding, equipment, data or materials required for research.

... allow to improve teaching and support for students.

... increase reputation within the scientific community.

... improve career prospects within academia.

... provide possibilities for generating personal income.

Sources: Abreu et al. 2009; D'Este and Perkmann 2011; Göktepe-Hulten and Mahagaonkar 2010; Lam 2011; Lee 2000; Meyer-Krahmer and Schmoch 1998; Olaya Escobar et al. 2017; Orazbayeva et al. 2020.

Notes: The figure shows the wording of the questions underlying the variables covering academic identities (translated from the original German version by the authors) and, where applicable, prior empirical investigations that informed the design of the questions.

Tables

Table A.1: Descriptive statistics for the main variables

	(1)	(2)	(3)	(4)	(5)
	Mean	Standard deviation	Minimum	Maximum	Observations
Academic identities					
<u>Value orientations</u>					
Direct contribution	4.23	0.84	1	5	4,284
Abstinence engagement [‡]	4.23	0.94	1	5	4,284
Separation economy [‡]	3.66	1.17	1	5	4,284
Compatibility income	3.18	1.23	1	5	4,284
<u>Attitudes</u>					
Knowledge and technology transfer	3.96	0.82	1	5	4,284
Continuing education	3.31	0.95	1	5	4,284
Societal engagement	3.55	0.96	1	5	4,284
Basic research	3.96	1.03	1	5	4,284
Applied research	4.15	0.81	1	5	4,284
Teaching	4.53	0.62	1	5	4,284
<u>Perceptions</u>					
Interesting challenges	4.06	0.81	1	5	4,284
Fun	3.86	0.90	1	5	4,284
Stimuli research	4.06	0.85	1	5	4,284
Access resources research	3.65	1.01	1	5	4,284
Teaching and student support	3.87	1.00	1	5	4,284
Reputation academia	3.14	1.07	1	5	4,284
Career prospects	2.89	1.01	1	5	4,284
Personal income	3.09	1.11	1	5	4,284

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Table A.1 (continued)

	(1)	(2)	(3)	(4)	(5)
	Mean	Standard deviation	Minimum	Maximum	Observations
Influences identities					
<u>Discipline</u>					
Group of disciplines					4,261
<i>Humanities and arts</i>	0.14	-	0	1	
<i>Social sciences</i>	0.14	-	0	1	
<i>Law and economics</i>	0.17	-	0	1	
<i>Mathematics and natural sciences</i>	0.15	-	0	1	
<i>Medical sciences and others</i>	0.09	-	0	1	
<i>Engineering science</i>	0.32	-	0	1	
<u>Organizational context</u>					
Institutional type					4,129
<i>University</i>	0.47	-	0	1	
<i>University of applied sciences</i>	0.53	-	0	1	
Income companies and others per professor (in '00,000 euro)	0.23	0.33	0.00	2.00	3,835
Income DFG per university professor (in '00,000 euro)	0.46	0.60	0.00	2.13	3,835
<u>Cohort</u>					
Age group					4,176
< 45 years	0.17	-	0	1	
45-54 years	0.38	-	0	1	
> 54 years	0.45	-	0	1	
<u>Individual characteristics</u>					
Gender					4,143
<i>Male</i>	0.74	-	0	1	
<i>Female</i>	0.26	-	0	1	
Early career professor					4,271
No	0.79	-	0	1	
Yes	0.21	-	0	1	

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Table A.1 (continued)

	(1)	(2)	(3)	(4)	(5)
	Mean	Standard deviation	Minimum	Maximum	Observations
Third mission activities					
<u>Knowledge and technology transfer</u>					
Boards and committees	0.59	-	0	1	4,257
Research collaboration	0.62	-	0	1	4,159
Contract research	0.42	-	0	1	4,063
Consulting	0.56	-	0	1	4,073
Activity intellectual property rights	0.12	-	0	1	4,073
Activity company foundation	0.14	-	0	1	4,200
Science communication books and grey literature	0.60	-	0	1	4,230
Science communication media	0.47	-	0	1	4,205
Science communication talks and discussions	0.72	-	0	1	4,239
Organization events	0.48	-	0	1	4,256
Contribution exhibitions and performances	0.42	-	0	1	4,247
Teaching formats external cooperation	0.62	-	0	1	4,232
<u>Continuing education</u>					
Organization continuing education	0.39	-	0	1	4,251
Teaching continuing education	0.67	-	0	1	4,227
<u>Societal engagement</u>					
Voluntary engagement	0.46	-	0	1	4,227
Citizen science	0.15	-	0	1	4,222
Service learning	0.17	-	0	1	4,217
Social entrepreneurship	0.02	-	0	1	3,908
Control variables engagement					
Full professorship					4,238
No	0.67	-	0	1	
Yes	0.33	-	0	1	
Number professors institution 2017	278.78	171.68	0	730	
Large city					3,864
No	0.69	-	0	1	
Yes	0.31	-	0	1	

Notes: The table shows the mean, the standard deviation (where applicable), the minimum and maximum value, and the number of observations for which data are available for the main variables included in the analysis (see Section 3.2, Figure 1 and Appendix B for details) for the full sample. † Variable is reverse coded. “others” includes pharmacy, health sciences, nutrition science, sport science, agronomy and forestry.

