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Breach of academic values and digital deviant behaviour: The case of Sci-Hub

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Breach of Academic Values and Digital Deviant Behaviour: the Case of Sci-Hub

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Breach of Academic Values and Digital Deviant Behaviour: the Case of Sci-Hub

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ABSTRACT

This paper bridges the organisational psychology and the economics of science literature to examine the role of ideology-based psychological contract breach in eliciting mild deviant behaviour in academia. We provide empirical evidence of how the deterioration of academic values related to the diffusion of the “publish or perish” paradigm sparkles copyright violations through Sci-Hub. Based on a representative sample of 2849 academics working in top institutions in 6 European countries, we find that ideology-based psychological contract breach explains Sci-Hub usage, also when controlling for other trivial motivations. The magnitude of the effect depends on contextual and demographic characteristics. Females, foreign and tenured scholars are less likely to respond with digital piracy when experiencing a contract breach of academic values. Our results contribute to prevention policy design, highlighting how policies restoring academic values might also address academic piracy.

KEYWORDS

Academic Values; Digital Piracy; Deviant Behaviour; Psychological Contract Breach; Sci-Hub.

JEL classification: D23, L86, O34

1. Introduction

Deviant workplace behaviour (DWB), or more generally counter-productive work behaviour (CWB), such as absenteeism, retaliation, sabotage, aggression, and violence, generates risks and costs for organisations (Spector, Fox, & Domagalski, 2006; Zaghini, Fida, Caruso, Kangasniemi, & Sili, 2016). These hazards also affect academia, and previous literature mostly looked at academic dishonesty and cheating behaviour of college students during exams or evaluations (Farnese, Tramontano, Fida, & Paciello, 2011; S. D. Lee, Kuncel, & Gau, 2020; McCabe, Treviño, & Butterfield, 2001; Whitley, 1998). However, research-related scandals¹, such as the well-known case of Stapel (Bhattacharjee, 2013), exacerbate the growing public interest in scholars' deviant research-related behaviour or opaque practices. A growing literature documents deviant or misbehaviour in academia, such as data fabrication (Fanelli, 2009), citation manipulation (Fong & Wilhite, 2017), plagiarism (Karabag & Berggren, 2012), questionable research practices (Necker, 2014), and misbehaviour in authorship (Smith et al.,

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¹See also <https://retractionwatch.com> for a collection of retraction cases (Last Access November 2022).

2020) to name a few.

Nevertheless, not all transgressions are extreme. Some mild ones might be pretty diffused or socially accepted, as in the case of academic software (Rahim, Rahman, & Seyal, 2000; Santillanes & Felder, 2015; Wickham, Plotnicki, & Athey, 1992) or article (Duić, Konjevod, & Grzunov, 2017; Hoy, 2017; Nicholas et al., 2017) piracy. Interestingly, academic piracy mainly harms third parties (e.g. publishers and software companies) and often stems from time or financial constraints. Thus, in most cases, it is undetected, tolerated, or even encouraged by universities. This paper investigates one specific academic deviant behaviour: using Sci-Hub to access scientific literature. The illegal downloading of scientific articles is a form of academic piracy, a mild deviant behaviour that violates publishers' copyright.

We focus on such a mild transgression because it might signal the beginning of negative feedback loops generating future more deviant severe behaviours. The literature interested in preventing DWB describes the diffusion of thereof as a snowball effect. Those studies underline the need to investigate mild transgressions and their determinants, as they might go unnoticed before they escalate (Griep & Vantilborgh, 2018; Spector et al., 2006). Past literature examines escalatory patterns where negative experiences, such as stress, conflicts, changes, and bureaucratic control, generate a perceived sense of injustice and negative emotions that induce CWB feeding subsequent transgressions (J. A.-M. Coyle-Shapiro, Pereira Costa, Doden, & Chang, 2019; Griep & Vantilborgh, 2018).

The literature on psychological contract breaches indicates that a trigger of DW is the experience of a contract breach. Every worker has an implicit psychological contract with their organisation, a set of beliefs about jobs' rights and duties. When the worker perceives a betrayal of those beliefs, the contract has been breached, and this experience elicits deviant behaviours (J. A.-M. Coyle-Shapiro et al., 2019; O'Donohue, Sheehan, Hecker, & Holland, 2007). Besides the extensive empirical evidence that experiencing contract breaches induces deviant behaviour (J. A.-M. Coyle-Shapiro et al., 2019), most studies examine the economic or socio-emotional dimensions of psychological contracts, not addressing the characteristics of specific professions. Thompson and Bunderson (2003) highlights that in some cases and professions, the psychological contract might also have an ideological base. Those ideology-based contracts are a credible commitment of workers to pursue a valued cause which goes beyond self-interest and constitutes the nexus of the individual and his/her profession (O'Donohue et al., 2007). Indeed, many professions have a valued cause intrinsic to them called "ideological currency" (Bunderson, 2001; J. A.-M. Coyle-Shapiro et al., 2019). For example, a nurse might feel the responsibility of saving lives (Krause & Moore, 2017) or a researcher might feel the one of advancing the knowledge frontier (O'Donohue et al., 2007).

The motivations for the academic profession are the quest for knowledge and confidence in scientific inquiry. These motivations drive academic values: interest in fundamental knowledge and curiosity-driven research, a lack of bureaucratic control and freedom of time allocation, an interest in sharing knowledge, and a reward system based on status and prestige rather than monetary rewards (Sauermann & Stephan, 2013). These values constitute the backbone of the ideology-based psychological contract of the academic profession (Merton, 1973; Sauermann & Stephan, 2013). However, these values are fading under global trends, such as the increase of teaching and administrative load², of short-term positions and, in par-

²See the recent article of Kathleen R. Brewer in the Financial Times about the Management Bloat <https://www.ft.com/content/338d7321-bc87-4573-885e-565f34a80b30>

ticular, the pressure on publishing and funding (Bryson, 2004; Carvalho & Santiago, 2010; Chatelain-Ponroy, Mignot-Gérard, Musselin, & Sponem, 2018; Siekkinen, Pekkola, & Carvalho, 2020).

These trends have increased academic discontent due to the reduction of scholars' time-allocation freedom, the lower recognition from pursuing curiosity-driven research, and a generalised emphasis on results' "publishability". This last change has been popularised with the expression "publish-or-perish", which emphasises how pivotal publishing is in proving academic lead.

Besides the recent acceleration, the "publish-or-perish" potential harm to the fundamental principle of research and academic values has been known since the 1940s (Garfield, 1996). In 1972, the political philosopher Hannah Arendt argued:

"This business of 'publish-or-perish' has been a catastrophe. People write things which should never have been written and which should never be printed. Nobody's interested. But for them to keep their jobs and get the proper promotion, they've got to do it. It demeans the whole of intellectual life."

Hannah Arendt 13th July 1972 panel discussion titled "Values in Contemporary Society"

Today's centrality of the "publish-or-perish" paradigm makes scientific publishers a crucial third party for the academic profession. Publishers' concern about bibliometric indicators and rankings is relevant to journals' marketability. However, it often contrasts with intrinsic research quality. For example, in a provocative commentary article, Kirchherr (2022) refers to 50% of publications in the field of sustainability as academic bullshit where "low-quality articles" are published to enhance journals' metrics. Besides quality concerns, two facts exacerbate the dystonia between publishers' interests and academic values. On the one hand, publishers are responsible for appointing journal editors and certifying the "quality" of scientific research through their journals' prestige and bibliometric indicators. On the other hand, expensive subscriptions to scientific publications can restrict access and harms individuals' careers.

In this paper, we explore how the experience of a breach of academic values (i.e. a loss of faith in knowledge and science), formally an ideology-based psychological contract breach, predicts deviant behaviour toward scientific publishers, as the use of Sci-Hub. We examine it after controlling for common antecedents of digital piracy and trivial explanations for using Sci-Hub (i.e. to save time and for lack of journal access).

