



What motivates academics for external engagement? Exploring the effects of motivational drivers and organizational fairness

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Abstract

Academics have different motivations for external engagement, including to acquire external resources for research (research advancement motivation), to contribute to society (prosocial motivation), or to acquire monetary benefits (pecuniary motivation). Universities also have varying policies for rewarding external engagement. This paper examines the relationship between academics' motivations for engaging, their perceptions of the fairness of their universities' policies, and their actual level of external engagement. Most academics consider contributing to the betterment of society as the most important reason for engagement, followed by the advancement of their research. Conversely, few academics consider obtaining personal income to be important. The perceived importance of all three motivations is positively associated with actual engagement behavior. Notably, the strength of research advancement motivation is more closely associated with external engagement than the strength of pecuniary motivation. However, perceptions of organizational fairness are not related to external engagement.

Key words: academic engagement; motivation; organizational fairness; third mission

1. Introduction

Universities are increasingly expected to contribute to solving societal challenges in collaboration with industry, governments, and civil society (Sanchez-Barrioluengo 2014). Accordingly, most institutions have integrated the societal engagement mission into their activities. However, academics are under pressure to perform in multiple areas, including as researchers and educators, and they enjoy considerable freedom in how they spend their time. Hence, achieving societal impact depends on the commitment and active participation of academics. Given the critical role of academics in external engagement, researchers and policymakers alike seek to understand the factors that might influence academics' external engagement (Perkmann et al. 2021).

A large volume of research has explored the role of individual and organizational factors in the external engagement of academics (see e.g. de Wit-de Vries et al. 2019; Perkmann et al. 2021), including the role of individual motivation (Iorio et al. 2017; Lam 2011; van de Burgwal et al. 2019b). Academics' external engagement can be driven by extrinsic motivations such as reputational and financial benefits (van de Burgwal et al. 2019b) as well as by intrinsic motivations such as a desire to contribute to society (Iorio et al. 2017; Orzabayeva and Plewa 2020). Although this line of research has shed considerable light on the working of individual motivations in external engagement, most studies have focused on researchers in the natural sciences and have been conducted in the context of

a single country, e.g. the UK (D'Este and Perkmann 2011; Lam 2011), the Netherlands (van de Burgwal et al. 2019b), or Italy (Iorio et al. 2017). The study of Orzabayeva et al. (2020) is hitherto the only broad cross-disciplinary and cross-national study of this phenomenon.

The growing emphasis on societal engagement also requires universities to change their organizational policies (Lach and Schankerman 2008; van de Burgwal et al. 2019a). Universities have traditionally relied on research and teaching performance as well as the ability to attract research funding as key criteria in promotion and remuneration decisions. Conversely, academics that perform well in external engagement often feel that their contributions are overlooked and that these policies are therefore unfair or do not reflect their efforts (Hayden et al. 2018). To address this, incentives such as royalty sharing, bonuses, and sabbaticals aimed at motivating faculty to engage with external actors are a common feature of most university policies (van de Burgwal et al. 2019a). Yet, little is known about how academics' perception of the fairness of organizational processes and outcomes influence actual engagement behavior. Organizational fairness¹ is important for individual behavioral outcomes in businesses (Laundon et al. 2019b: 295) and public organizations (Cho and Sai 2013). Fairness is also related to motivation, insofar as academics who perceive their organization to be unjust may lose motivation for their work. However, scant attention has been devoted to investigating its effect on external engagement, although there have been

calls for research in this direction (van de Burgwal et al. 2019a).

This paper addresses these gaps to shed new light on how individual motives and fairness perceptions are associated with academics' external engagement. We draw on theories of motivation and organizational justice to examine the relationship between different motivational drivers, fairness of incentives and rewards, and the external engagement of academics. Additionally, we go a step further and analyze how the effects of motivations on external engagement differ between academics at different career stages and across different types of engagement. We do this using survey data collected from 625 academics across all disciplines in seven European Consortium of Innovative Universities (ECIU) member institutions located in seven countries.

We find that most academics rate prosocial motivation as the most important reason they engage with external actors, followed by research advancement motivation. Few academics consider pecuniary motivation to be important. Furthermore, we find a positive and significant association between the perceived importance of all three types of motivation and actual external engagement. Notably, research advancement motivation tends to be more strongly related to external engagement than pecuniary motivation. However, we observe no significant association between distributive and procedural fairness, and external engagement. This suggests that how academics perceive organizational fairness has little impact on their external engagement activities.

The remainder of the paper is structured as follows: The following section reviews the literature and develops the hypotheses for subsequent testing. The third section describes the data, the variables, and the methods utilized in the analysis. The empirical results are reported in the penultimate section. The final section draws conclusions and points to some policy implications.

2. Theoretical framework and hypotheses

2.1 Determinants of external engagement of academics

Research spanning varied fields analyzes external engagement between academic scientists and non-academic actors. The bulk of the literature hitherto focused on scientists' collaboration with firms. But recent studies have broadened the scope to incorporate engagement with other social partners, such as governmental agencies and civil society (Llopis et al. 2018). This stream of research has primarily aimed at unraveling the mechanisms and processes that determine the engagement behavior of academics. These factors arise from diverse contexts, at the individual, organizational, and institutional level (Perkmann et al. 2021).

Individual level antecedents have been widely explored in the literature. The sustained attention stems chiefly from the crucial role individual academics play in engagement with external actors. Among the individual factors, demographic attributes have obtained special scrutiny. Several studies demonstrate the relationship between external engagement and gender (Abreu and Grinevich 2017), age (Tartari and Breschi 2012), place of birth or nationality (Lawson et al. 2019), and mobility (Edler et al. 2011).

Whereas external interactions are primarily determined by individual volitions and characteristics, organizational-level factors also exert some influence. These organizational conditions may enable or constrain the engagement of academics in external interactions. Some of the key factors identified in previous studies include university or department quality (Ponomariov and Boardman 2008), university strategic orientation (Giuri et al. 2019), and university promotion and incentive policies (van de Burgwal et al. 2019a). Existing studies have highlighted the effects of incentives, but the evidence has been ambiguous. While some research suggests that incentives are relevant in motivating academics to participate in commercialization (Caldera and Debande 2010; Lach and Schankerman 2008), others indicate incentives do not matter or may even have deleterious effects (Göktepe-Hulten and Mahagaonkar 2010; Markman et al. 2004). These inconsistent findings perhaps arise from a narrow focus on monetary incentives and on one type of engagement activities, specifically commercialization. However, this is gradually changing as recent works have included broader incentive mechanisms in a range of external engagement activities (van de Burgwal et al. 2019a). Furthermore, studies hint at the possible influence of academics' perceptions of fairness of university policies in the performance of external engagement activities (e.g. Arqué-Castells et al. 2016; van de Burgwal et al. 2019a). Nevertheless, no studies have explicitly accounted for the perceived organizational fairness of existing policies in empirical analyses. The absence of such empirical evidence limits university managers in making an informed evaluation of the effectiveness of these policies in stimulating a desired behavioral change.

2.2 The effects of motivational drivers on external engagement

Motivation has long been identified as a fundamental driver of diverse human behaviors. As a result, scholars have sought to comprehend the nature of individual motivation as well as the mechanisms explaining the link between forms of motivation and behavior (Ryan 2014). Particularly, the self-determination perspective in social psychology conceptualizes motivation as a function of external control and an individual's internal need for autonomy and self-regulation (Deci and Ryan 2000; Gagné and Deci 2005). Individual motivation exists on a continuum of self-determination, ranging from amotivation through extrinsic to intrinsic motivation. Amotivation denotes expressing no intent of participation in an activity due to disinterest. Extrinsic motivation means participating in an activity for external rewards, while intrinsic motivation refers to participation in an activity out of innate desire and willingness (Deci and Ryan 2000).

Drawing on the extrinsic and intrinsic dimensions of motivation, researchers have distinguished different motivational drivers of academics in external engagement. Academics may be motivated by learning opportunities to access complementary knowledge, ideas, and external resources to improve their research activities (D'Este and Perkmann 2011; Iorio et al. 2017). They may also acquire monetary benefits to supplement their personal income (Lam 2011; Orazbayeva and Plewa 2020). Besides these extrinsic motivations, academics may also have intrinsic motivations to pursue external engagement, as they derive satisfaction and joy from engaging in

challenging activities and offering creative solutions to external actors (Lam 2011). For instance, many academics want their research to make a difference in society (Iorio et al. 2017).