Table A.2: Detailed descriptive statistics for the variables covering academic identities

	(1)	(2)	(3)	(4)	(5)
	%	%	%	%	%
	<i>not agree at all</i>	<i>tend not to agree</i>	<i>neither agree, nor disagree</i>	<i>tend to agree</i>	<i>fully agree</i>
Value orientations					
Direct contribution	1.1	3.5	9.2	43.3	42.9
Abstinence engagement [‡]	1.6	4.7	12.0	32.5	49.2
Separation economy [‡]	4.7	14.4	19.4	33.2	28.4
Compatibility income	10.0	22.1	23.3	29.1	15.5
	<i>not important at all</i>	<i>not that important</i>	<i>somewhat important</i>	<i>very important</i>	<i>extremely important</i>
Attitudes					
Knowledge and technology transfer	0.4	3.6	22.0	47.1	26.8
Continuing education	2.8	16.6	36.2	34.9	9.4
Societal engagement	2.5	10.2	33.2	38.1	16.1
Basic research	2.3	7.7	18.3	34.6	37.0
Applied research	0.6	2.9	13.9	46.1	36.5
Teaching	0.2	0.4	4.9	35.7	58.8
	<i>not agree at all</i>	<i>tend not to agree</i>	<i>neither agree, nor disagree</i>	<i>tend to agree</i>	<i>fully agree</i>
Convictions					
Interesting challenges	0.9	4.4	11.6	53.5	29.6
Fun	1.5	5.5	23.0	45.9	24.1
Stimuli research	0.9	5.2	11.9	50.7	31.3
Access resources research	3.0	12.1	20.2	46.4	18.3
Teaching and student support	2.3	9.4	15.1	45.8	27.4
Reputation academia	6.0	24.0	29.4	31.6	9.1
Career prospects	8.1	28.6	34.2	24.5	4.6
Personal income	9.7	20.5	29.1	32.5	8.2

Notes: The table shows the share of professors in the respective response category for the variables covering academic identities (see Section 3.2 and Figure 1 for details). Number of observations = 4,284, except for *basic research* = 4,258, *applied research* = 4,258, and *teaching* = 4,272. [‡] Variable is reverse coded.

Table A.3: Correlations between the variables covering academic identities

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Value orientations		Value orientations				Attitudes				Perceptions						
		Direct contribution		Abstinence engagement [#]		Separation economy [#]		Compatibility income		Knowledge transfer		Continuing education		Societal engagement		
		1.000														
Attitudes		0.323	1.000													
		0.187	0.148	1.000												
		0.116	0.066	0.304	1.000											
Perceptions		Knowledge transfer	0.336	0.202	0.213	0.142	1.000									
		Continuing education	0.203	0.104	0.120	0.088	0.419	1.000								
		Societal engagement	0.346	0.361	0.040	0.016	0.469	0.422	1.000							
		Interesting challenges	0.277	0.196	0.243	0.181	0.331	0.172	0.243	1.000						
		Fun	0.269	0.176	0.245	0.201	0.364	0.178	0.256	0.506	1.000					
		Stimuli research	0.268	0.152	0.269	0.169	0.357	0.199	0.224	0.515	0.439	1.000				
		Access resources research	0.144	0.044	0.212	0.181	0.182	0.136	0.058	0.225	0.147	0.336	1.000			
		Teaching and student support	0.236	0.124	0.248	0.179	0.324	0.193	0.204	0.379	0.412	0.470	0.275	1.000		
		Reputation academia	0.156	0.053	0.177	0.154	0.205	0.193	0.148	0.271	0.251	0.308	0.285	0.270	1.000	
		Career prospects	0.089	0.023	0.101	0.106	0.121	0.179	0.114	0.193	0.129	0.233	0.357	0.195	0.536	1.000
		Personal income	0.019	-0.025	0.127	0.360	0.022	0.050	-0.067	0.097	0.092	0.126	0.275	0.114	0.153	0.207

Notes: The table shows the Pearson's correlation coefficients for all combinations of the variables covering academic identities (see Section 3.2 and Figure 1 for details). All correlations are significant at the 5 percent-level except for: direct contribution x personal income; abstinence engagement x career prospects; abstinence engagement x personal income; compatibility income x societal engagement; and knowledge transfer x personal income. Number of observations = 4,284. [#] Variable is reverse coded.

Table A.4: Potential influences on academic identities – exponentiated coefficients

	Identity type			
	Dedicated	Idealistic	Pragmatic	Reserved
	(1)	(2)	(3)	(4)
Discipline				
Group of disciplines				
<i>Humanities and arts</i>	-	1.374 * (0.244)	0.904 (0.197)	1.302 (0.245)
<i>Social sciences</i>	-	-	-	-
<i>Law and economics</i>	-	0.267 *** (0.041)	0.883 (0.140)	0.346 *** (0.069)
<i>Mathematics and natural sciences</i>	-	0.881 (0.143)	1.027 (0.195)	1.319 (0.228)
<i>Medical sciences and others</i>	-	0.474 *** (0.098)	0.621 ** (0.119)	0.362 *** (0.076)
<i>Engineering science</i>	-	0.416 *** (0.054)	0.760 * (0.114)	0.367 *** (0.063)
Organizational context				
Institutional type				
<i>University</i>	-	-	-	-
<i>University of applied sciences</i>	-	0.609 *** (0.104)	0.601 *** (0.091)	0.171 *** (0.029)
Income companies and others per professor (in '00,000 euro)	-	0.608 *** (0.093)	0.655 *** (0.092)	0.573 *** (0.097)
Income companies and others per professor (in '00,000 euro) x institutional type	-	0.885 (0.641)	1.091 (0.487)	4.009 ** (2.257)
Income DFG per university professor (in '00,000 euro)	-	1.118 (0.166)	1.240 (0.165)	0.981 (0.134)
Cohort				
Age group				
< 45 years	-	0.957 (0.132)	1.415 *** (0.186)	1.110 (0.176)
45-54 years	-	-	-	-
> 54 years	-	0.921 (0.091)	0.910 (0.084)	0.745 ** (0.094)