Additionally, while existing literature on academics' copyright violation and deviant behaviour focuses on either one scientific discipline (Boudry et al., 2019a; Karabag & Berggren, 2012; Mejia et al., 2017; Necker, 2014), one country (Duić et al., 2017; Meyer & McMahon, 2004), or small samples without systematic survey strategies (Fanelli, 2009; Nicholas et al., 2017, 2019), we overcome these data limitations using new survey data on 2849 academics in 30 top institutions in 6 European countries (i.e. Germany, Hungary, Ireland, Italy, The Netherlands, and Sweden) collected in 2021.

Our results indicate that scholars experiencing a contract breach of academic values provoking academic discontent are more likely to use Sci-Hub. Additionally, we find that its relative magnitude changes depending on contextual and demographic moderating factors. Our results underline that demographic characteristics and job security moderate the link between academic discontent and Sci-Hub use. These results imply that any policy aiming to prevent deviant behaviour against publishers must simultaneously address access needs, contextual workplace characteristics, and the consequences of increasing dystonia between copyright

and academic values.

This paper makes three contributions which provide a fresh and original perspective on mild DWBs. First, we contribute to the theory by combining the organisational psychology literature with the economics of science literature. Relying on both allows underpinning better the peculiarity of academics and the relevance of specific ideological values (i.e. academic values). Second, we provide novel empirical evidence on the diffusion of mild DWBs across disciplines, universities, and countries. We also examine the role of emotions connected to a breach of ideology-based psychological contracts in eliciting mild deviant behaviours. Third, our results inform administrators and policymakers on policies targeting DWBs prevention, specifically academic digital piracy. Identifying DWB triggers and more resilient workers help to design policy interventions at any level better.

The paper is structured as follows: Section 2 discusses the theoretical framework and hypothesis development. Section 3 describes the data, the variables and the method, and Sections 4 and 5, respectively, present and discuss the empirical findings. Conclusions will follow.

2. Theoretical Framework and Hypothesis Development

From the theoretical perspective, we combine two separate streams of literature. First, we use the organisational psychology literature, which examines the role of psychological contract breaches in eliciting deviant behaviours. Second, we leverage the economics of science literature to account for the academic's specificities and highlight the ideological dimension of the implicit contract in academic research.

The frustration-aggression model (Fox & Spector, 1999), and more recent empirical studies on deviant behaviour (K. Lee & Allen, 2002; Xu, Luo, & Hsu, 2020) emphasise that negative emotions (or feelings) related to the workplace increase the likelihood of deviant behaviours. Such emotions might develop from a breach of the implicit psychological contract that workers form with their organisation (Conway & Briner, 2009). Past research examines how the perception of a contract breach negatively affects employees' attitudes and behaviours towards the employing organisation, internal parties, and external parties (J. A.-M. Coyle-Shapiro et al., 2019). Regarding attitudes, the literature indicates that contract breach decreases: employees' affective organisational commitment (Restubog, Bordia, & Tang, 2006), organisational trust (Robinson & Wolfe Morrison, 2000), public sector commitment (Conway, Kiefer, Hartley, & Briner, 2014), job satisfaction (Conway, Guest, & Trenberth, 2011), perceived organisational support (J. A. Coyle-Shapiro & Conway, 2005), organisational identification (Zagenczyk et al., 2013) and increases turnover intention (Orvis, Dudley, & Cortina, 2008), mistrust (Ann Feldheim, 2007), and organisational cynicism (Johnson & O'Leary-Kelly, 2003). Similarly, the experience of contract breach negatively affects employees' behaviour reducing performance (S. P. Costa & Neves, 2017), organisational citizenship behaviour (Restubog, Bordia, Tang, & Krebs, 2010) and increasing deviance (Bordia, Restubog, & Tang, 2008), absenteeism (Deery, Iverson, & Walsh, 2006), turnover (Karagonlar, Eisenberger, & Aselage, 2016) and negative behaviour towards clients or external users (Conway et al., 2014; Deng, Coyle-Shapiro, & Yang, 2018). While the implicit contract between employer and employees certainly relates to economic and professional aspects, some professions entail an ideological element defined as a credible commitment of workers to pursue a valued cause beyond the self-interest and intrinsic to the profession (Bunderson, 2001; O'Donohue et al., 2007; Thompson & Bunderson, 2003). The literature highlights this possibility; however, only a few studies looked at the consequences of such specific psychological contract breaches, failing to account for the specific characteristics of each profession (J. A.-M. Coyle-

Shapiro et al., 2019).

The academic profession is characterised by a shared adherence to academic values and beliefs that differ from other “knowledge workers” (Siekkinen et al., 2020). Examining 5000 US life scientists and physical scientists working either in the industry or in academia, Sauermann and Stephan (2013) show that academics have a different value system compared with corporate scientists testifying the existence of academic values. Academic values are implicit, unspoken values, beliefs, and rules about the academic profession. In contrast to commercial values, individuals endowed with academic values “prefer” the quest for fundamental knowledge and curiosity-driven research upon applied incremental research, research freedom over bureaucratic control, peer recognition over monetary rewards, and open disclosure of research results in the form of publication over patent activity (Agarwal & Ohyama, 2013; Merton, 1973; Sauermann & Stephan, 2013). Unlike other types of work, those who choose an academic career are willing to “pay to be a scientist” as they accept lower wages compared to corporate scientists that might experience publishing restrictions (Sauermann & Roach, 2014; Stern, 2004,?).³ The diffusion of such values and the willingness to earn less to adhere to them indicates that the implicit contract characterising the academic job has a strong ideological dimension.

In the case of academics, beliefs concerning their job relate to terms and conditions (such as duties and rights, job security, career development, and work-life balance) and loyalty to academic value. Any systematic dyscrasia between academics’ experience and expectations about both dimensions breaches the contract between an academic and its institution.

Increasing performance-based managerialism, bureaucratisation, university market-like behaviour (Chatelain-Ponroy et al., 2018; Siekkinen et al., 2020; Walsh & Lee, 2015), as well as changes in sizes and the shift to short-term contracts (Bryson, 2004; Cyranoski, Gilbert, Ledford, Nayar, & Yahia, 2011; Hakala, 2009), have enormously changed the academic work. Whether these changes are good or bad, they might have altered the inner perception of academics regarding their job and the profession’s core values, producing more significant responses than general administrative psychological contract breach (Bunderson, 2001).

A significant change in the academic profession is the diffusion of the “publish or perish” paradigm. This principle makes scholars more concerned about the publishability of their results, affecting topic choices and reducing scholars’ freedom in pursuing curiosity-driven research. This reduced freedom undermines one of the scientific research’s fundamental principles, harming academic values. A secondary but not less important consequence of the emergence of the “publish or perish” culture is the identification of scientific publishers as a relevant third party, contributing to jeopardising academic values. While scientific publishers restrict access to science and exploit academic free work (i.e. editors and referees often work for free), scholars have little choice about their publishing outlets as scientific publishers act as the certifiers of research quality.

Thus, the experience of a contract breach derived from undermining academic values related to the emergence of the “publish or perish” paradigm triggers a reaction towards scientific publishers. Therefore, we hypothesise:

H1: *Academics perceiving a contract breach because of academic discontent are more likely to violate copyright using Sci-Hub.*

³Based on a sample of 164 multiple job offers received by 66 Ph. D.s in Biology, Stern (2004) estimates that scientists accept a wage 14,000\$ lower to have the freedom to publish their results.

2.1. Moderating Factors

While we expect that perceiving an ideology-based contract breach relates positively to deviant behaviour against publishers, some employees' characteristics might moderate the relation.

A large body of literature highlights gender discrimination in the workplace in general (Coffman, Exley, & Niederle, 2021; Heilman & Caleo, 2018; Snizek & Neil, 1992; Trentham & Larwood, 1998) and academia in particular. Female scholars are underrepresented across fields and job ranks (Kahn & Ginther, 2017; Rossello, 2021), less likely to be promoted (De Paola & Scoppa, 2015), are paid less (Barbezat & Hughes, 2005) and obtain lower recognition from co-authorship (Sarsons, 2017). The presence of gender stereotypes and discrimination affects women's careers and often makes academia a male-dominated environment. However, the women who make it through might have developed strategies to cope with such environment. Recent theoretical work explores the link between female discrimination and resilience (Bridges, Wulff, & Bamberly, 2021). It highlights that females with high individual resilience are more likely to thrive in a male-dominated environment. Thus, females pursuing an academic career might be used to negative experiences in the workplace and resilient in response to academic discontent.