In this paper, we distinguish between three main types of motivation for external engagement: research advancement, pecuniary, and prosocial motivation. Academics may be driven to engage with external partners because it provides access to data, networks, and resources needed to develop their research (D'Este and Perkmann 2011; Ramos-Vielba et al. 2016; Iorio et al. 2017). Put differently, academics can derive research-related benefits from the learning obtained through external engagement. External engagement also offers a way for academics to obtain extra income to augment their salaries (Lam 2015; Orazbayeva and Plewa 2020; van de Burgwal et al. 2019b). For instance, a large literature has examined how the revoking of professors' privilege and the introduction of Bayh–Dole type legislation has influenced academic innovation (e.g. Ejermo and Toivanen 2018; Grimaldi et al. 2011; Hvide and Jones 2018), often from the perspective that the relative loss of individual financial rewards reduces the incentives for academics to innovate. Finally, the need for research to make a meaningful contribution to the wider society or improve the quality of human life also plays a role in academics' external engagement (Iorio et al. 2017; van de Burgwal et al. 2019b). Academics are driven by values and ethos that seek to advance science and its application to solving societal challenges (Lam 2011). One of the means of achieving this goal remains collaborating with external stakeholders (D'Este et al. 2018).

The previous literature has used similar typologies to examine the role of motivation in external engagement. For instance, Iorio et al. (2017) highlight pecuniary, learning, and prosocial motivations and describe learning as being motivated by the improvement of one's own research. Similarly, Lam (2011) highlights the importance of pecuniary, career, and intrinsic motivations, which she refers to as gold, ribbon, and puzzle, respectively. The latter two are both related to research advancement, as research involves puzzles and is also essential for the development of academic careers. van de Burgwal et al. (2019b) add moral motivation as a fourth dimension, corresponding to what we refer to as prosocial motivation. These studies have found that intrinsic, prosocial, and career motivations have a greater impact than pecuniary motivation on academics' level of external engagement in general, as well as on a broader variety of types of engagement activities (Lam 2011; Iorio et al. 2017; van de Burgwal et al. 2019b). However, previous studies (with some exceptions, e.g. Orazbayeva et al. 2020) tend to be limited to academics in the natural sciences and are often conducted in a single country context. We examine whether these findings hold more broadly also beyond these contexts and hypothesize that:

H1a: Research advancement motivation is more closely associated than pecuniary motivation with participation in a broad range of external engagement activities.

H1b: Prosocial motivation is more closely associated than pecuniary motivation with participation in a broad range of external engagement activities.

The impact of these motivational drivers is not necessarily the same for all types of external engagement but may vary

across different engagement channels (D'Este and Perkmann 2011; De Fuentes and Dutrénit 2012; Franco and Haase 2015). External engagement is an umbrella concept that covers a wide range of activities, including human resource development/training, research, service provision, and commercialization (De Fuentes and Dutrénit 2012). Engagement in each of these activities is shaped in different ways by the underlying motivations for engagement or by the benefits academics seek to derive. For instance, D'Este and Perkmann (2011) found that academics motivated exclusively by commercial or financial gain engage mainly through commercialization channels, whereas those driven strongly by research advancement motives interact via research-related channels.

In a similar vein, the saliency of different motivational drivers might vary over the course of an academic career, in particular across different career stages. In general, academics exhibit different attitudes and behaviors at varied career stages (Subramaniam 2003). These differences arise because of the changes in value orientations, needs, and interests that occur at the distinct junctures of their careers (Jung 2014). For instance, given the uncertain nature of an early-stage academic career and the stringent requirements for tenure, research advancement motivation is more likely to be salient at this stage. Since research outcomes, such as publications, feature prominently in tenure and promotion decisions, academics at this stage might engage with external partners mainly with the view of enhancing their research (Lam 2011). In contrast, securing personal income may be a primary motivation at the late career stage. Having accomplished significant professional goals and established their reputation, the need for making additional money from research and engagement activities become more germane for academics at this stage (Audretsch and Stephan 1999; Janger and Nowotny 2016). Thus, academics' engagement with external actors may be triggered by motives consistent with the needs or values salient at a particular career stage.

2.3 The effects of organizational fairness on external engagement

Academic engagement remains only weakly institutionalized in universities. Performance in research is the most important influence on recruitment, promotion, and remuneration decisions (Cadez et al. 2017). Other types of rewards, such as sabbaticals, are in most cases also linked to research activities. Furthermore, in institutions where engagement is emphasized, the focus and priority tend to be on formal or commercialization activities (i.e. patents and spin-offs), while informal interactions are often ignored. This is evident in the establishment of technology transfer offices and support mechanisms at most universities to promote research commercialization (Fini and Grimaldi 2017). Hence, academics who engage primarily through informal channels may feel that their contributions go under the radar and are not adequately recognized or rewarded by their university (Hayden et al. 2018). In essence, they may feel that the organizational processes or outcomes are unfair. This may result in amotivation for these types of activities over time.

Fairness or justice is considered a prerequisite for an effective functioning of organizations. This is because fairness perceptions determine individual behaviors in the workplace

(Greenberg 1990; Laundon et al. 2019b: 295). Individuals' relations with their organizations are governed by mutual responsibilities. As such, individuals invest effort in the furtherance of organizational goals if they are equitably rewarded. However, they tend to withdraw from the pursuit of the organization's goals if they perceive their rewards are not commensurate with their inputs. Therefore, issues related to organizational fairness are at the heart of most employee and organizational outcomes (McFarlin and Sweeney 1992).

In the literature, organizational fairness is conceptualized as a multidimensional concept consisting of three dimensions—distributive, procedural and interactional fairness.² These dimensions are interdependent, but they differ conceptually with respect to the level of justice evaluation. Perceptions of distributive and procedural fairness are associated with processes and outcomes at the organizational level, whereas interactional fairness perceptions are linked closely with microprocesses at the relational level (Balven et al. 2018). Given that the empirical focus of this paper is to understand the influence of organizational factors on external engagement, we consider only distributive and procedural fairness. Interactional fairness pertains mainly to internal relationships and is less relevant in this context.

2.3.1 Distributive fairness and external engagement

The issue of fairness of compensation and promotion policies has significant implications for academics' external engagement. The compensation and promotion policies of most universities are most closely connected to research performance, while the integration of external engagement in such policies varies widely (van de Burgwal et al. 2019a). Given that the perceived equity in the distribution of outcomes relative to one's effort leads to behavioral modification, academics' perception of the degree of equity in compensation and promotion decisions is likely to influence their external engagement (Greenberg 2005). For example, researchers who feel that external engagement is accorded relatively similar importance to research or teaching may be more inclined to engage with external actors. By contrast, those who perceive that external engagement is insufficiently appreciated in rewards might avoid performing this role (Laundon et al. 2019a; Törnblom and Kazemi 2015).

Moreover, academics may receive some form of reward for external engagement. This ranges from royalty sharing for inventions to prizes and awards in recognition of service to society (van de Burgwal et al. 2019a). While these rewards may not provide full compensation for the efforts expended, they nonetheless signal the value that universities place on external engagement (Gallus and Frey 2017). All else equal, an academic will continue to interact with external actors to the extent that they feel their reward is relatively commensurate with the effort and resources expended vis-à-vis other academics (Greenberg 2005). Conversely, academics who participate in external engagement may alter their behavior if they feel that less deserving colleagues have been rewarded instead of them.

In summary, we expect academics' perceptions of distributive fairness to influence their external engagement. They would participate more in these external activities if compensation and rewards are judged as fair and may avoid engaging

if they consider them to be unjustly distributed. Based on the above arguments, we propose that:

H2a: The higher the perceived distributive fairness of academics, the more they will participate in a broader variety of external engagement activities.

2.3.2 Procedural fairness and external engagement

Much as individuals prefer fair remuneration and promotion outcomes, they are also concerned about the procedures for determining these outcomes. Procedures for distribution of rewards are important to people because of their association with fair outcomes (Bobocel and Gosse 2015; Konovsky 2000). Emphasizing the saliency of procedures, earlier theorists posit that individuals perceive outcomes as fair when they are allowed some degree of control over the reward allocation process (Thibaut and Walker 1975). Given that people are the best evaluators of their own inputs and contributions, granting them some control in the decision process enhances their perception of the fairness of the procedure and subsequent outcomes (Bobocel and Gosse 2015). In an organizational context, the form of control can be employees providing inputs in the formulation of procedures and rules, as well as offering them the opportunity to voice concerns in the event of perceived injustice (Avery and Quiñones 2002).

Based on this reasoning, academics may be motivated to participate in external engagement if they feel that fair procedures govern the determination of promotion and remuneration. Academics' perception of fairness may be reinforced if they can provide information to the formulation of policies or given the chance to air their grievances in the event of unjust treatment. Conversely, they may choose not to engage in these activities if they perceive that fair procedures are not followed in allocation decisions, or their inputs are not respected (Bobocel and Gosse 2015).