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Table A.4 (continued)

	Identity type			
	Dedicated	Idealistic	Pragmatic	Reserved
	(1)	(2)	(3)	(4)
Individual characteristics				
Gender				
Male	-	-	-	-
Female	-	1.523 *** (0.162)	0.624 *** (0.064)	1.076 (0.127)
Early career professor				
No	-	-	-	-
Yes	-	0.881 (0.107)	0.795 ** (0.089)	0.929 (0.127)
Constant	-	2.544 *** (0.550)	1.988 *** (0.420)	3.134 *** (0.666)
Observation		4,284		
Pseudo R-squared		0.066		

Notes: The table shows the exponentiated coefficients and standard errors (cluster-robust at the level of the higher education institution) estimated from a multinomial logit model regressing the variable containing the four identity types on the variables and the interaction term listed (see Section 3.2, Figure 1 and Section 4.2 for details) and summary statistics for the model estimated. The reference groups are indicated by the empty cells. Significance level: * p < 0.1, ** p < 0.05, *** p < 0.01.

B. Data Sources

The main data source for our analysis is an original survey of professors, which was part of a research project on the third mission in Germany. The main topics of the survey were the perspective of respondents on the third mission and their engagement in third mission activities in the areas of knowledge and technology transfer, continuing education and societal engagement (Figure A.1 provides an overview on the structure and content of the survey). The survey furthermore obtained information on respondents' academic career and current employment as well as their demographic characteristics. We developed a first version of the survey instrument based on extant analytical considerations on and prior empirical investigations of the third mission. This version was then tested and revised via 22 cognitive interviews and a subsequent field test conducted between August 12 and August 19, 2020, which yielded 54 responses.

The target population of the survey included all professors at German higher education institutions governed by the state (except for civil service institutions) or by religious institutions. We identified 45,635 individuals belonging to the target population based on two sources. For professors at universities and some art and music colleges, we used the online version of the *Hochschullehrer Verzeichnis 2019* (DHV 2019), a regularly updated register of professors edited by the *German Association of University Professors and Lecturers (Deutscher Hochschulverband)*. For professors at institutions not covered by this register, we reverted to institutions' websites. No adequate contact details could be obtained for 502 professors, and 501 professors were included in the pretest of the survey questionnaire, leading to a gross sample of 44,632 individuals.

The survey was distributed online between October 5 and November 15, 2020 and yielded 4,726 valid responses. All individuals in the gross sample received an invitation via e-mail or via an online contact form. Those who had not yet completed the survey received a reminder 8 and 22 days after the initial invitation. In 1,844 cases, all three contact attempts failed due to, among other reasons, inactive e-mail addresses or spam filters. An additional 703 cases were identified as not belonging to our target population based on feedback during the field phase and the survey results. This led to an adjusted gross sample of 42,085 individuals. Overall, 4,726 valid responses could be obtained, which amounts to a net response rate of 11.2 percent. This response rate is similar to that of two Germany-wide scientific surveys at a similar point in time by the *German Centre for Higher Education Research and Science Studies (DZHW)*. Those surveys obtained response rates from professors, excluding those at universities of applied sciences, of 10.0 percent in 2016 (Neufeld and Johann 2018) and 12.4 percent in 2019/2020 (Ambrasat, Heger, and Rucker 2020).

For the purpose of this paper, we restricted the sample to 4,284 professors. In a first step, we excluded all 258 professors working at colleges of art and music. The professional activities of many professors at colleges of art and music, especially those who are involved in training young artists, differ strongly from the activities of their peers at universities and universities of applied sciences. This also applies to relations with the extra-academic environment, which limits the comparability of those two groups of professors within the context of our investigation. In a second step, we checked the remaining observations for sufficient data quality, speeding and straightlining. As a result, we removed 22 observations to which any of the following characteristics applied: a share of missing values for the main survey items above 50 percent; a response time below one third of the median; and no variation in the response pattern for more than half of the six main item batteries. In addition, we removed all 162 observations that had a missing value in any of the three sets of items covering academic identities (see Section 3.2 for details), which form the core of our analysis. The sample used for the analysis therefore includes 4,284 of the 4,726 observations generated via the survey. For the final sample, we checked all variables individually for their data quality and recoded impossible values to missing values.

For analyzing the representativeness of our sample for the population and for some of the variables covering characteristics of higher education institutions we furthermore drew on data from the *Federal Statistical Office (Statistisches Bundesamt)* of Germany. Data on academic staff were obtained via the information system *DZHW ICEland* (data set 60002). Data on higher education institutions' finances were obtained via a direct request to the *Federal Statistical Office*. The variables based on these financial data do not include data for university hospitals and higher education institutions active in the field of medicine exclusively, because these have income structures that are not comparable to that of higher education institutions in general. Data on the size of the cities in which higher education institutions are located were obtained via an official publication (Statistisches Bundesamt 2021).