This widespread resignation to the current "status quo" makes women decouple their career expectations from their publication performance. In a nutshell, while aware of likely "perish", women are more indifferent to the "publish or perish" paradigm. This unconcern is supported by the empirical evidence that women publish fewer articles than males colleagues (Rossello, Cowan, & Mairesse, 2020) and are less interested in competition (Dato & Nieken, 2014).

Furthermore, a recent meta-analysis confirms that, in general, females are less likely to engage in CWB (Ng, Lam, & Feldman, 2016), and less involved in DWBs such as workplace aggression (Hershcovis et al., 2007), sabotage (Dato & Nieken, 2014), and digital piracy (Duić et al., 2017; Mejia et al., 2017).

Thus, we hypothesize:

H2 *Female academics perceiving a contract breach because of academic discontent are less likely to violate copyright using Sci-Hub than male colleagues.*

Foreign workers are part of a minority in the workplace and, similarly to females, experience discrimination (Aguirre, 2020; Dupree & Boykin, 2021). The theoretical link between discrimination and resilience applies to workers from a minority too (Bridges et al., 2021). Thus, the foreign workers that continue their careers at universities might have developed high individual resilience to thrive in a context dominated by white males.

Additionally, they might be less susceptible to the "publish-or-perish" paradigm for their attitudes towards competition and topic choices. On the one hand, ethnic minorities are less individualistic and responsive to competition than white males (Cox, Lobel, & McLeod, 1991). And on the other hand, they are interested in topics systematically found less likely to be funded (Hoppe et al., 2019) or published (Zeina, Balston, Banerjee, & Woolf, 2020).

Past experiences of discrimination can make foreign scholars more resilient to academic discontent, moderating the link between ideology-based psychological contract breaches and deviant behaviour. Thus:

H3 *Foreign academics perceiving a contract breach because of academic discontent are less likely to violate copyright using Sci-Hub than non-foreign colleagues.*

Besides gender and nationality, some context-specific features, such as job insecurity, play a role in strengthening the relationship between psychological contract breach and deviant

behaviour (S. Costa & Neves, 2017; J. A.-M. Coyle-Shapiro et al., 2019; Piccoli & De Witte, 2015). Employees' job insecurity generates the perception of a lack of reciprocity because the organization signals to its employees that it does not value their contribution (Piccoli & De Witte, 2015). In academia, non-tenured faculty is under pressure on publishing to progress. Based on a sample of 448 tenured and non-tenured faculty members in management departments in the US, Miller, Taylor, and Bedeian (2011) find that tenured faculty feel less pressure for publishing than non-tenured ones. Overall, non-tenured academics are strongly affected by the diffusion of the "publish or perish" culture that jeopardizes academic values. Accordingly, we hypothesize:

H4 *Tenured academics perceiving a contract breach because of academic discontent are less likely to violate copyright using Sci-Hub than non-tenured.*

3. Data & Methods

3.1. Survey Method

We test our hypothesis using an original database collected through an online survey targeting the top 5 universities according to the 2021 Times Higher Education (THE) World University Ranking⁴ in Germany, Hungary, Ireland, Italy, Netherlands, and Sweden.⁵ We select these countries to account for different types of European university systems (Center-European, Southern-European, Northern-European, Eastern-European, and Anglo-Saxon) and to ensure representativeness across Europe.⁶

We directly distributed the survey between June and October 2021 through university email addresses we web-scraped from each institution's website. We collected approximately 104,000 email addresses, scraping information from more than 19,700 web pages of 30 universities.⁷ This collection strategy allows us to cover all academic fields (including humanities) and all types of contracts (part-time, contract professors, teaching contracts); however, we oversampled our population. While we tried to target all the academics with any research or teaching activities and job contracts in the select universities, each country has different rules, and each university might show emails differently on its website. For instance, in many cases, we could not identify and exclude the administrative personnel not involved in research and teaching activities. Our average response rate is 4% and ranges between 3% to 7% de-

⁴See THE website for details about their ranking methods https://www.timeshighereducation.com/world-university-rankings/2021/world-ranking#!/page/0/length/25/sort_by/rank/sort_order/asc/cols/stats; Last access November 2021

⁵See table A1 in the Appendix for the list of universities in each country. We decided to exclude from our sample medical schools because too small and our institution (SSSA) to avoid biases in responses. Furthermore, we withdrew Wageningen University & research as the university denied permission to distribute our survey to the faculty directly. Their proposed delivery method was not scientifically sound for this research purpose.

⁶The selected countries represent the different universities systems: Center-European (Germany), Souther-European (Italy), Northern-European (Netherlands, Sweden), Eastern-European (Hungary), and Anglo-Saxon (Ireland). Germany is the most populous European country and represents Center-European university systems. Italy has the oldest university in the world (the University of Bologna funded in 1088), is the 3rd most populous European country and represents Southern-European university systems. Germany and Italy are among the largest university systems in Europe (<https://www.statista.com/statistics/918403/number-of-universities-worldwide-by-country/>). The Irish university system has similarities with the UK and a hybrid public-private system. The Netherlands and Sweden represent Northern-European countries with a relatively small population but primarily focus on technology and research. Hungary represents Eastern European university systems and has a long historical tradition in research. It is the 25th country in the world for relative research spending (https://en.wikipedia.org/wiki/Science_and_technology_in_Hungary#Nobel_Prize_laureates)

⁷We gathered more than 130,000 email addresses; however, some were not existing or contained errors. We sent our survey to 104,020 valid email addresses distributed by country as follows: 21,563 Germany; 10,000 Hungary; 10,670 Ireland; 20,619 Italy; 20,002 The Netherlands; and 21,166 Sweden.

pending on the country.⁸

Considering that we sent the survey to the population working at those 30 target universities, our sample of 2849 responses represents our target population well. Indeed, the representative sample size of a population of 104020 people with a selected margin of error of 3% and a confidence level of 99% is 1811; way below our sample size.⁹

In our sample 40% of respondents are females, 20% are foreigners¹⁰, 60% are faculty members¹¹, and the average age is 45 years. Looking at respondents by country, 16% are from Germany; 6% from Hungary; 10% from Ireland; 33% from Italy; 15% from The Netherlands; and 19% from Sweden. The distribution of respondents by field is 18% Life Sciences (LS); 29% Physical Sciences & Engineering (PE); 42% Social Sciences & Humanities (SH); the remaining 11% conduct cross-domain research.¹²

The questionnaire and additional details on the survey methods are available in Rossello, Martinelli, Ferri, and Donnellan (2022). The data that support the findings of this study are available from the corresponding author upon request. Our study received the ethical approval from Scuola Superiore Sant'Anna Research Ethics committee on the 11th February 2021.

3.2. *Measuring Ideology-Based Psychological Contract Breach*

Most of the literature in organizational psychology measures psychological contract breach using Likert scales or dichotomous variables derived from survey data (J. A.-M. Coyle-Shapiro et al., 2019; Robinson & Brown, 2004). In the first case, a sentence related to contract fulfilment or breach is included in the survey and respondents indicate to what extent they agree or disagree with it. The advantage of this approach is developing a standardized measure that considers breach as a nuanced process and not a discrete event. However, some scholars have argued that psychological contract breach is discrete, either occurs or do not, and therefore, individual evaluation might be complex, leading to possible measurement errors (Robinson & Brown, 2004).