Empirical evidence in organizational studies suggests that procedural fairness predicts employee work attitudes such as organizational commitment and job satisfaction (McFarlin and Sweeney 1992) and behaviors such as counterproductive work behavior and organizational citizenship behavior (Holtz and Harold 2013; Moorman et al. 1998), among others. While studies focusing on the academic context are scarce, the few that exist show an association between procedural justice and academics' work attitudes and behaviors. For example, in a longitudinal study of untenured management professors in the USA, Ambrose and Cropanzano (2003) find that procedural fairness perceptions relate strongly to job satisfaction, organizational commitment, and turnover intentions prior to and immediately after the tenure decision. Based on the preceding discussion, we postulate that:

H2b: The higher the perceived procedural fairness of academics, the more they will participate in a broader variety of external engagement activities.

3. Data and methodology

3.1 Data

The empirical analysis draws on data from the Role of Universities in Innovation and Regional Development (RUNIN)-ECIU Academics Survey. The survey was conducted by the

Centre for Innovation Research in 2019 as part of the European Union funded RUNIN Project.³ The study's participants were academics working at universities affiliated with the ECIU. The choice of this network as the study context is based on both theoretical and practical reasons. The theoretical rationale arises from the integration of external engagement into the mission of the ECIU member universities. Established in 1997 with ten universities, ECIU presently consists of thirteen members with one affiliate partner. It sees itself as an association of mid-sized, research intensive, and entrepreneurial universities committed to fostering innovation and the leveraging of research to solve industrial and societal challenges. This ideal is reflected in the close linkages between the universities and industry and other societal partners (Nieth and Benneworth 2020). Although these institutions are located in different countries and country-specific conditions may affect their external interactions differently, their common profiles and shared beliefs make them comparable institutions.

The practical reason is mainly due to accessibility to academics for data collection. In the context of the EU's General Data Protection Regulation, university managers are often unwilling to provide proprietary information (e.g. email addresses of employees) to external researchers. Thus, we had to rely on our networks in the ECIU to secure access to academics to participate in the study.

In all, seven universities in seven different countries took part in the survey (see Table 1). The targeted population was academics in all scientific fields, from the rank of research fellow to full professor, involved in research and/or teaching in all disciplines at these universities. We contracted a survey company to undertake the data collection. The initial version of the questionnaire was prepared in English and subsequently translated into eleven European languages. These were then reviewed by experts in the field who are native speakers to ensure equivalence across the questionnaires (Hui and Triandis 1985). Before the survey was administered, a press release was issued on the intranet of the respective universities to inform respondents about the upcoming survey. After this, the survey was distributed via email from local university contact persons to all respondents in the target group, using university mailing lists to 7,330 academics. At the end of the data collection period, 635 completed responses were collected, representing a response rate of 8.7 per cent. The data were then cleaned to remove responses from ineligible respondents (e.g. PhD candidates), leaving a final sample of 625. Table 1 presents the distribution of the population, sample size, and response rate of the individual universities.

Considering the possible effects of the relatively low response rate on the representativeness of the sample, we conducted non-response bias tests to compare the respondents with the non-respondents with regard to external engagement, motivations, organizational fairness, gender, age, rank, professional experience, and scientific discipline. Auxiliary data on non-respondents are unfortunately unavailable, implying that we cannot directly compare respondents and non-respondents. As a second-best option, we followed existing conventions in the literature and used late respondents as a proxy for non-respondents in the analyses (Armstrong and Overton 1977). As appropriate, we conducted chi-square and *t*-tests to verify if differences existed between academics that returned the questionnaire without any prompting and

Table 1. Survey response rate by university.

University	Population ^a	Number of respondents	Response rate (%)
Aalborg University	1,387	137	9.90
Autonomous University of Barcelona	2,666	151	5.70
Dublin City University	625	28	4.50
Kaunas University of Technology	680	32	4.71
University of Stavanger	699	126	18.00
University of Trento	643	50	7.80
University of Twente	630	111	17.60
Total	7,330	635	8.66

^aPopulation represents post-doctoral fellows to full professors in research and/or teaching positions.

those that required one or more reminders. The results largely show small and insignificant differences between early and late respondents on the variables of interest and provide no evidence for non-response bias in the study.

3.2 Measures

3.2.1 Dependent variable

The dependent variable is built with information from the survey. Building on D'Este and Patel (2007), respondents were asked whether they engaged in any of nine activities with external actors in the past three years. The activities include giving informal advice, joint supervision of students, membership of advisory boards of organizations, joint research, and commercialization of research outputs, among others (see Table A.1 in the Appendix for the full list of activities). We use the responses to construct a measure of engagement breadth, following the approach of previous studies (D'Este and Patel 2007; Lawson et al. 2019). The dependent variable measures whether respondents are active in a broad or narrow range of engagement activities by identifying the number of different engagement activities they have engaged in. We create a summary measure by counting the number of activities, such that a respondent who did not engage in any activity scores zero and one who engaged in all activities scores nine. This measure has a Cronbach's alpha of 0.76, indicating a high reliability.

3.2.2 Independent variables

The independent variables employed in the analysis measure academics' motivational drivers and their perceptions of fairness in their organizations. Using a 5-point scale (1 = unimportant; 5 = very important), respondents were asked to rate the importance of seven reasons for their engagement with external partners. On this basis, we identify three dimensions of motivational drivers: research advancement, pecuniary, and prosocial motivations. The measure for the research advancement motivation is created by mean scoring the responses to four items: 'Gain new insights in the area of my research', 'Build and maintain professional networks', 'Secure access to specialist equipment, materials or data' and 'Secure funding for research'. This measure has a Cronbach's alpha of 0.60, suggesting a low reliability.⁴ Prosocial and

pecuniary motivations are measured with single items. These are ‘Promote the practical application of my research in society’ and ‘Secure personal income’, respectively. One item, ‘Create student project and job placement opportunities’, is removed from the analysis because it does not conceptually relate to any of the motivations.

We adapt six items from the Organizational Justice Measure (Colquitt 2001) to construct the distributive fairness and procedural fairness measures. In the questionnaire, respondents were asked to rate the extent to which their pay and promotion and the procedures used by university management to determine those outcomes have been fair. The items include ‘Does your pay or promotions reflect the effort you put into your work?’, and ‘Have the procedures to determine your pay or promotions been based on accurate information?’. The full list of items is presented in Table A.1 in the Appendix. Respondents rate the items using a 5-point scale (1 = ‘to a small extent’; 5 = ‘to a very large extent’). A ‘Don’t know’ option was included in the responses. We replaced each observation with this option with an item mean. Afterward, three items are mean scored to create a summated measure for distributive and procedural fairness, with Cronbach’s alphas of 0.87 and 0.75, respectively.

3.2.3 Control variables

We control for various individual and contextual characteristics that the extant literature has shown to influence academics’ external engagement. To account for individual demographics, we first include controls for gender (a dummy variable coded 1 for female and 0 for male), age (a categorical variable coded into three groups: below 40 years, 40–49, and 50 and above) and professional experience (a dummy taking the value 1 if the respondent has worked in other sectors prior to joining academia and 0 otherwise).

In addition, we control for the career stage of academics. Building on the faculty career stages model (Baldwin 1990), we distinguish between three career stages based on the academic rank of the respondents. Unfortunately, we did not ask respondents directly about their career stage or whether or not they are tenured in the survey. However, respondents were asked to indicate their position, ranging from post-doctoral fellow to full professor. As these positions are closely associated with different career stages, we use them as proxies in the analysis. Specifically, we classify post-doctoral fellows and assistant professors/lecturers as early career stage since these positions are typically not tenured. Associate professors/senior lecturers are typically tenured positions and are classified as midcareer stage, whereas full professors are classified as late career stage, as the highest-ranking academic position.

Furthermore, we control for scientific discipline, classified as biological sciences and health, engineering and natural sciences, humanities and arts, and social sciences. Finally, seven university dummies are added to account for differences across the universities in external engagement.

3.3 Empirical strategy and model specification

We adopt a two-stage approach in the empirical estimation of the model. In the survey, only academics who indicate engagement with external actors were asked about their

motivations for engagement (i.e. 486 academics of 625). Failure to account for the reasons respondents choose to engage externally creates a risk of selection bias in the analysis. Following D’Este and Perkmann (2011), we first run a logistic model to compute the predicted probability for each respondent to engage with external partners. In the second stage, we include this probability in the main model to control for selection bias.