The sample of our survey covers the German higher education system comprehensively, but there are some differences in distribution between the sample and the population (see Table B.1). Overall, the sample has a broad coverage of the German higher education system, including professors from the full range of academic disciplines and more than 200 institutions. The most pronounced difference when comparing the sample to the population is a strong overrepresentation of professors at universities of applied sciences in our sample and a strong underrepresentation of professors at universities. In addition, assistant professors are underrepresented whereas associate professors are overrepresented, and there is an underrepresentation of professors from the group of academic disciplines comprising the medical and health sciences, nutrition science, sport science, agronomy and forestry.

There is furthermore reason to assume a certain extent of self-selection into the survey based on professors' stance on the engagement with the extra-academic environment. We reverted to the results of the *Academic Profession in Knowledge Societies* (APIKS) research project (Schneijderberg and Götze 2020), which surveyed academics in Germany about their general employment and working conditions and thus had no specific focus on the third mission, to gauge the extent. Even though differences in sample composition and measurement pose challenges for a direct comparison, there are indeed differences between the two samples (see Table B.2). The shares of professors engaged in third mission activities are markedly higher in our sample than in the sample of the APIKS survey. This suggests that our sample is positively selected in terms of a greater openness of professors toward the third mission.

Table B.1: Representativeness of the sample for the population

	Sample		Population		Chi-squared test	
	N	%	N	%	X ²	p-value
	(1)	(2)	(3)	(4)	(5)	(6)
Gender						2.185 0.139
Male	3,074	74.2	31,570	75.1		
Female	1,069	25.8	10,445	24.9		
Type of professorship						175.479 0.000
Assistant professor (W1/C2)	251	5.9	4,660	11.2		
Associate professor (W2/C3)	2,607	61.5	22,405	53.9		
Full professor (W3/C4)	1,380	32.6	14,485	34.9		
Group of academic disciplines						110.064 0.000
Humanities and arts	576	13.5	5,905	14.3		
Social sciences	585	13.7	4,675	11.3		
Law and economics	709	16.6	6,835	16.5		
Mathematics and natural sciences	651	15.3	6,195	15.0		
Medical sciences and others	383	9.0	5,620	13.6		
Engineering sciences	1,357	31.9	12,195	29.4		
Type of institution						242.068 0.000
University	1,956	47.4	24,660	58.7		
University of applied sciences	2,173	52.6	17,355	41.3		
Type of governance						17.541 0.000
State	4,115	97.1	41,145	97.9		
Religious institutions	124	2.9	865	2.1		

Notes: The table shows the number of professors and their share in the sample used in the analysis and the population as of 2019 (as the most recent year for which data are available) by the characteristics listed (columns 1 to 4) and the results of Pearson's chi-squared tests (columns 5 and 6). Data on the population are based on official higher education statistics and were retrieved via the information system *DZHW ICEland* (data set 60102). In contrast to the sample, data for the population include professors without permanent contracts and assistant professors outside of the salary scale common for professors (i.e., the salary grade W1). Totals among characteristics differ due to differences in categorization between the survey and the secondary data as well as item non-response in the survey data. "others" includes pharmacy, health sciences, nutrition science, sport science, agronomy and forestry.

Table B.2: Comparison of the sample used in the analysis with the APIKS survey sample

Sample analysis							APIKS survey sample					
	Mathematics and natural sciences	Medical sciences and others	Engineering sciences	Humanities and arts	Social sciences	Law and economics	Full sample	Hard fields of knowledge basic	Hard fields of knowledge applied	Soft fields of knowledge basic	Soft fields of knowledge applied	Full sample
	%	%	%	%	%	%	%	(8)	(9)	(10)	(11)	(12)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)					
Year survey	2020							Year survey				2018
Cooperation	<i>Involvement previous full year</i>							Cooperation				<i>Involvement current / previous year</i>
Contract research	36	52	56	18	39	33	42	Contract research	19	41	18	28
Consulting	39	65	60	45	64	61	56	Consulting	26	55	40	52
Public engagement	<i>Use previous full year</i>							Public engagement				<i>Involvement current / previous year</i>
Speeches, talks or podium discussions	58	78	66	83	86	75	72	Public speeches or talks	48	55	67	65
Books, articles or grey literature	46	69	49	68	77	66	59	Publications for broader audiences	23	26	47	39
												34

Notes: The table shows descriptive statistics of the engagement with the extra-academic environment of professors at public higher education institutions in the sample used in the analysis and in the German survey sample of the research project *Academic Profession in Knowledge Societies* (APIKS) based on Schneijderberg and Götze (2020, 32-33). The table shows the shares of professors engaged in activities in the areas of cooperation and public engagement, both by academic discipline. In the case of the APIKS survey data on third mission activities, scientific disciplines are grouped along two dimensions: the first dimension distinguishes between hard fields of knowledge (i.e., the natural and technical sciences) and soft fields of knowledge (i.e., the humanities and social sciences); the second dimension distinguishes between disciplines oriented toward basic research (e.g., chemistry, German philology, physics and sociology) and disciplines oriented toward application (e.g., business administration, mechanical engineering and social work) (Schneijderberg and Götze 2020, 31).