In our survey, we adopted the second approach, and we asked “*What are for you the most negative aspects of being an academic*” where respondents could select one or more items from the following 13:

- (1) *teaching responsibilities (TEACHING_LOAD);*
- (2) *administrative responsibilities (ADMINISTRATIVE_LOAD);*
- (3) *not being prepared, emotionally for distressing aspects of competition (COMPETITION_LOAD);*
- (4) *being unable to concentrate on my research (LACK_RESEARCH_TIME);*
- (5) *feeling under pressure to proceed in the career (CAREER_STRESS);*
- (6) *the behaviour of junior colleagues (BEHAVIOR_JUNIOR_COLLEAGUES);*
- (7) *the behaviour of senior colleagues (BEHAVIOR_SENIOR_COLLEAGUES);*
- (8) *the inadequate facilities or funding (LACK_FUNDING_FACILITIES);*
- (9) *being away from home (HOMESICKNESS);*

⁸ As a back-of-the-envelope calculation since for most universities the ratio between faculty and administrative personnel is 1:1 or 1:2, roughly we can estimate that more than half of our emails were sent to them. Thus reducing the denominator by half, our response rate will be about 8%.

⁹ <https://www.checkmarket.com/sample-size-calculator/>; last access November 2021

¹⁰ Among the scholars with a foreign nationality the 31% come from a developing or emerging economy.

¹¹ As faculty, we consider professors, researchers, and lecturers while non-faculty are PhDs, Post-Doc, Administrative staff and others.

¹² They report more than one broad ERC field (PE, SH, and LS).

- (10) *the feeling that sometimes my research is a waste of time (RESEARCH_WASTE_TIME);*
(11) *the feeling that sometimes my research is a waste of public money (RESEARCH_WASTE_MONEY)*
(12) *it undermined my confidence in knowledge and science (IDEOLOGY_BASED_BREACH);*
(13) *not having the appropriate recognition from my colleagues (LACK_RECOGNITION).*

We assume that individuals who perceive an ideology-based psychological contract breach related to academic values will select item 12 “*It undermined my confidence in knowledge and science*”. Therefore, the dummy *IDEOLOGY_BASED_BREACH* is equal to one if the respondent selected item 12 and zero otherwise. We consider this variable an indicator of a violation of academic values and, therefore, a measure of ideology-based contract breach. Table 1 shows that average *IDEOLOGY_BASED_BREACH* is higher for Sci-Hub users looking across countries, ERC fields and demographics. In section 4.1, we check the robustness of our results at alternative measures of ideology-based psychological contract breach related to academic values.

| Variable | USE_SCI_HUB=0 | | s.d. | USE_SCI_HUB=1 | | s.d. | Row Total | s.d. |
|-------------|---------------|------|------|---------------|------|------|-----------|------|
| GERMANY | 0.09 | 0.29 | | 0.16 | 0.37 | | 0.13 | 0.33 |
| HUNGARY | 0.02 | 0.13 | | 0.07 | 0.26 | | 0.05 | 0.22 |
| IRELAND | 0.02 | 0.15 | | 0.08 | 0.27 | | 0.04 | 0.21 |
| ITALY | 0.07 | 0.26 | | 0.16 | 0.37 | | 0.12 | 0.32 |
| NETHERLANDS | 0.05 | 0.23 | | 0.11 | 0.31 | | 0.08 | 0.27 |
| SWEDEN | 0.07 | 0.26 | | 0.1 | 0.3 | | 0.08 | 0.27 |
| SH | 0.06 | 0.23 | | 0.12 | 0.32 | | 0.08 | 0.28 |
| LS | 0.06 | 0.23 | | 0.14 | 0.34 | | 0.09 | 0.29 |
| PE | 0.07 | 0.26 | | 0.12 | 0.33 | | 0.1 | 0.3 |
| PE.LS | 0.1 | 0.31 | | 0.2 | 0.41 | | 0.15 | 0.36 |
| PE.SH | 0.12 | 0.33 | | 0.15 | 0.36 | | 0.14 | 0.34 |
| SH.LS | 0.08 | 0.28 | | 0.2 | 0.41 | | 0.13 | 0.34 |
| MALE | 0.05 | 0.22 | | 0.11 | 0.32 | | 0.08 | 0.27 |
| FEMALE | 0.09 | 0.28 | | 0.15 | 0.36 | | 0.12 | 0.32 |
| NON-FOREIGN | 0.06 | 0.24 | | 0.13 | 0.34 | | 0.09 | 0.29 |
| FOREIGN | 0.08 | 0.28 | | 0.12 | 0.32 | | 0.1 | 0.3 |
| NON-FACULTY | 0.09 | 0.29 | | 0.17 | 0.38 | | 0.14 | 0.35 |
| FACULTY | 0.05 | 0.22 | | 0.07 | 0.25 | | 0.06 | 0.23 |
| All | 0.07 | 0.25 | | 0.13 | 0.33 | | 0.1 | 0.29 |

Table 1. Distribution of average *IDEOLOGY_BASED_BREACH* between Sci-hub users (*USE_SCI_HUB=1*) and non Sci-Hub users (*USE_SCI_HUB=0*) across Countries, ERC fields and Demographics

3.3. Econometric model and other variables

Our dependent variable is *USE_SCI_HUB*, a dummy equal to one if the respondent used Sci-Hub in the past and zero otherwise. To address the dichotomous nature of our dependent variable, we run logistic regression models, and we estimate:

$$Pr(USE_SCI_HUB = 1) = \beta_0 + \beta_1 IDEOLOGY_BASED_BREACH + \beta_2 MODERATORS + \beta_3 X + \theta_f + \theta_u + \theta_c \quad (1)$$

Where *IDEOLOGY_BASED_BREACH* is our measure of (ideology-based) psychological

contract breach of the academic values presented in the previous section. *MODERATORS* are the dummies *FEMALE* equal to one for females and zero otherwise, *FOREIGN* equal to one if respondents indicate a foreign nationality and zero otherwise, and *FACULTY* equal to one if professor, researcher, or lecturer and zero otherwise. *X* is the vector of control variables, and θ_f , θ_u , and θ_c are dummy variables controlling for respondents' ERC scientific field, university, and country.

To test our hypotheses about factors moderating the relation between *IDEOLOGY_BASED_BREACH* and the use of Sci-Hub, we estimate:

$$Pr(USE_SCI_HUB = 1) = \beta_0 + \beta_1 IDEOLOGY_BASED_BREACH + \beta_2 MODERATORS + \beta_3 X + \beta_4 IDEOLOGY_BASED_BREACH \times MODERATOR + \theta_f + \theta_u + \theta_c \quad (2)$$

where we interact *IDEOLOGY_BASED_BREACH* with one dummy variable described in the hypothesis as moderator *FEMALE* or *FOREIGN* or *FACULTY*.

The vector *X* includes controls for several factors identified in the literature as drivers of digital piracy.

In a recent meta-analysis, Eisend (2019) examines 174 studies conducted in 36 countries between 1980 and 2016 and underlines four groups of theories to explain digital piracy that we use as a theoretical framework to identify our main control variables: i) reasoned action and planned behaviour, ii) ethical decision-making models, iii) expected utility theory, and iv) reinforcement mechanisms.

Both reasoned action and planned behaviour concern the cultural dimension of the individual. The first considers the behaviour as driven by social norms and, therefore, whether the social locus of the agent accepts the use of piracy. We control for this with the variable *COLLEAGUES_PIRACY_PERCEPTION*, which ranges from 1 “*Extremely uncommon*” to 8 “*Extremely Common*” and encode responses to the question “*Software piracy is considered common or uncommon among your colleagues*”. The second theory suggests the importance of perceived control ability over the act of pirating (i.e. how easy or difficult it is for agents to do piracy, avoiding negative consequences). Since this might be a sensitive question, we control for this factor, asking about the training respondents receive about copyright law and enforcement. The variable *INSTITUTIONAL_TRAINING* ranges from 1 “*No*” to 4 “*Yes*”. The associated question is “*Does your university institution provide guidance and advice of rules relating to copyright law and your work as an academic?*”.