The dependent variable in the first stage takes the value of one when a respondent engaged with external actors and zero otherwise. We regress this variable on all the control variables specified above, as well as on four variables that measure perceived satisfaction with the time to perform different work roles. Specifically, we asked to what extent respondents were satisfied with the amount of time available to them to conduct the following tasks: ‘conducting research’, ‘teaching and related activities’, ‘performing outreach activities’, and ‘performing administrative activities’. For each task, respondents answered on a 5-point scale (1 = very dissatisfied; 5 = very satisfied). Specifically, the model takes the following form:

$$\begin{aligned} \text{Logit}(\text{Pr}(\text{External engagement}_i = 1)) \\ = \alpha + \beta_1 \text{Time availability}_i + \beta_2 \text{Controls}_i + \varepsilon_i \end{aligned} \quad (1)$$

The results of the logistic regression are reported in Table A.2 in the Appendix.

In the second stage, we use the number of types of external engagement activities in the past 3 years as the dependent variable. Since this is a count variable, Poisson regression models (PRMs) or negative binomial regression models (NBRMs) could be used in the empirical analysis. We conduct formal tests comparing the two models to ascertain which one fits the data better (Long and Freese 2014). Both the Bayesian Information Criterion (BIC) and the Akaike Information Criterion (AIC) test statistics suggest that the PRM provides a better fit than the NBRM (PRM:BIC = 1983.936 vs NBRM:BIC = 1990.123; PRM:AIC = 1896.026 vs NBRM:AIC = 1898.026). Hence, we estimate a series of PRMs using a quasi-maximum likelihood approach to examine the relationships between external engagement, motivational drivers, and fairness perceptions.⁵ The econometric model is of the following specification:

$$\begin{aligned} \log(\lambda_i) = \alpha + \beta_1 \text{Research advancement motivation}_i \\ + \beta_2 \text{Pecuniary motivation}_i + \beta_3 \text{Prosocial} \\ \text{motivation}_i + \beta_4 \text{Distributive fairness}_i \\ + \beta_5 \text{Procedural fairness}_i + \beta_6 \text{Probability} \\ \text{of engagement}_i + \beta_7 \text{Controls}_i + \varepsilon_i \end{aligned} \quad (2)$$

where λ_i refers to the expected number of types of external engagement activities of academic i . We use a log link function as we fit a PRM. *Research advancement motivation*, *Pecuniary motivation*, *Prosocial motivation*, *Distributive fairness*, and *Procedural fairness* represent the explanatory variables defined above. *Probability of engagement* is the estimated probability from the logistic regression of model (1). *Controls* is a vector of the academic and disciplinary specific control variables specified above, and ε_i is the error term.

We also conduct two further types of analyses: First, we add a series of interactions between each type of motivation and dummy variables for the early, middle, and late career stages. Second, we examine whether the effects of

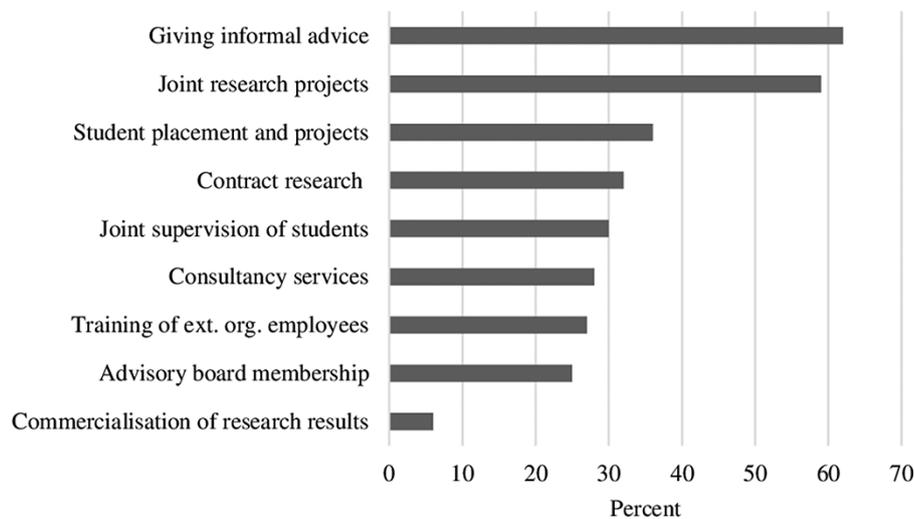


Figure 1. Proportion of academics using different channels for engagement with external actors ($n = 625$).

the various types of motivation differ for different types of external engagement. In order to do this, we split the dependent variable into three different engagement channels. These are education-related, research-related, and advise-related engagement. For education-related engagement, we mean score the following items: ‘Joint supervision of Masters/PhD students’, ‘Arranging student projects/placements with external organizations’, and ‘Organizing training courses for employees of external companies’. For research-related engagement, we use the mean scores for ‘Participating in joint research’ and ‘Conducting contract research’. Finally, for advise-related engagement, we include the mean scores for ‘Giving informal advice/invited lectures’, ‘Sitting on scientific advisory boards of external organizations, and ‘Providing consultancy services’.

4. Results

We now turn to the empirical results, which we divide into two parts: First, we examine how prevalent different types of engagement activities are among academics and how important the various motivational drivers are for them. Second, we turn to the regression analysis for examining whether academics for whom different motivational drivers are more important, also tend to engage more.

4.1 What motivates academics for engagement?

Starting with the engagement activities, Fig. 1 displays the distribution of the nine types of activities during the past 3 years (2016–9). Providing informal advice and joint research are the most widely used mechanisms for engagement. Approximately 60 per cent of respondents report engaging in these activities. Student projects and contract research follow, with over 30 per cent of academics involved in these activities. Almost 30 per cent of academics are also involved in consultancy services, training activities, and advisory board memberships. At the other end of the scale, just 6 per cent of respondents engage in the commercialization of research activities. Overall, these findings are in line with existing

research which demonstrates that academics interact more with external actors through informal and less formal channels than through formal ones such as patenting or spinouts (Abreu and Grinevich 2013; D’Este and Patel 2007; Thune et al. 2016). This provides further support for the idea that the most frequently used indicators of academic engagement only capture the tip of the iceberg of engagement activities.

Figure 2 shows the importance of different types of motivations for engagement. The largest share of academics considers the societal impact of research as the most important reason for external engagement. More than half of academics consider this a very important motivation for their engagement, and almost 90 per cent consider it somewhat or very important. Hence, prosocial motivation emerges as the leading reason for academics to engage in external activities. However, it is followed closely by various types of research advancement motivations, including acquiring new ideas, building professional networks, and obtaining funding for research. More than 80 per cent of respondents rate the first two of these as somewhat or very important, while 70 per cent do the same for research funding. Conversely, only 17 per cent rate acquiring personal income as somewhat or very important, while more than half find it unimportant.

The importance of motivations for engagement is fairly stable across career stages (Fig. 3). The only dimension for which there are statistically significant differences across career stages is building of professional networks, which is more important for midcareer academics. The average score for midcareer academics is 4.3, compared to 4.0 for early-career and late-career academics ($F(2, 483) = 3.65, P < 0.05$). At the 10 per cent significance level, there are also significant differences across career stages in the motivation for securing student projects and job placements, which is less important for early-career academics. The average score for this variable is 2.9 for early-career academics, compared to 3.3 for midcareer and 3.2 for late-career academics ($F(2, 483) = 2.54, P < 0.1$). For the other types of motivation, there are only marginal and non-significant differences across career stages.

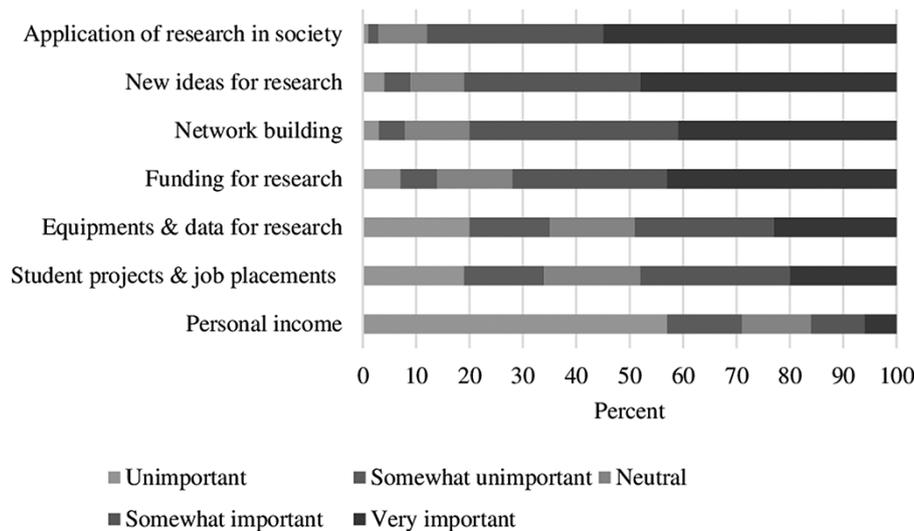


Figure 2. Importance of different motivations for academics' external engagement.