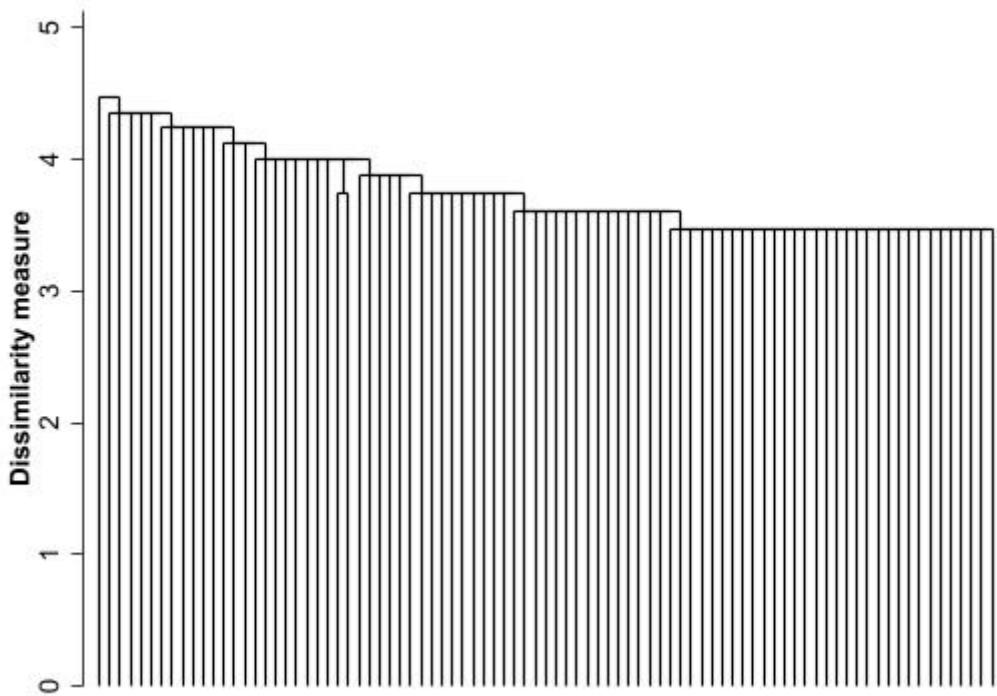
C. Cluster Analysis

The cluster analysis is based on all 15 variables covering academic identities. The variables enter the analysis in their original format with two exceptions. As in the rest of the analysis, the two variables that cover respondents' perspectives on the separation of science and the economy and on academics' abstinence from sociopolitical engagement were reverse coded. Given that all variables are based on a 5-point response scale, we abstained from standardizing them.

The survey sample does not include extreme cases that could distort the cluster analysis. We checked the presence of extreme cases using an agglomerative hierarchical cluster analysis with the single linkage algorithm based on the Euclidean distance. The resulting dendrogram (see Figure C.1) shows that there is no sudden break in the increase of the dissimilarity measure during the last steps of the cluster process, which would indicate an extraordinary degree of dissimilarity.

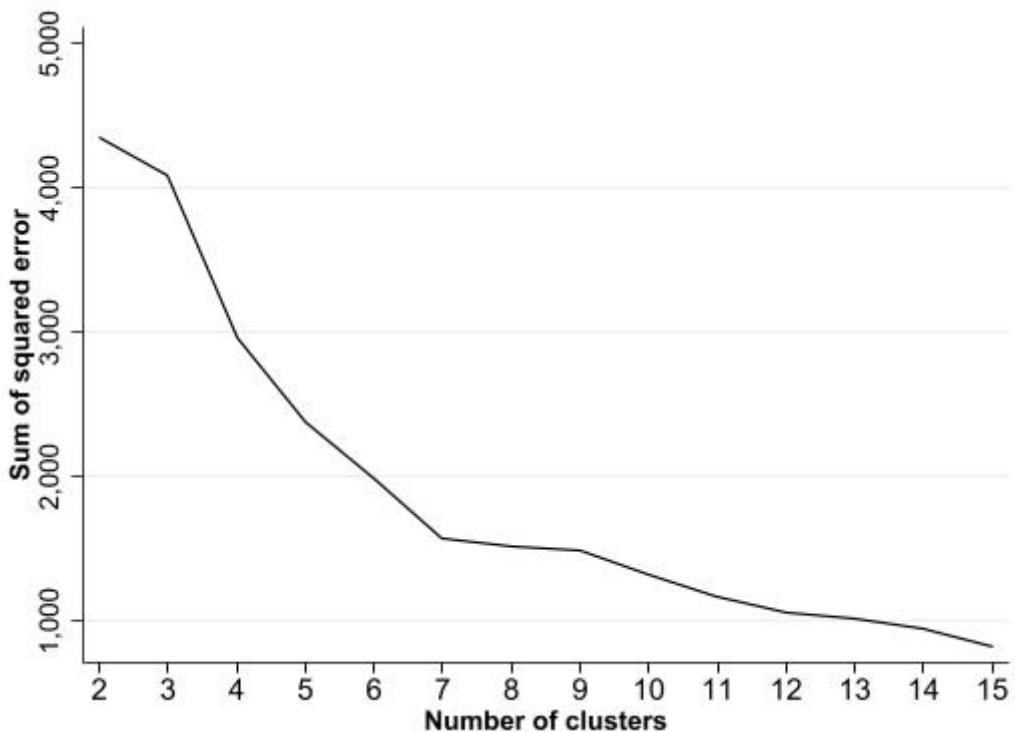
For the main analysis, we use a partitional cluster analysis. To determine the number of clusters and the starting points for the algorithm of the main cluster analysis, we use an agglomerative hierarchical cluster analysis with the Ward algorithm based on the squared Euclidean distance. Neither the Calinski-Harabasz nor the Duda-Hart stopping rule indicates a clearly superior number of clusters. The elbow criterion based on the sum of squared error provides weak support for a solution with four clusters, even weaker support for a solution with five clusters, and strong support only for a solution with seven clusters (see Figure C.2). Given that the cluster analysis is based on the limited number of 15 variables, which can all take merely five different values, we generally consider a limited number of clusters preferable to ensure that the clusters are clearly distinct for the purpose of the analysis. We therefore rule out the solution with seven clusters and revert to the dendrogram of the agglomerative hierarchical cluster analysis (see Figure C.3) to determine the number of clusters for the main cluster analysis. The dendrogram shows that a solution with four clusters yields distinct groups, and that there is no clear indication of preferable solutions when successively increasing the number of clusters. We thus opt for the solution with four clusters. The fact that the four clusters emerge as distinct in their characteristics (see Section 4.1) corroborates this decision. For the main cluster analysis based on these parameters, we use a partitional cluster analysis with the k-means algorithm based on the Euclidean distance.