According to ethical decision-making models, another important driver of digital piracy is the trade-off between the morality of the individual and her/his justification for breaking the law (Jacobs, Heuvelman, Tan, & Peters, 2012; Nicholas et al., 2019). We control for this factor using the variable *MORAL_JUSTIFICATION* which ranges from 1 “*Yes*” to 4 “*No*” where respondents answer the question “*Do you feel guilty when you use copyrighted material (papers, software, books, movies) without permission for research purposes?*”. Finally, in the case of using Sci-Hub, the academics' perception of scientific publishers might play a role in the individual moral justification as they might consider using Sci-Hub as a boycott act. We control for this factor through the dummy variable *UNETHICAL_PUBLISHERS*. This dummy is equal to one if the respondent reported above the median score to the question: “*How much adequate from 0 to 100 is the sentence to describe your thoughts: Big publishers (like Springer-Nature or Elsevier) have an unethical business model and their profits rely on the free work of academics*”.

The expected utility theory predicts as drivers of digital piracy the positive or negative

| Variable Name | N | Mean | St. Dev. | Min | Max |
|-------------------------------------|-------|----------|----------|------|-----|
| Dependent Variable | | | | | |
| <i>USE_SCI-HUB</i> | 2,849 | 0.5 | 0.5 | 0 | 1 |
| Contract Breach | | | | | |
| <i>IDEOLOGY_BASED_BREACH</i> | 2,849 | 0.1 | 0.3 | 0 | 1 |
| <i>ACADEMIC_BREACH</i> | 2,849 | 1.7 | 1.1 | 0 | 6 |
| <i>JUNIOR_DISCONTENT (PC1)</i> | 2,849 | 1.3e-09 | 1.4 | -1.9 | 6.3 |
| <i>COLLEAGUES_BEHAVIOUR (PC2)</i> | 2,849 | 1.2e-09 | 1.2 | -2.1 | 6.6 |
| <i>SENIOR_DISCONTENT (PC3)</i> | 2,849 | -1.2e-09 | 1.1 | -4.0 | 4.5 |
| Moderators | | | | | |
| <i>FEMALE</i> | 2,849 | 0.4 | 0.5 | 0 | 1 |
| <i>FOREIGN</i> | 2,849 | 0.2 | 0.4 | 0 | 1 |
| <i>FACULTY</i> | 2,849 | 0.6 | 0.5 | 0 | 1 |
| Controls | | | | | |
| Ethical Decision-Making Models | | | | | |
| <i>MORAL_JUSTIFICATION</i> | 2,822 | 2.9 | 1.2 | 1 | 4 |
| <i>UNETHICAL_PUBLISHERS</i> | 2,849 | 0.6 | 0.5 | 0 | 1 |
| Reasoned Action – Norms | | | | | |
| <i>COLLEAGUES_PIRACY_PERCEPTION</i> | 2,827 | 4.1 | 2.1 | 1 | 8 |
| Planned Behaviour – Control Ability | | | | | |
| <i>INSTITUTIONAL_TRAINING</i> | 2,844 | 3 | 1.1 | 1 | 4 |
| Expected Utility Theory | | | | | |
| <i>LIBRARY_SATISFACTION</i> | 2,847 | 6.5 | 1.6 | 1 | 8 |
| <i>TEACHING_LOAD</i> | 2,849 | 0.1 | 0.3 | 0 | 1 |
| <i>COPYRIGHT_KNOWLEDGE</i> | 2,763 | 2.0 | 2.1 | 0 | 6 |
| Reinforcement Mechanisms | | | | | |
| <i>PAST_PIRACY</i> | 2,841 | 5.6 | 2.5 | 1 | 8 |

Table 2. Summary Statistics of regression variables

outcomes in doing piracy (Peace, Galletta, & Thong, 2003). Positive outcomes, in this case, are the obvious reasons why people might use Sci-Hub, the lack of access to the scientific literature (Boudry et al., 2019b), and/or because it is convenient and saves time (González-Solar & Fernández-Marcial, 2019; Travis, 2016). While we have this information for Sci-Hub users, we do not have it for non-users. We overcome this issue by proxying the lack of access to the literature and Sci-Hub convenience using the variable *LIBRARY_SATISFACTION*. This variable ranges from one “*Extremely Dissatisfied*” to 8 “*Extremely Satisfied*” when the respondent answer to the question “*How much you are satisfied or dissatisfied with the resources of your library*”. In addition, we add *TEACHING_LOAD* a dummy equal to one if the respondent reports an excessive teaching load and zero otherwise. I Since the shortage of time is often associated with finding shortcuts to save time while doing research. The variable *COPYRIGHT_KNOWLEDGE* considers the potential for avoiding negative outcomes while using Sci-Hub, since individuals who know copyright law can predict consequences. This variable ranges from 0 (none of the symbols known) to 6 (all symbols known) depending on how many copyright creative commons symbol the respondents declare to know. At last, frontier research in digital piracy shows the reinforcement role of agents’ pirating experience in predicting future pirate behaviour (Cronan & Al-Rafee, 2008; Eisend, 2019). We control users’ piracy experience using the variable *PAST_PIRACY*. This variable ranges from 1 “*Extremely unlikely*” to 8 “*Extremely likely*” depending on the respondent’s answers to the question “*When you were a student, how likely or unlikely is that you used proprietary software, data, or books copies without the licence*”. Table 2 reports the descriptive statistics of all the variables included in the regressions.

| | Total Resp. | | USE_SCI-HUB | | | |
|-------------|-------------|-------|-------------|-------|------|-------|
| | N | Col.% | No | Row % | Yes | Row % |
| Country | | | | | | |
| GERMANY | 460 | 16% | 234 | 51% | 226 | 49% |
| HUNGARY | 173 | 6% | 60 | 35% | 113 | 65% |
| IRELAND | 292 | 10% | 174 | 60% | 118 | 40% |
| ITALY | 951 | 33% | 452 | 48% | 499 | 52% |
| NETHERLANDS | 421 | 15% | 203 | 48% | 218 | 52% |
| SWEDEN | 552 | 19% | 378 | 68% | 174 | 32% |
| ERC fields | | | | | | |
| LS | 509 | 18% | 268 | 53% | 241 | 47% |
| PE | 813 | 29% | 371 | 46% | 442 | 54% |
| SH | 1188 | 42% | 686 | 58% | 502 | 42% |
| PE.LS | 88 | 3% | 48 | 55% | 40 | 45% |
| PE.SH | 126 | 4% | 51 | 40% | 75 | 60% |
| PE.SH.LS | 22 | 1% | 9 | 41% | 13 | 59% |
| SH.LS | 78 | 3% | 48 | 62% | 30 | 38% |
| Total | 2849 | 100% | 1501 | 53% | 1348 | 47% |

Legend: The 25 ERC academic fields are aggregated here in the 3 broad categories PE (1-10) is Physical Sciences& Engineering; SH (1-6) is Social Sciences & Humanities; LS (1-9) is Life Sciences. Individual were asked to select up to 4 ERC sub-categories.

Table 3. Summary Statistics of the Usage of Sci-Hub.

4. Results

In this section, we present some descriptive patterns and the results of the econometric exercise.

Table 3 shows how the main dependent variable (*USE_SCI-HUB*) distributes across countries and academic fields. Overall, 47% of the academics used Sci-Hub, and not surprisingly, this varies more across countries than across academic fields. Looking across countries, academics using Sci-Hub varies from 65% in Hungary to 32% in Sweden. In contrast, across fields, it varies between 60% in the interdisciplinary field of Physical Sciences & Engineering and Social Sciences & Humanities (PE.SH) to 38% in the interdisciplinary field of Social Sciences & Humanities and Life Sciences (SH.LS).