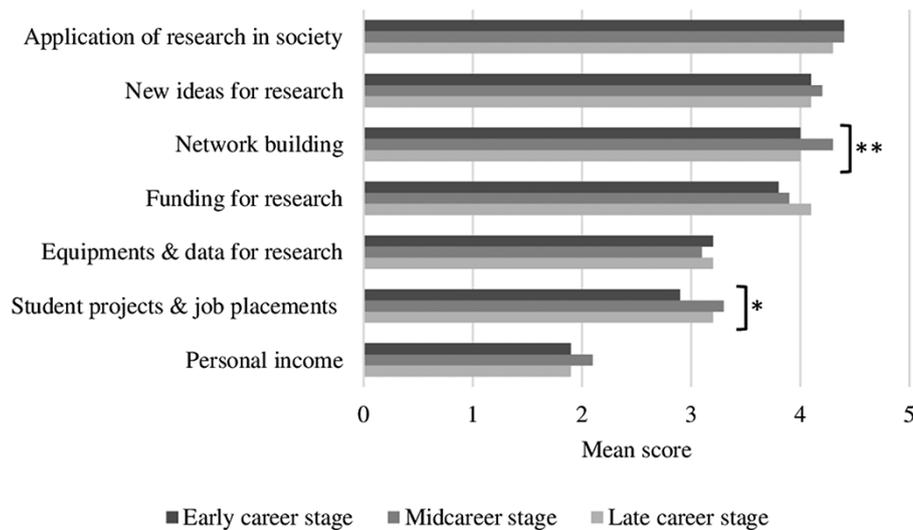


Figure 3. Importance of different motivations for academics' external engagement by career stage (mean score). *Note:* Stars indicate motivations for which there is a significant difference between groups in the mean scores. * $P < 0.1$, ** $P < 0.05$.

4.2 What motivates academics who engage more broadly?

While the analysis above shows how important academics consider different motivations for external engagement to be, the question remains which motivations are most closely related to whether academics in fact also engage more broadly in external activities. To address this, we now turn to the regression analysis.

Tables 2 and 3 present descriptive statistics and the correlations between all variables used in the analysis, respectively. The correlations among the motivation variables are low, indicating that each measures a distinct aspect of motivation. The correlation between the organizational fairness variables is somewhat higher (0.56) but still not large enough to cause multicollinearity concerns. The variance inflation factors (VIF) show a mean value of 1.35, and no variable has a VIF above 5.

Table 4 reports the results of the Poisson estimation testing the association between motivational drivers, fairness perceptions, and the external engagement of academics.

We adopt a three-step approach in the estimations. First, we specify a baseline model for the entire sample (Model 1) containing only the control variables with external engagement as the dependent variable. Next, the explanatory variables are introduced in the main model (Model 2). Finally, we add interaction terms to the main specification (Models 3–5) to assess whether the effect of each motivation on external engagement differs across career stages.

Beginning with the controls (Model 1), being female has a negative and significant effect on external engagement. This is in line with prior studies showing a gender gap in external engagement (Abreu and Grinevich 2017; Tartari and Salter 2015). The results also show that academics at late career stages tend to engage more with external actors, compared to early-career academics. This is consistent with previous research that shows experience effects in external engagement activities (D'Este and Perkmann 2011; Lam 2011). Finally, we find higher levels of engagement in biological sciences and engineering disciplines than in the social sciences.

Table 2. Descriptive statistics.

Variable	Obs.	Mean	SD	Min	Max
External engagement	625	3.05	2.34	0	9
Research advancement motivation	486	3.65	0.83	1	5
Prosocial motivation	486	4.37	0.84	1	5
Pecuniary motivation	486	1.97	1.31	1	5
Distributive fairness	598	2.67	1.07	1	5
Procedural fairness	534	2.78	0.93	1	5
Early career stage	625	0.31	0.46	0	1
Midcareer stage	625	0.43	0.50	0	1
Late career stage	625	0.26	0.44	0	1
Female	625	0.44	0.50	0	1
Age < 40	625	0.21	0.41	0	1
Age 40–49	625	0.31	0.46	0	1
Age ≥ 50	625	0.48	0.50	0	1
Professional experience	625	0.60	0.49	0	1
Biological Science & Health	625	0.18	0.39	0	1
Engineering & Natural Sciences	625	0.28	0.45	0	1
Humanities & Arts	625	0.16	0.37	0	1
Social Sciences	625	0.38	0.48	0	1

Table 3. Correlation matrix of variables.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) External engagement	1.00													
(2) Research advancement motivation	0.28*	1.00												
(3) Prosocial motivation	0.19*	0.27*	1.00											
(4) Pecuniary motivation	0.12*	0.05	0.06	1.00										
(5) Distributive fairness	0.00	0.06	0.06	−0.07	1.00									
(6) Procedural fairness	−0.04	0.00	0.02	−0.11*	0.56*	1.00								
(7) Female	−0.06	0.02	0.14*	−0.04	−0.01	−0.03	1.00							
(8) Age below 40	−0.18*	−0.01	−0.05	0.05	0.04	0.09*	0.04	1.00						
(9) Age 40 to 49	0.08*	0.01	0.04	−0.07	−0.06	0.03	0.06	−0.35*	1.00					
(10) Early career	−0.14*	−0.05	0.00	−0.06	−0.05	0.03	0.10*	0.50*	−0.12*	1.00				
(11) Late career	0.13*	−0.03	−0.06	−0.03	0.19*	0.05	−0.14*	−0.27*	−0.09*	−0.40*	1.00			
(12) Professional experience	0.15*	0.01	0.02	0.09*	−0.10*	−0.12*	0.05	−0.13*	0.04	−0.05	0.04	1.00		
(13) Engineering & Natural Sciences	0.11*	0.07	−0.10*	0.00	0.05	0.09*	−0.23*	0.13*	−0.01	0.04	0.03	−0.12*	1.00	
(14) Humanities & Arts	−0.14*	−0.06	0.11*	0.02	0.01	−0.02	0.10*	−0.06	0.05	−0.05	−0.06	0.02	−0.28*	1.00

Note: *P < 0.05. Some variables with insignificant correlation coefficients are omitted for space reasons.

In Model 2, we include the explanatory variables. All the control variables have the same signs and significance levels as in the baseline model. All types of motivations are positively and significantly associated with engaging in a broad variety of external engagement activities. Comparing the effect sizes, research advancement motivation is most closely related to external engagement, followed by prosocial motivation, while pecuniary motivation has the smallest effect. We formally test H1a and find that the coefficients for research advancement motivation and pecuniary motivation are significantly different ($\chi^2(1) = 3.92, P < 0.05$). H1b is not supported, as the difference between the coefficients

for prosocial motivation and pecuniary motivation is not statistically significant ($\chi^2(1) = 1.60, P > 0.10$). One standard deviation (SD) higher scores on research advancement motivation is associated with an 11 per cent expected increase in external engagement, while a SD increase in prosocial and pecuniary motivations is associated with 9 per cent and 8 per cent higher external engagement scores, respectively. Overall, the findings are consistent with prior studies, confirming the relevance of all motivational drivers (D’Este and Perkmann 2011; Iorio et al. 2017; van de Burgwal et al. 2019b) and the primary importance of research advancement motivation.

Table 4. Poisson regression analysis of academics' external engagement.