Figure C.1: Dissimilarity of observations in the cluster analysis



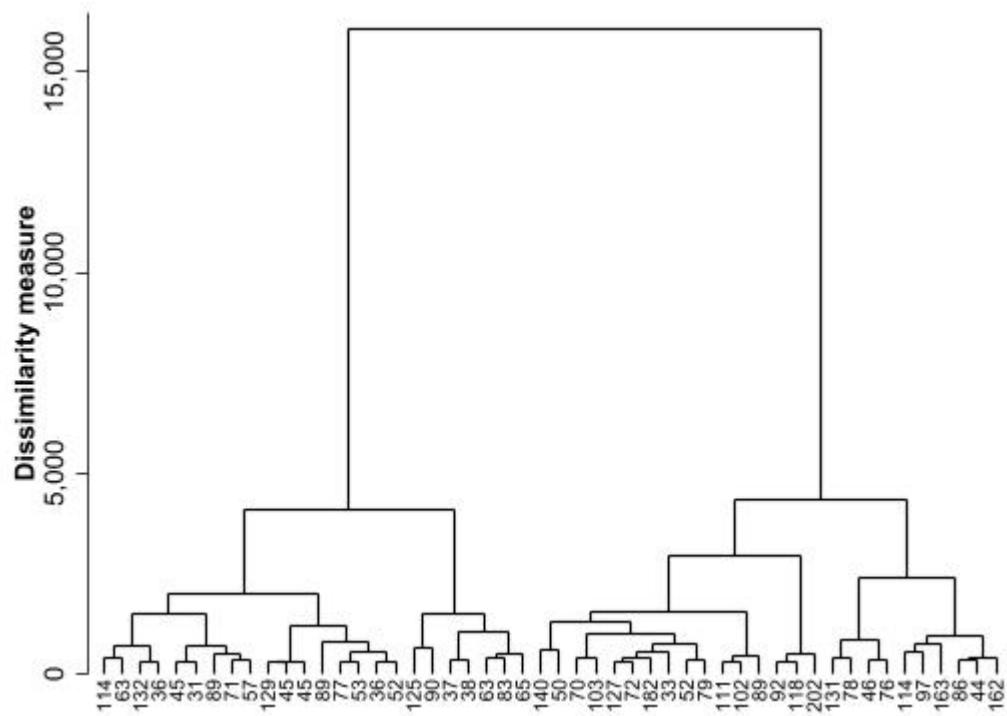
Notes: The figure shows a dendrogram of the last 87 steps of an agglomerative hierarchical cluster analysis with the single linkage algorithm based on the Euclidean distance. The spikes represent an observation or a cluster of observations; the height of the spikes represents the dissimilarity between observations / clusters. Number of observations = 4,284.

Figure C.2: Comparison of cluster solutions via sum of squared error



Notes: The figure shows the sum of squared error for the solutions with 2 to 15 clusters of an agglomerative hierarchical cluster analysis with the Ward algorithm based on the squared Euclidian distance. Number of observations = 4,284.

Figure C.3: Comparison of cluster solutions via dendrogram



Notes: The figure shows the dendrogram of the last 50 steps of an agglomerative hierarchical cluster analysis with the Ward algorithm based on the squared Euclidian distance, including the number of observations in the initial clusters at the bottom of the figure. All spikes represent a cluster of observations; the height of the spikes represents the dissimilarity between clusters. Number of observations = 4,284.

D. Clustering Standard Errors

For 420 of the 4,284 observations in our sample, information on the exact institution at which respondents are employed is not available, which poses challenges for correctly calculating standard errors that are cluster-robust at the level of the higher education institution. For our main analysis, we use supplementary information to assign the 420 observations to synthetic institutions. For 196 of the 420 observations, information on the legal type of institution at which the respondent is employed, its form of governance and the state in which it is located is available. Based on this information, we assign the 196 observations to 33 synthetic institutions that can by definition not overlap. The remaining 224 observations are assigned to an additional synthetic institution. The main deficiency of this approach is that observations assigned to the synthetic institutions might actually belong to one of the other institutions, wherefore the related clustering of standard errors cannot be taken into account in the model estimated.

An estimation of the main model for the subset of observations with full information confirms that our results are robust. For this robustness check, we estimate the main model separately for the subsample of observations for which information on the exact institution at which respondents are employed is available. Table D.1 and Table D.2 show the results from the main analysis including 4,284 observations and the results from the replication of the analysis for the subsample of 3,864 observations. Both the size of the coefficients and their significance barely differ between the two estimations. There is thus no indication for a perturbing effect of the missing information on the exact institution for some of the observations on our results.