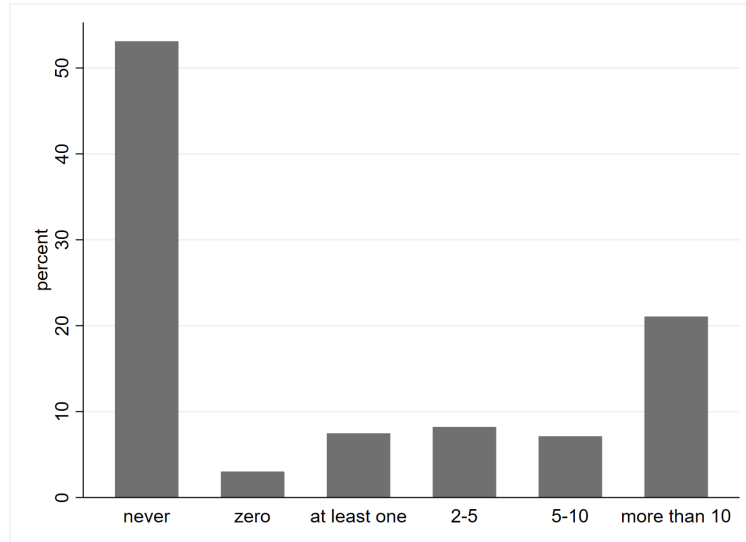


Figure 1. Intensity of Sci-Hub use last year. The category “never” represents non Sci-Hub users, those who never used Sci-Hub.

Figure 1 shows the intensity of Sci-Hub usage last year. More than half are non Sci-Hub users, while among those who declared they ever used it, the 97% used it at least once last year and 45% are frequent users (they used it more than 10 times). For this reason we dicotomize our dependent variable and focus the analysis on Sci-Hub usage rather than the intensity of use.

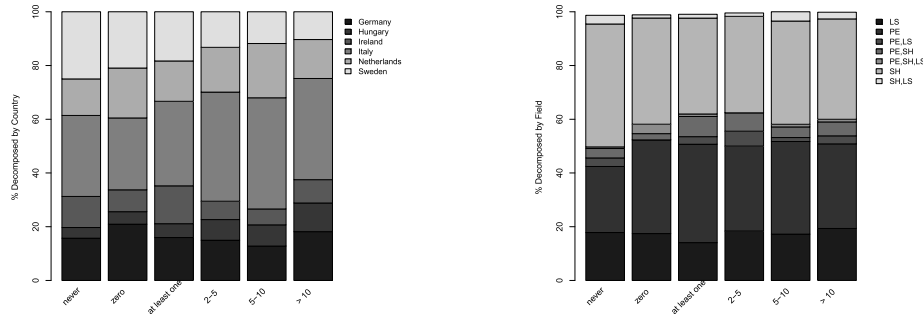


Figure 2. Distribution across country (bottom-left) and ERC scientific fields (bottom-right) of the intensity of Sci-Hub use in the last year.

Figure 2 displays the distribution of the intensity of Sci-Hub usage last year across countries and academic fields. The figures indicate similar patterns to the previous table, indicating higher country-level variance. These two observations combined suggest that the characteristics of the university system matter more than field differences in explaining the use of Sci-Hub and its intensity.

Table 4 reports the estimation results of equations 1 and 2. Column 1 shows regression results including only the controls and the moderators, whereas column 2 including only our main variable *IDEOLOGY_BASED_BREACH*. In column 3, we report the results for estimating equation 1 and test H1.

The model in column 3 indicates that the experience of an ideology-based contract breach (*IDEOLOGY_BASED_BREACH=1*) corresponds to a statistically significant increase in the likelihood of using Sci-Hub. Considering the odds ratios, the estimated model indicates a sizable effect. All else being equal, those who experienced a contract breach generating *IDEOLOGY_BASED_BREACH* have 75% more odds of using Sci-Hub compared to those who do not experience it (*IDEOLOGY_BASED_BREACH=0*). This finding confirms our H1.

Looking at the controls and the moderators models 1-2 report results consistent with the existing literature. The likelihood of using Sci-Hub is lower for females (*FEMALE*) and faculty members (*FACULTY*), whereas it is higher for foreign scholars (*FOREIGN*).

The likelihood of using Sci-Hub decreases the higher the perceived quality of the genuine product, expressed by the satisfaction individuals report about library services of their institution (*LIBRARY_SATISFACTION*). Several controls have the expected positive sign and drive Sci-Hub use. These are individual moral justification for breaking copyright law (*MORAL_JUSTIFICATION*), scientific publishers' business model perception as unethical (*UNETHICAL_PUBLISHERS*), excessive teaching load (*TEACHING_LOAD*), and positive social perception surrounding piracy (*COLLEAGUES_PIRACY_PERCEPTION*). On the contrary, the likelihood of using Sci-Hub is higher for experienced users (*PAST_PIRACY*), and knowledgeable scholars about copyright (*COPYRIGHT_KNOWLEDGE*).

Results in columns 4-6 of table 4 test the moderating effects stated in H2-H4. Since we are estimating a nonlinear model, interpretation of the interaction effects cannot be based only on

Table 4. Main Specification and Models with Moderating Effects. The dependent variable is a dummy equal to 1 if the respondent used Sci-Hub in the past and 0 otherwise.

| | Dependent variable: | | | | | |
|-------------------------------------|------------------------|---------------------|------------------------|------------------------|------------------------|------------------------|
| | USE_SCI-HUB | | | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| FACULTY | -0.835*** (0.0959) | | -0.802*** (0.0965) | -0.802*** (0.0965) | -0.808*** (0.0967) | -0.753*** (0.100) |
| FEMALE | -0.147 (0.0960) | | -0.165* (0.0965) | -0.159 (0.102) | -0.167* (0.0966) | -0.163* (0.0966) |
| FOREIGN | 0.345*** (0.122) | | 0.347*** (0.123) | 0.346*** (0.123) | 0.407*** (0.128) | 0.343*** (0.123) |
| COPYRIGHT_KNOWLEDGE | 0.141*** (0.0215) | | 0.141*** (0.0215) | 0.141*** (0.0216) | 0.142*** (0.0216) | 0.142*** (0.0215) |
| MORAL_JUSTIFICATION | 0.369*** (0.0384) | | 0.365*** (0.0384) | 0.365*** (0.0384) | 0.366*** (0.0385) | 0.367*** (0.0385) |
| LIBRARY_SATISFACTION | -0.0821*** (0.0292) | | -0.0817*** (0.0291) | -0.0816*** (0.0291) | -0.0811*** (0.0292) | -0.0825*** (0.0292) |
| PAST_PIRACY | 0.121*** (0.0201) | | 0.121*** (0.0201) | 0.121*** (0.0201) | 0.121*** (0.0200) | 0.122*** (0.0201) |
| COLLEAGUES_PIRACY_PERCEPTION | 0.148*** (0.0236) | | 0.148*** (0.0238) | 0.148*** (0.0238) | 0.148*** (0.0238) | 0.149*** (0.0238) |
| TEACHING_LOAD | 0.342** (0.159) | | 0.351** (0.160) | 0.350** (0.160) | 0.348** (0.160) | 0.346** (0.160) |
| INSTITUTIONAL_TRAINING | 0.0414 (0.0414) | | 0.0406 (0.0415) | 0.0405 (0.0415) | 0.0395 (0.0415) | 0.0399 (0.0415) |
| UNETHICAL_PUBLISHERS | 0.301*** (0.0925) | | 0.292*** (0.0927) | 0.292*** (0.0927) | 0.294*** (0.0927) | 0.289*** (0.0927) |
| IDEOLOGY_BASED_BREACH=1 | | 0.746*** (0.133) | 0.560*** (0.150) | 0.591*** (0.212) | 0.682*** (0.167) | 0.792*** (0.201) |
| IDEOLOGY_BASED_BREACH=1 X FEMALE=1 | | | | -0.0652 (0.300) | | |
| IDEOLOGY_BASED_BREACH=1 X FOREIGN=1 | | | | | -0.660* (0.358) | |
| IDEOLOGY_BASED_BREACH=1 X FACULTY=1 | | | | | | -0.591* (0.313) |
| COUNTRY | Yes | No | Yes | Yes | Yes | Yes |
| ERC | Yes | No | Yes | Yes | Yes | Yes |
| UNIVERSITY | Yes | No | Yes | Yes | Yes | Yes |
| OBSERVATIONS | 2701 | 2849 | 2701 | 2701 | 2701 | 2701 |

Notes: Models are estimated using a logit model and the coefficients are reported. Robust standard errors in parentheses.
Legend: *p<0.1; **p<0.05; ***p<0.01

the signs and significance of the coefficients (Ai & Norton, 2003), and we plot the marginal effects.