	Baseline model	Full model with predictors	Full models with interactions		
	(1)	(2)	(3)	(4)	(5)
Research advancement motivation		0.135 ^{***} (0.025)	0.186 ^{***} (0.052)	0.134 ^{***} (0.025)	0.134 ^{***} (0.025)
Prosocial motivation		0.104 ^{***} (0.026)	0.102 ^{***} (0.026)	0.107 ^{**} (0.050)	0.104 ^{***} (0.026)
Pecuniary motivation		0.059 ^{***} (0.017)	0.059 ^{***} (0.017)	0.059 ^{***} (0.017)	0.067 ^{**} (0.033)
Distributive fairness		-0.014 (0.023)	-0.013 (0.023)	-0.014 (0.023)	-0.014 (0.022)
Procedural fairness		-0.013 (0.026)	-0.011 (0.026)	-0.012 (0.026)	-0.013 (0.026)
Female	-0.089 ^{**} (0.045)	-0.104 [*] (0.045)	-0.108 [*] (0.045)	-0.104 [*] (0.045)	-0.106 ^{**} (0.045)
Age (Ref: Age ≥ 50)					
Age < 40	-0.026 (0.079)	-0.032 (0.072)	-0.032 (0.073)	-0.032 (0.072)	-0.034 (0.073)
Age 40–49	0.034 (0.046)	0.057 (0.043)	0.055 (0.043)	0.057 (0.043)	0.055 (0.043)
Professional experience	0.065 (0.049)	0.039 (0.045)	0.037 (0.045)	0.040 (0.045)	0.040 (0.045)
Career stage (Ref: Early career stage)					
Midcareer stage	0.104 (0.064)	0.094 (0.058)	0.467 [*] (0.247)	0.138 (0.277)	0.108 (0.096)
Late career stage	0.255 ^{***} (0.066)	0.291 ^{***} (0.062)	0.421 [*] (0.249)	0.287 (0.314)	0.323 ^{***} (0.094)
Discipline (Ref: Social Sciences)					
Bio. Sciences & Health	0.198 ^{***} (0.069)	0.227 ^{***} (0.065)	0.234 ^{***} (0.064)	0.227 ^{***} (0.065)	0.227 ^{***} (0.065)
Engineering & Nat. Sci.	0.098 [*] (0.050)	0.087 [*] (0.046)	0.088 [*] (0.047)	0.086 [*] (0.046)	0.088 [*] (0.047)
Humanities & Arts	-0.036 (0.070)	-0.053 (0.067)	-0.054 (0.067)	-0.053 (0.067)	-0.053 (0.068)
Probability of engagement	0.739 ^{***} (0.239)	0.681 ^{***} (0.221)	0.689 ^{***} (0.219)	0.682 ^{***} (0.222)	0.681 ^{***} (0.220)
Midcareer × research adv.			-0.099 (0.064)		
Late career × research adv.			-0.035 (0.064)		
Midcareer × prosocial				-0.010 (0.060)	
Late career × prosocial				0.001 (0.068)	
Midcareer × pecuniary					-0.008 (0.038)
Late career × pecuniary					-0.018 (0.041)
Constant	0.554 ^{**} (0.219)	-0.364 (0.237)	-0.567 [*] (0.291)	-0.381 (0.293)	-0.378 (0.239)
University dummies	Yes	Yes	Yes	Yes	Yes
Log likelihood	-953.881	-926.982	-926.019	-926.968	-926.914
Wald Chi ²	92.53[16] ^{***}	204.7[21] ^{***}	216.4[23] ^{***}	204.9[23] ^{***}	205.8[23] ^{***}
Pseudo R ²	0.0378	0.0650	0.0659	0.0650	0.0650
Observations	486	486	486	486	486

Note: Robust standard errors in parentheses.

***P < 0.01,

**P < 0.05,

*P < 0.10.

Contrary to expectations, academics' perceptions of the fairness of their institutions have little or no effect on external engagement. Specifically, distributive and procedural fairness have no significant relationship with external engagement in any of the models (Table 4). Therefore, Hypotheses 2a and 2b are not supported. This evidence does not

support the proposition that academics' perception of unfair compensation and promotion policies has adverse effects on their external engagement.

Models 3–5 include interaction terms to test whether the effects of academics' motivations on external engagement differ across career stages. The interaction effects

Table 5. Marginal effects of motivations at each career stage, calculated from Models (3)–(5).

	Early career	Mid career	Late career
Research advancement motivation (Model 3)	0.648 ^{***} (0.184)	0.331 ^{**} (0.144)	0.698 ^{***} (0.182)
Prosocial motivation (Model 4)	0.371 ^{**} (0.172)	0.370 ^{**} (0.139)	0.501 ^{**} (0.219)
Pecuniary motivation (Model 5)	0.233 ^{**} (0.117)	0.224 ^{***} (0.082)	0.229 [*] (0.128)

Note: Robust standard errors in parentheses.

*** $P < 0.01$,

** $P < 0.05$,

* $P < 0.10$.

between research advancement motivation and career stages are not statistically significant in Model 3. Similarly, the interactions between pecuniary motivation and career stages and between prosocial motivation and career stages are all statistically insignificant in Models 4 and 5. We further compute the marginal effects of research advancement, pecuniary, and prosocial motivations at each career stage (Table 5). The results show that the marginal effects of all motivations are positive and significant for every career stage. We, therefore, conclude that all motivational dimensions are associated with engagement at every career stage.

Table A.5 in the Appendix reports the results for the analysis of how motivations and organizational fairness affect different channels of academic engagement. The results show that the impact of different motivations is relatively consistent for all types of engagement. All three motivational dimensions are significantly associated with research-related and advise-related engagement and with relatively similar effect sizes. However, the results for education-related engagement are somewhat different. The degree to which academics participate in this type of engagement is closely associated with the strength of their research advancement motivation, while prosocial and pecuniary motivations are not significant. The latter result is not surprising, as pecuniary incentives are rare in education-related engagement compared to the other types (Orazbayeva et al. 2020). However, the importance of research advancement motivations might seem paradoxical and requires an explanation. While activities such as student supervision and engagement with external organizations for student placements or in the delivery of courses are part of the educational mission of universities, it seems that academics are often motivated to participate in these activities by the opportunities they provide to form networks with or get access to data from external organizations, which they can subsequently use to further their research (D'Este and Perkmann 2011).

5. Conclusions

Academics represent important agents driving the external engagement mission of universities. Besides teaching and research, faculty also engage in knowledge exchange activities with external partners. However, this role is often seen as insufficiently appreciated and not beneficial for progress in an academic career (Hayden et al. 2018). This raises the question of what motivates academics to participate in these activities. Various motivations, such as research advancement, pecuniary, and prosocial motivations, have been identified as

potential drivers of external engagement. This paper builds on the academic engagement literature in highlighting the influence of individual motivations and organizational fairness on external engagement.

These findings generally confirm existing research in other contexts that has shown that academics are driven by a combination of both extrinsic and intrinsic motivations (e.g. Lam 2011; D'Este and Perkmann 2011; Orazbayeva and Plewa 2020; van de Burgwal et al. 2019b). Notably, research advancement motivation is closely associated with external engagement. This is in line with studies (e.g. D'Este and Perkmann 2011) that find that academics are more inclined to engage for the purposes of obtaining knowledge, ideas, and competences present in the external environment. There may be an intrinsic element inherent in this insofar as academics may naturally want external partners to derive some benefits from knowledge exchange interactions (Lam 2011). However, academics also derive instrumental benefits for their research through external engagement, and this seems to be an important motivation to engage for many academics (D'Este and Perkmann 2011; Ramos-Vielba et al. 2016).

Furthermore, both the descriptive and regression results support recent studies (e.g. Iorio et al. 2017) that suggest that large numbers of academics collaborate with external organizations because of their desire to contribute to the wider society. However, although academics rate the importance of prosocial motivation higher than research advancement motivation, variation in the latter is at least as closely associated with engagement activities as variation in the former. We also cannot discount that respondents may exaggerate the importance of prosocial motivation to portray themselves in a positive light.

The findings also demonstrate the importance of pecuniary motivation to the external engagement of academics. While few academics consider these to be important for them, those who are motivated by pecuniary incentives do indeed tend to engage more. Nonetheless, the effect on engagement is weaker than that of research advancement motivation. This resonates with several studies (e.g. Lam 2011; D'Este and Perkmann 2011; van de Burgwal et al. 2019b) that show pecuniary motivation to be the least important driver of external engagement. But this does not suggest academics' motive to acquire financial benefits is absent or irrelevant to engagement activities, as Orazbayeva and Plewa (2020) conclude. Although pecuniary motivation may be more salient for specific engagement activities such as commercialization (Lam 2011), it may also be an underlying driver for other activities if they can provide monetary benefits to academics. Therefore, instead of playing down the role of pecuniary motivation relative to the others, it is imperative to understand that all these motivations coexist and jointly influence the engagement behavior of academics (Lam 2011; Deci and Ryan 2000).

Finally, the findings also indicate that perceptions of organizational fairness tend to play a lesser or no role in academics' engagement with external actors. Neither the perception of fairness of the outcomes nor of the procedures for determining the outcomes are associated with engagement behavior. This suggests that academics are not particularly preoccupied with organizational rewards when engaging externally. One explanation might be that the benefits academics derive from external engagement exceed the incentives and rewards they receive from their institutions (Törnblom and Kazemi 2015).

It could also reflect that academics' main loyalty are not to the university in which they work, but to the broader academic community. In this respect, improving their research impact is more important than internal organizational processes. This is especially so in an academic labor market, which is becoming more fluid and mobile (Janger and Nowotny 2016).