Table D.1: Robustness check of influences on academic identities – average marginal effects

	<u>Full sample</u>				<u>Reduced sample</u>			
	<u>Identity type</u>				<u>Identity type</u>			
	Dedicated	Idealistic	Pragmatic	Reserved	Dedicated	Idealistic	Pragmatic	Reserved
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Discipline								
Group of disciplines								
<i>Humanities and arts</i>	-0.027 (0.023)	0.060 ** (0.028)	-0.055 ** (0.027)	0.022 (0.022)	-0.028 (0.025)	0.052 * (0.029)	-0.052 * (0.029)	0.028 (0.024)
[Social sciences]	[0.190]	[0.353]	[0.244]	[0.213]	[0.194]	[0.360]	[0.244]	[0.202]
<i>Law and economics</i>	0.136 *** (0.023)	-0.186 *** (0.023)	0.129 *** (0.025)	-0.079 *** (0.022)	0.130 *** (0.025)	-0.194 *** (0.025)	0.136 *** (0.027)	-0.072 *** (0.025)
<i>Mathematics and natural sciences</i>	-0.004 (0.022)	-0.050 * (0.028)	-0.001 (0.028)	0.056 ** (0.022)	-0.005 (0.023)	-0.058 ** (0.028)	0.002 (0.029)	0.061 ** (0.025)
<i>Medical sciences and others</i>	0.128 *** (0.031)	-0.066 * (0.036)	0.014 (0.029)	-0.076 *** (0.023)	0.132 *** (0.035)	-0.087 ** (0.037)	0.021 (0.031)	-0.066 *** (0.025)
<i>Engineering science</i>	0.121 *** (0.020)	-0.107 *** (0.024)	0.063 *** (0.023)	-0.078 *** (0.020)	0.115 *** (0.021)	-0.116 *** (0.024)	0.069 *** (0.024)	-0.068 *** (0.023)

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Table D.1 (continued)

	Full sample				Reduced sample			
	Identity type				Identity type			
	Dedicated	Idealistic	Pragmatic	Reserved	Dedicated	Idealistic	Pragmatic	Reserved
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Organizational context								
Institutional type								
[University]	[0.188]	[0.268]	[0.269]	[0.274]	[0.186]	[0.266]	[0.271]	[0.277]
University of applied sciences	0.128 *** (0.025)	0.016 (0.029)	0.012 (0.025)	-0.155 *** (0.021)	0.128 *** (0.028)	0.018 (0.032)	0.016 (0.029)	-0.163 *** (0.023)
Income economy and others per professor (in '00,000)								
At universities	0.067 *** (0.016)	-0.022 (0.026)	-0.006 (0.025)	-0.038 (0.030)	0.071 *** (0.016)	-0.024 (0.026)	-0.010 (0.026)	-0.037 (0.030)
At universities of applied sciences	0.063 (0.080)	-0.115 (0.140)	-0.045 (0.089)	0.097 ** (0.048)	0.064 (0.083)	-0.110 (0.139)	-0.043 (0.090)	0.090 ** (0.045)
Income DFG per university professor (in '00,000)								
At universities	-0.015 (0.016)	0.009 (0.022)	0.034 * (0.020)	-0.028 (0.021)	-0.017 (0.018)	0.013 (0.023)	0.038 * (0.022)	-0.034 (0.022)
At universities of applied sciences	-	-	-	-	-	-	-	-

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Table D.1 (continued)

	Full sample				Reduced sample			
	Identity type				Identity type			
	Dedicated	Idealistic	Pragmatic	Reserved	Dedicated	Idealistic	Pragmatic	Reserved
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Cohort								
Age group								
< 45 years	-0.028 (0.019)	-0.038 * (0.021)	0.067 *** (0.023)	-0.001 (0.020)	-0.023 (0.020)	-0.031 (0.023)	0.059 ** (0.024)	-0.005 (0.021)
[45-54 years]	[0.255]	[0.282]	[0.265]	[0.198]	[0.256]	[0.278]	[0.269]	[0.196]
> 54 years	0.024 (0.015)	0.007 (0.015)	0.001 (0.015)	-0.031 ** (0.014)	0.022 (0.016)	0.010 (0.016)	0.002 (0.015)	-0.034 ** (0.015)
Individual characteristics								
Gender								
[Male]	[0.261]	[0.250]	[0.305]	[0.183]	[0.262]	[0.252]	[0.307]	[0.178]
Female	-0.002 (0.016)	0.114 *** (0.019)	-0.117 *** (0.014)	0.005 (0.015)	0.001 (0.017)	0.105 *** (0.020)	-0.117 *** (0.015)	0.011 (0.016)
Early career professor								
[No]	[0.254]	[0.280]	[0.283]	[0.183]	[0.258]	[0.279]	[0.285]	[0.178]
Yes	0.029 (0.018)	-0.005 (0.020)	-0.031 * (0.017)	0.007 (0.016)	0.016 (0.019)	-0.003 (0.022)	-0.026 (0.019)	0.013 (0.018)

Notes: The table shows the average marginal effects at observed values in the sample and standard errors (cluster-robust at the level of the higher education institution) for the variables covering the discipline, the organizational context, the cohort to which academics belong and individual characteristics estimated following a multinomial logit model regressing the variable containing the four identity types on the variables listed (see Section 3.2 and Section 4.2 for details) and an interaction term between the variable containing the institutional type and the variable containing the institutional third party income from companies and similar organizations for two samples: the full sample included in the analysis (columns 1 to 4) and a reduced sample including only those observations for which information on the exact higher institution at which professors are employed is available (columns 5 to 8). For the reference groups of the categorical variables indicated by square brackets, the table shows predictive margins. The coefficients represent the change in the probability of belonging to each of the four identity types deriving from a change of the value of the covariate in question. "others" includes pharmacy, health sciences, nutrition science, sport science, agronomy and forestry. Significance level: * p < 0.1, ** p < 0.05, *** p < 0.01.