H2 predicts that females experiencing *IDEOLOGY_BASED_BREACH* are less likely to use Sci-Hub. Column 4 in table 4 and the marginal effects of the predicted probability in figure 3 indicate we cannot confirm the hypothesis. Overall, we can observe that the interaction term of *FEMALE* and *IDEOLOGY_BASED_BREACH* is negative but not different from zero at 10% significance level. Figure 3 shows that the probability of using Sci-Hub is higher for both males and females experiencing *IDEOLOGY_BASED_BREACH* and males appear more responsive to *IDEOLOGY_BASED_BREACH* than females.

Column 5 in table 4 tests H3 about the moderating role of being foreign. The result supports H3 where the interaction term of *IDEOLOGY_BASED_BREACH* and *FOREIGN* is negative and significant at 10% significance level. Looking at the marginal effects in figure 4, we can observe that the probability that non-foreign academics use Sci-Hub is higher for those experiencing *IDEOLOGY_BASED_BREACH*. At the same time, foreigners are equally likely to use Sci-Hub irrespective of their experience of *IDEOLOGY_BASED_BREACH*. In other

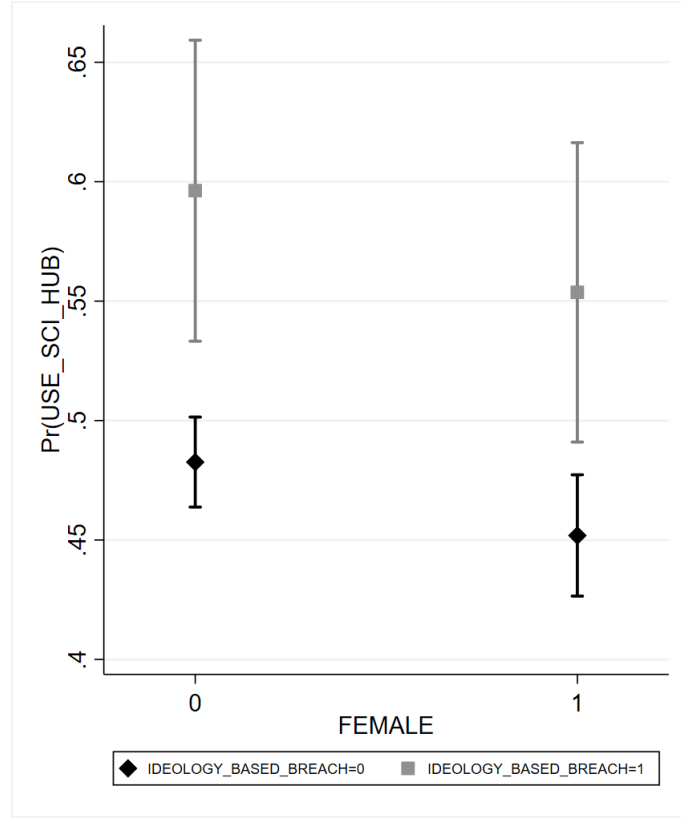


Figure 3. Marginal effects *IDEOLOGY_BASED_BREACH*. Model in column 3 table 4 testing hypothesis H2. The x-axis shows *FEMALE*=1 and *MALE*=0 while the y-axis is the predicted probability of Using Sci-Hub

words, non-foreigners academics are more responsive to *IDEOLOGY_BASED_BREACH* than foreigners.

Finally, the model in column 6 of table 4 shows support for H4, where we test the moderating effect of having a tenure. The interaction term coefficient is negative and significant at 10% significance level. The marginal effects in figure 5 provide additional details and help interpret the effect. The probability of using Sci-Hub is higher for non-faculty members experiencing *IDEOLOGY_BASED_BREACH*, but the probability that faculty members use Sci-Hub is unresponsive to *IDEOLOGY_BASED_BREACH*. We can conclude that non-faculty members are more responsive to *IDEOLOGY_BASED_BREACH* than faculty members.

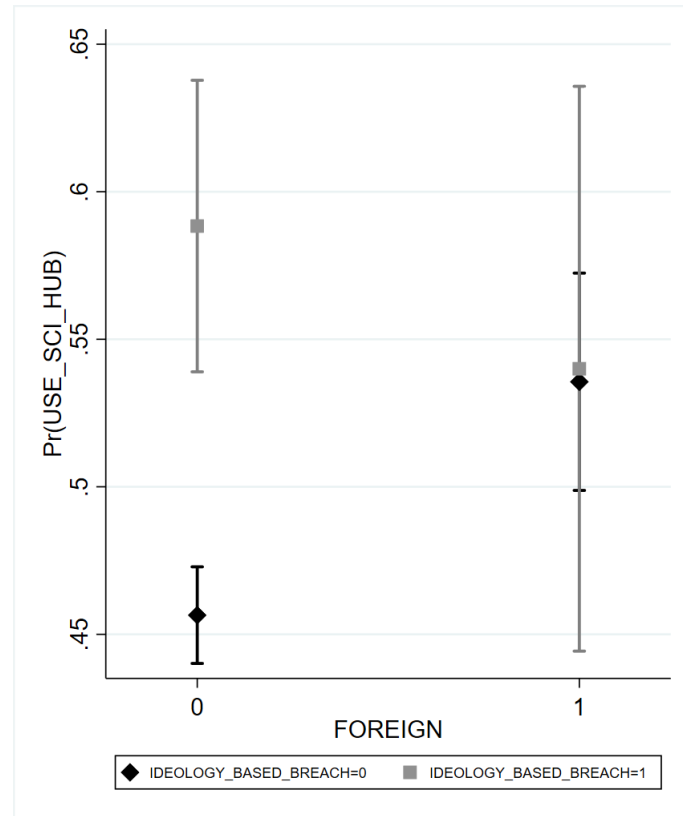


Figure 4. Marginal effects *IDEOLOGY_BASED_BREACH*. Model in column 4 table 4 testing H3. The x-axis shows *FOREIGN*=1 and *NON-FOREIGN*=0 while the y-axis is the predicted probability of Using Sci-Hub

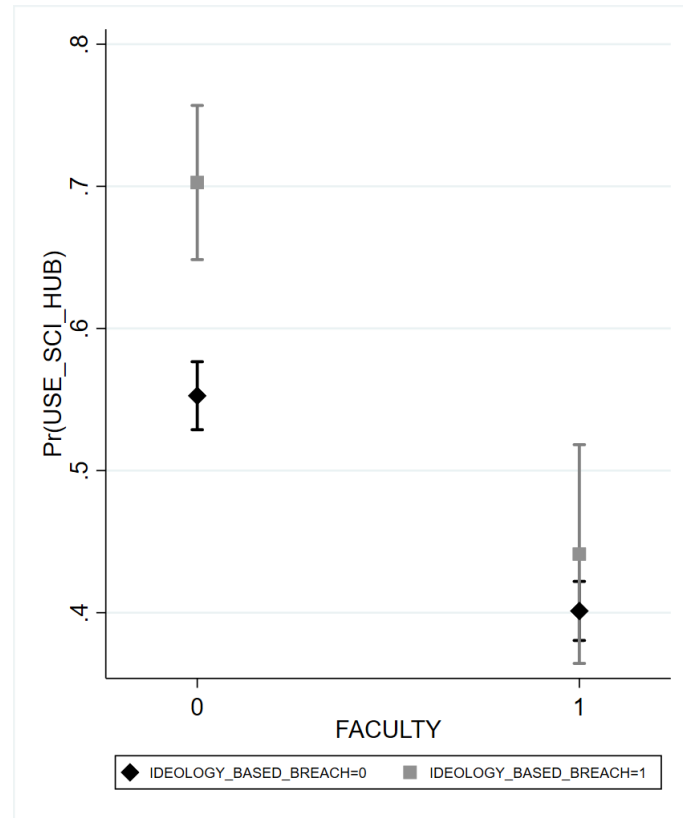


Figure 5. Marginal effects *IDEOLOGY_BASED_BREACH*. Model in column 5 of table 4 test H4. The x-axis shows *FACULTY*=1 and *NON-FACULTY*=0 while the y-axis is the predicted probability of Using Sci-Hub

4.1. Robustness Checks: Alternative Measures of Ideology-Based Psychological Contract Breach

We investigate our results' robustness using two alternative measures to proxy an ideology-based psychological contract breach related to academic values. We account for the potential drawback of using a dichotomous variable combining the 13 items described in section 3.2.