The study has implications for policies to promote external engagement. It is important to highlight that engagement need not come at the expense of research. On the contrary, it can provide access to funding, resources, and data that are important for developing a research agenda. Providing a foundation for research and engagement activities to mutually support each other may be important to avoid the perception that engagement represents a burden that comes at the expense of research time. Furthermore, given that academics are driven by a mix of varied motivations and values, they may be unamenable to the same incentives and rewards. Understanding which motives are important for specific groups of academics and targeting them with appropriate incentives could be an effective means to enhance engagement efforts.

There are some limitations to the study. Data were collected from a small number of universities, all with a specific ambition to excel in the engagement mission. Caution should therefore be exercised when extending these findings to other universities, although the consistency of the findings with that of previous research in other contexts suggests that they may hold more broadly (e.g. Lam 2011; D'Este and Perkmann 2011; van de Burgwal et al. 2019b). In addition, potential measurement error may be a concern in the analysis. This relates to how the motivations for engagement questions were asked. Respondents were directly asked to rate the importance of the reasons informing external engagement. Therefore, some level of social desirability bias may be present. Moreover, the cross-sectional nature of the research design limits the possibility of making causal claims. Hence, the findings should be interpreted in the light of these limitations.

These limitations notwithstanding, this study provides new evidence supporting the primacy of individual motivations in external engagement of academics. As universities work on fulfilling their third mission and policymakers devise policies to bring universities closer to society, it is important to recognize what motivates academics to engage. By highlighting the complementary effects of the desire to advance their research, contribute to society, and acquire monetary benefits, we hope to have provided useful new insights that can inform policy in this area.

Funding

This work was supported by the European Union Horizon 2020 Marie Skłodowska-Curie Actions Innovative Training Network on the Role of Universities in Innovation and Regional Development (RUNIN), grant agreement number 722295.

Conflict of interest statement. None declared.

Acknowledgements

The authors would like to thank Christian Richter Østergaard for helpful comments on a draft version of this paper, and Paul Benneworth, Ina Drejer, Dzamila Bienkowska, Magnus Klof-

sten, Emili Grifell-Tatjé, Pilar Màrques-Gou, David Charles, and Carlos Rodrigues for help in developing the survey questionnaire. Gerwin Evers, Maria Salomaa, David Fernández Guerrero, Sergio Manrique, Liliana Fonseca, Lisa Nieth, and Giuseppe Calignano also helped in the translation of the questionnaire to different languages. We are grateful to the ECIU and to university administrators at the seven case universities for their assistance in distributing the survey to respondents.

Notes

1. Organizational fairness refers to employees' perception of fairness in the processes, interactions, and outcomes in a workplace (Greenberg 1990).
2. Distributive fairness refers to an individual's evaluation of how commensurate their inputs are with rewards or recognition. Procedural fairness denotes the fairness of the procedures or rules guiding the distribution of rewards or recognition. Finally, interactional fairness represents an individual's perception of the quality of interpersonal treatment and the provision of accurate and timely information by superiors (Colquitt and Rodell 2015).
3. The aim of this data collection exercise was to examine the attitudes and perceptions of academics toward their knowledge exchange interactions with external actors. The survey comprises two main parts. The first part asks about the variety of channels through which respondents interact with external actors, the frequency, and the geographical scale, as well as the importance of various motivations for external interaction. The second part asks about perceptions of organizational fairness, attitudes toward the geographic area where the university is located, and individual and demographic characteristics.
4. We nonetheless use it in the analysis because a low alpha does not always mean a measure is not useful. Cronbach's alpha captures the correlation between the items, but research advancement may require success in different dimensions. As Schmitt (1996: 352) suggested, such a measure can still be useful when it has 'other desirable properties like meaningful content coverage of some domain.' Qualitative evaluation of the items underlying the measure indicates that they adequately cover motivation for the various dimensions involved in research advancement.
5. As robustness checks, we also estimate the model with an ordered logit and an ordinary least squares (OLS) regression. The results are presented in Tables A.3 and A.4 in the Appendix, respectively. Generally, they are not qualitatively different from the main analysis.

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Appendix

Table A.1. Summary statistics of individual items of key variables.

Variable name	Item	N	Mean	SD	Min	Max
External engagement	Giving informal advice/invited lectures	625	0.62	0.49	0	1
	Joint supervision of Masters/PhD students	625	0.30	0.46	0	1
	Arranging student projects/placements with external organizations	625	0.36	0.48	0	1
	Sitting on scientific advisory boards of external organizations	625	0.25	0.43	0	1
	Organizing training courses for employees of external companies	625	0.27	0.44	0	1
	Participating in joint research	625	0.59	0.49	0	1
	Conducting contract research	625	0.32	0.47	0	1
	Providing consultancy services	625	0.28	0.45	0	1
	Securing patents/providing licenses of inventions/creating spin-offs	625	0.06	0.25	0	1
Research advancement motivation	Gain new insights in the area of my research	486	4.17	1.04	1	5
	Build and maintain professional networks	486	4.12	0.98	1	5
	Secure access to specialist equipment, materials or data	486	3.16	1.45	1	5
	Secure funding for research	486	3.94	1.22	1	5
Prosocial motivation	Promote the practical application of my research in society	486	4.37	0.84	1	5
Pecuniary motivation	Secure personal income	486	1.96	1.31	1	5
Distributive fairness	Do your pay or promotions reflect the effort you put into your work?	625	2.53	1.16	1	5
	Do your pay or promotions reflect what you have contributed to the university?	625	2.53	1.15	1	5
	Is your pay or promotions justified, given your performance?	625	2.94	1.30	1	5
Procedural fairness	Have the procedures to determine your pay or promotions been applied consistently by your university?	625	2.85	1.17	1	5
	Have the procedures to determine your pay or promotions been based on accurate information?	625	3.10	1.16	1	5
	Have you been able to appeal the pay and promotions determined by those procedures?	625	2.42	1.07	1	5

Table A.2. Logistic regression analysis of academics' external engagement.

	Probability of engagement
Research time	-0.053 (0.104)
Teaching time	0.163 (0.129)
Outreach time	0.340*** (0.120)
Administration time	-0.669*** (0.121)
Female	0.385* (0.231)
Age (Reference: Age \geq 50)	
Age < 40	-0.705** (0.324)
Age 40–49	0.061 (0.282)
Professional experience	0.636*** (0.226)
Career stage (Reference: Early career stage)	
Midcareer stage	0.319 (0.297)
Late career stage	0.149 (0.344)

(continued)

Table A.2. (Continued)

	Probability of engagement
Discipline (Reference: Social Sciences)	
Bio. Sciences & Health	−0.651** (0.293)
Engineering & Nat. Sci.	0.023 (0.305)
Humanities & Arts	−0.775** (0.317)
Constant	1.919*** (0.612)
University dummies	Yes
Log likelihood	−285.690
Pseudo R ²	0.137
Observations	625

Note: Robust standard errors in parentheses.

***P<0.01,

**P<0.05,

*P<0.1.

Table A.3. Ordered logistic regression analysis of academics' external engagement—robustness check.

	Baseline model	Full model with predictors	Full models with interactions		
	(1)	(2)	(3)	(4)	(5)
Research advancement motivation		0.584*** (0.136)	0.797*** (0.252)	0.583*** (0.136)	0.588*** (0.136)
Prosocial motivation		0.418*** (0.127)	0.414*** (0.127)	0.315 (0.202)	0.430*** (0.128)
Pecuniary motivation		0.280*** (0.095)	0.296*** (0.094)	0.281*** (0.096)	0.190 (0.191)
Distributive fairness		−0.051 (0.110)	−0.062 (0.111)	−0.046 (0.112)	−0.050 (0.109)
Procedural fairness		0.031 (0.101)	0.060 (0.102)	0.032 (0.100)	0.028 (0.101)
Female	−0.357* (0.183)	−0.327 (0.215)	−0.312 (0.217)	−0.324 (0.215)	−0.345 (0.219)
Age (Ref: Age ≥ 50)					
Age < 40	−0.032 (0.304)	−0.137 (0.347)	−0.182 (0.344)	−0.136 (0.347)	−0.116 (0.352)
Age 40–49	0.201 (0.191)	0.046 (0.215)	0.049 (0.214)	0.070 (0.220)	0.044 (0.215)
Professional experience	0.314 (0.198)	0.168 (0.226)	0.169 (0.230)	0.166 (0.229)	0.151 (0.227)
Career stage (Ref: Early career stage)					
Midcareer stage	0.483** (0.238)	0.420 (0.267)	2.589** (1.203)	0.021 (1.210)	0.130 (0.453)
Late career stage	1.146*** (0.285)	1.089*** (0.312)	0.922 (1.309)	0.112 (1.417)	0.987** (0.482)
Discipline (Ref: Social Sciences)					
Bio. Sciences & Health	0.691** (0.284)	1.269*** (0.330)	1.332*** (0.333)	1.266*** (0.330)	1.280*** (0.330)
Engineering & Nat. Sci.	0.386* (0.214)	0.431* (0.238)	0.465* (0.240)	0.432* (0.239)	0.431* (0.241)
Humanities & Arts	−0.101 (0.271)	−0.056 (0.316)	−0.064 (0.313)	−0.041 (0.319)	−0.036 (0.324)
Probability of engagement	2.767*** (1.016)	3.701*** (1.094)	3.697*** (1.057)	3.736*** (1.098)	3.736*** (1.095)
Midcareer × research adv.			−0.562* (0.308)		
Late career × research adv.			0.046 (0.341)		
Midcareer × prosocial				0.088 (0.266)	
Late career × prosocial				0.224 (0.314)	
Midcareer × Pecuniary					0.146