Table D.2: Robustness check of influences on academic identities – exponentiated coefficients

	<u>Full sample</u>				<u>Reduced sample</u>			
	Identity type				Identity type			
	Dedicated	Idealistic	Pragmatic	Reserved	Dedicated	Idealistic	Pragmatic	Reserved
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Discipline								
Group of disciplines								
<i>Humanities and arts</i>	-	1.374 *	0.904	1.302	-	1.346	0.919	1.349
		(0.244)	(0.197)	(0.245)		(0.245)	(0.215)	(0.278)
<i>Social sciences</i>	-	-	-	-	-	-	-	-
<i>Law and economics</i>	-	0.267 ***	0.883	0.346 ***	-	0.270 ***	0.929	0.365 ***
		(0.041)	(0.140)	(0.069)		(0.045)	(0.158)	(0.084)
<i>Mathematics and natural sciences</i>	-	0.881	1.027	1.319	-	0.867	1.049	1.376 *
		(0.143)	(0.195)	(0.228)		(0.149)	(0.204)	(0.264)
<i>Medical sciences and others</i>	-	0.474 ***	0.621 **	0.362 ***	-	0.441 ***	0.637 **	0.380 ***
		(0.098)	(0.119)	(0.076)		(0.102)	(0.129)	(0.090)
<i>Engineering science</i>	-	0.416 ***	0.760 *	0.367 ***	-	0.416 ***	0.799	0.396 ***
		(0.054)	(0.114)	(0.063)		(0.057)	(0.126)	(0.077)

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Table D.2 (continued)

	Full sample				Reduced sample			
	Identity type				Identity type			
	Dedicated	Idealistic	Pragmatic	Reserved	Dedicated	Idealistic	Pragmatic	Reserved
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Organizational context								
Institutional type	-	-	-	-	-	-	-	-
<i>University</i>	-	-	-	-	-	-	-	-
<i>University of applied sciences</i>	-	0.609 *** (0.104)	0.601 *** (0.091)	0.171 *** (0.029)	-	0.607 *** (0.111)	0.601 *** (0.103)	0.160 *** (0.029)
Income companies and others per professor (in '00,000 euro)	-	0.608 *** (0.093)	0.655 *** (0.092)	0.573 *** (0.097)	-	0.595 *** (0.091)	0.636 *** (0.092)	0.563 *** (0.096)
Income companies and others per professor (in '00,000 euro) x institutional type	-	0.885 (0.641)	1.091 (0.487)	4.009 ** (2.257)	-	0.921 (0.669)	1.129 (0.510)	3.924 ** (2.191)
Income DFG per university professor (in '00,000 euro)	-	1.118 (0.166)	1.240 (0.165)	0.981 (0.134)	-	1.145 (0.180)	1.273 (0.188)	0.967 (0.141)
Cohort								
Age group	-	-	-	-	-	-	-	-
<i>< 45 years</i>	-	0.957 (0.132)	1.415 *** (0.186)	1.110 (0.176)	-	0.966 (0.143)	1.348 ** (0.186)	1.067 (0.183)
<i>45-54 years</i>	-	-	-	-	-	-	-	-
<i>> 54 years</i>	-	0.921 (0.091)	0.910 (0.084)	0.745 ** (0.094)	-	0.940 (0.100)	0.920 (0.090)	0.738 ** (0.100)

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Table D.2 (continued)

	Full sample				Reduced sample			
	Identity type				Identity type			
	Dedicated	Idealistic	Pragmatic	Reserved	Dedicated	Idealistic	Pragmatic	Reserved
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Individual characteristics								
Gender								
Male	-	-	-	-	-	-	-	-
Female	-	1.523 *** (0.162)	0.624 *** (0.064)	1.076 (0.127)	-	1.460 *** (0.166)	0.620 *** (0.068)	1.102 (0.139)
Early career professor								
No	-	-	-	-	-	-	-	-
Yes	-	0.881 (0.107)	0.795 ** (0.089)	0.929 (0.127)	-	0.934 (0.124)	0.853 (0.101)	1.016 (0.149)
Constant	-	2.544 *** (0.550)	1.988 *** (0.420)	3.134 *** (0.666)	-	2.521 *** (0.575)	1.893 *** (0.442)	3.053 *** (0.719)
Observation	4,284				3,864			
Pseudo R-squared	0.066				0.066			

Notes: The table shows the exponentiated coefficients and standard errors (cluster-robust at the level of the higher education institution) estimated from a multinomial logit model regressing the variable containing the four identity types on the variables and the interaction term listed (see Section 3.2 and Section 4.2 for details) and summary statistics for the model estimated for two samples: the full sample included in the analysis (columns 1 to 4) and a reduced sample including only those observations for which information on the exact higher institution at which professors are employed is available (columns 5 to 8). The reference groups are indicated by the empty cells. "others" includes pharmacy, health sciences, nutrition science, sport science, agronomy and forestry. Significance level: * p < 0.1, ** p < 0.05, *** p < 0.01.