(continued)

Table A.3. (Continued)

	Baseline model		Full model with predictors		Full models with interactions		
	(1)	(2)	(3)	(4)	(5)	(5)	(5)
Late career × pecuniary							(0.201) 0.060 (0.217)
Constant	–	–	–	–	–	–	
University dummies	Yes	Yes	Yes	Yes	Yes	Yes	
Log likelihood	–942.123	–768.267	–765.363	–767.953	–767.953	–767.882	
Wald Chi ²	70.19[16] ^{***}	131.1[21] ^{***}	137.5[23] ^{***}	132.3[23] ^{***}	132.3[23] ^{***}	132.5[23] ^{***}	
Pseudo R ²	0.0432	0.0808	0.0843	0.0812	0.0812	0.0813	
Observations	486	486	486	486	486	486	

Note: Robust standard errors in parentheses.
 ***P < 0.01,
 **P < 0.05,
 *P < 0.1.

Table A.4. OLS regression analysis of academics’ external engagement—robustness check.

	Baseline model		Full model with predictors		Full models with interactions		
	(1)	(2)	(3)	(4)	(5)	(5)	(5)
Research advancement motivation		0.509 ^{***} (0.097)	0.581 ^{***} (0.172)	0.508 ^{***} (0.097)	0.508 ^{***} (0.097)	0.508 ^{***} (0.097)	
Prosocial motivation		0.364 ^{***} (0.091)	0.362 ^{***} (0.091)	0.347 ^{**} (0.153)	0.364 ^{***} (0.091)	0.364 ^{***} (0.091)	
Pecuniary motivation		0.221 ^{***} (0.072)	0.224 ^{***} (0.071)	0.221 ^{***} (0.072)	0.232 [*] (0.129)	0.232 [*] (0.129)	
Distributive fairness		–0.062 (0.092)	–0.054 (0.091)	–0.063 (0.092)	–0.061 (0.091)	–0.061 (0.091)	
Procedural fairness		–0.047 (0.107)	–0.041 (0.107)	–0.044 (0.107)	–0.048 (0.107)	–0.048 (0.107)	
Female	–0.334 [*] (0.176)	–0.369 ^{**} (0.177)	–0.380 ^{**} (0.177)	–0.368 ^{**} (0.178)	–0.371 ^{**} (0.180)	–0.371 ^{**} (0.180)	
Age (Ref: Age ≥ 50)							
Age < 40	–0.087 (0.298)	–0.103 (0.276)	–0.109 (0.277)	–0.103 (0.276)	–0.105 (0.276)	–0.105 (0.276)	
Age 40–49	0.137 (0.189)	0.205 (0.176)	0.193 (0.177)	0.210 (0.178)	0.203 (0.177)	0.203 (0.177)	
Professional experience	0.283 (0.195)	0.155 (0.182)	0.148 (0.183)	0.155 (0.183)	0.156 (0.184)	0.156 (0.184)	
Career stage (Ref: Early career stage)							
Midcareer stage	0.391 [*] (0.237)	0.347 (0.223)	1.257 (0.841)	0.389 (0.890)	0.371 (0.361)	0.371 (0.361)	
Late career stage	1.037 ^{***} (0.268)	1.181 ^{***} (0.254)	0.927 (0.860)	0.889 (1.090)	1.218 ^{***} (0.384)	1.218 ^{***} (0.384)	
Discipline (Ref: Social Sciences)							
Bio. Sciences & Health	0.759 ^{***} (0.289)	0.874 ^{***} (0.278)	0.898 ^{***} (0.275)	0.875 ^{***} (0.278)	0.874 ^{***} (0.277)	0.874 ^{***} (0.277)	
Engineering & Nat. Sci.	0.394 [*] (0.210)	0.358 [*] (0.195)	0.355 [*] (0.195)	0.355 [*] (0.196)	0.359 [*] (0.197)	0.359 [*] (0.197)	
Humanities & Arts	–0.088 (0.243)	–0.132 (0.242)	–0.129 (0.243)	–0.124 (0.245)	–0.132 (0.245)	–0.132 (0.245)	
Probability of engagement	2.590 ^{***} (0.868)	2.383 ^{***} (0.808)	2.397 ^{***} (0.802)	2.408 ^{***} (0.814)	2.384 ^{***} (0.811)	2.384 ^{***} (0.811)	
Midcareer × research adv.			–0.247 (0.228)				
Late career × research adv.			0.068 (0.234)				
Midcareer × prosocial				–0.010 (0.198)			
Late career × prosocial				0.067 (0.241)			
Midcareer × pecuniary						–0.013 (0.150)	

(continued)

Table A.4. (Continued)

	Baseline model	Full model with predictors	Full models with interactions		
	(1)	(2)	(3)	(4)	(5)
Late career × pecuniary					−0.021 (0.174)
Constant	1.017 (0.808)	−2.268** (0.877)	−2.557** (1.028)	−2.214** (1.005)	−2.286** (0.893)
University dummies	Yes	Yes	Yes	Yes	Yes
Log likelihood	−957.9	−922.2	−921	−922.2	−922.2
F statistic	5.6[16, 469]***	9.2[21, 464]***	8.8[23, 462]***	8.3[23, 462]***	8.4[23, 462]***
R ²	0.165	0.279	0.282	0.279	0.279
Observations	486	486	486	486	486

Note: Robust standard errors in parentheses.

***P < 0.01,

**P < 0.05,

*P < 0.1.

Table A.5. Poisson regression analysis of different channels of external engagement.

	Education-related engagement	Research-related engagement	Advise-related engagement
	(1)	(2)	(3)
Research advancement motivation	0.283*** (0.048)	0.056* (0.033)	0.081** (0.031)
Prosocial motivation	0.047 (0.046)	0.106*** (0.034)	0.138*** (0.041)
Pecuniary motivation	0.023 (0.030)	0.083*** (0.022)	0.062*** (0.021)
Distributive fairness	0.017 (0.039)	−0.033 (0.028)	−0.000 (0.029)
Procedural fairness	−0.027 (0.043)	0.048 (0.031)	−0.056 (0.037)
Female	−0.098 (0.076)	−0.059 (0.053)	−0.109* (0.058)
Age (Ref: Age ≥ 50)			
Age < 40	−0.081 (0.120)	0.030 (0.092)	0.061 (0.105)
Age 40–49	−0.036 (0.071)	0.102* (0.056)	0.091 (0.058)
Professional experience	−0.007 (0.072)	−0.027 (0.055)	0.071 (0.063)
Career stage (Ref: Early career stage)			
Midcareer stage	0.041 (0.100)	0.142* (0.075)	0.095 (0.085)
Late career stage	0.197* (0.101)	0.275*** (0.082)	0.326*** (0.090)
Discipline (Ref: Social Sciences)			
Bio. Sciences & Health	0.359*** (0.104)	0.167** (0.076)	0.087 (0.079)
Engineering & Nat. Sci.	0.234*** (0.083)	0.043 (0.062)	−0.163** (0.067)
Humanities & Arts	−0.075 (0.132)	−0.153* (0.091)	−0.029 (0.084)
Probability of engagement	1.126** (0.442)	0.024 (0.268)	0.963*** (0.307)
Constant	−2.161*** (0.475)	−0.929*** (0.302)	−1.395*** (0.353)
University dummies	Yes	Yes	Yes
Log likelihood	−615.294	−574.250	−652.319
Wald Chi ²	132.4[21]***	139.3[21]***	97.59[21]***
Pseudo R ²	0.0629	0.0280	0.0373
Observations	486	486	486

Note: Robust standard errors in parentheses.

***P < 0.01,

**P < 0.05,

*P < 0.1.