First, we create a composite numeric index aggregating the items specific to the academic profession representing a breach of academic values. We call the variable *ACADEMIC_BREACH* that is the sum of the items (1) *teaching responsibilities*; (2) *administrative responsibilities*; (4) *being unable to concentrate on my research*; (8) *the inadequate facilities or funding*; (10) *the feeling that sometimes my research is a waste of time*; (11) *the feeling that sometimes my research is a waste of public money*; (12) *It undermined my confidence in knowledge and science*; selected by respondents. The variable ranges from 0 (none of the items is selected) to 7 (all items are selected).

| Variable | PC1 Junior Discontent | PC2 Colleagues Behavior | PC3 Senior Discontent | PC4 Lack of Time |
|-----------------------------------|-----------------------------|-------------------------------|-----------------------------|------------------------|
| <i>TEACHING_LOAD</i> | -0.0738 | 0.2008 | 0.0771 | 0.4475 |
| <i>ADMINISTRATIVE_LOAD</i> | -0.3253 | 0.1915 | 0.1833 | 0.3655 |
| <i>COMPETITION_LOAD</i> | 0.3943 | -0.0041 | -0.3180 | 0.2102 |
| <i>LACK_RESEARCH_TIME</i> | 0.0654 | 0.2182 | 0.1853 | 0.6056 |
| <i>CAREER_STRESS</i> | 0.3974 | -0.1324 | -0.3459 | 0.1511 |
| <i>BEHAVIOR_JUNIOR_COLLEAGUES</i> | 0.0815 | 0.4816 | 0.1567 | -0.2452 |
| <i>BEHAVIOR_SENIOR_COLLEAGUES</i> | 0.1847 | 0.5556 | -0.0257 | -0.1489 |
| <i>LACK_FUNDING_FACILITIES</i> | -0.0528 | 0.3263 | -0.2386 | 0.1428 |
| <i>HOMESICKNESS</i> | 0.2303 | -0.0501 | -0.4243 | 0.1855 |
| <i>RESEARCH_WASTE_TIME</i> | 0.4745 | -0.0676 | 0.3620 | 0.0108 |
| <i>RESEARCH_WASTE_MONEY</i> | 0.3667 | -0.1098 | 0.4738 | -0.0626 |
| <i>IDEOLOGY_BASED_BREACH</i> | 0.3153 | 0.0713 | 0.2264 | 0.1097 |
| <i>LACK_RECOGNITION</i> | 0.1246 | 0.4320 | -0.1907 | -0.2815 |
| Eigenvalues | 1.90 | 1.31 | 1.21 | 1.13 |
| Proportion of variance | 0.15 | 0.10 | 0.09 | 0.09 |
| Cumulative prop | 0.15 | 0.25 | 0.34 | 0.43 |

Table 5. Results of PCA on the 13 variables representing the negative aspects of being an academic described in section 3.2

Second, we run a Principal Component Analysis (PCA) on the 13 items, obtaining four main components. We select the four components with eigenvalues above one, and that explain most of the variance (see bottom of Table B and Figure B1 in Appendix). Table B shows details of the composition of the four components. We consider the first component as the main one representing an ideology-based psychological breach of academic values because it is the one with the highest correlation with the item *IDEOLOGY_BASED_BREACH* and related variables (*RESEARCH_WASTE_TIME*, *RESEARCH_WASTE_MONEY*). We call it *JUNIOR_DISCONTENT* because it is also positively and strongly correlated with variables affecting more young non-tenured researchers (e.g. career stress, competition load) while negatively or mildly related to those more likely to impact senior faculty members (e.g. teaching and administrative load, lack of research time). We call the second component *COLLEAGUE_BEHAVIOUR* because it positively correlates with discontent stemming from colleagues' behaviour capturing the peer pressure effect. The third component, *SENIOR_DISCONTENT* is the counterpart of the *JUNIOR_DISCONTENT* as it correlates both with the variables representing an ideology-based psychological contract breach and with variables more likely to affect senior tenured scholars negatively. The fourth component, *LACK_OF_TIME*, has the highest positive correlation with the variables representing a contract breach related to the lack of time.

Table 6 shows the results for equations 1 and 2 using the two broader definitions of the psychological contract breach of academic values defined above. Table 6 confirms our previous results showing the strong effect of an ideology-based psychological contract breach related to academic values in increasing the likelihood of scholars using Sci-Hub.

In particular, column 1-4 indicates that one unit increase of *ACADEMIC_BREACH* increased the odds of using Sci-Hub between 17% and 25%. Looking at the interaction terms in columns 2 and 3 of the variable with the moderators *FEMALE* and *FOREIGN*, we find that they are both negative and different from zero at 1% significance level, supporting H2 and H3.

Also, the variable *JUNIOR_DISCONTENT* shows a sizable effect in affecting the use of Sci-Hub. Columns 5-8 show that we will see between the 25% and the 33% of an increase in the odds of using Sci-Hub for a one-unit increase in *JUNIOR_DISCONTENT*. Additionally, the interaction of the variable with the moderators *FEMALE* and *FACULTY* (columns 7-8) provide support for H2 and H4. The coefficients are indeed both negative and statistically significant at 10% significance level.

Table 6. Robustness Check. The dependent variable is a dummy equal to 1 if respondent used Sci-Hub in the past and 0 otherwise

| | Dependent variable: | | | | | | | |
|--|------------------------|------------------------|------------------------|------------------------|------------------------|-----------------------|------------------------|------------------------|
| | <i>USE_SCI-HUB</i> | | | | | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| <i>FACULTY</i> | -0.855*** (0.0959) | -0.844*** (0.0961) | -0.867*** (0.0963) | -0.662*** (0.166) | -0.693*** (0.101) | -0.689*** (0.101) | -0.690*** (0.101) | -0.691*** (0.101) |
| <i>FEMALE</i> | -0.165* (0.0963) | 0.136 (0.170) | -0.172* (0.0967) | -0.157 (0.0968) | -0.219** (0.0978) | -0.210** (0.0975) | -0.223** (0.0980) | -0.214** (0.0982) |
| <i>FOREIGN</i> | 0.352*** (0.123) | 0.350*** (0.123) | 0.868*** (0.211) | 0.347*** (0.123) | 0.309** (0.125) | 0.303** (0.126) | 0.322** (0.125) | 0.315** (0.126) |
| <i>COPYRIGHT_KNOWLEDGE</i> | 0.138*** (0.0215) | 0.138*** (0.0215) | 0.137*** (0.0215) | 0.139*** (0.0215) | 0.139*** (0.0218) | 0.137*** (0.0219) | 0.138*** (0.0218) | 0.140*** (0.0219) |
| <i>MORAL_JUSTIFICATION</i> | 0.367*** (0.0384) | 0.369*** (0.0384) | 0.370*** (0.0385) | 0.367*** (0.0384) | 0.364*** (0.0388) | 0.365*** (0.0388) | 0.364*** (0.0388) | 0.361*** (0.0388) |
| <i>LIBRARY_SATISFACTION</i> | -0.0770*** (0.0292) | -0.0785*** (0.0291) | -0.0780*** (0.0292) | -0.0777*** (0.0293) | -0.0764*** (0.0293) | -0.0745** (0.0293) | -0.0765*** (0.0293) | -0.0763*** (0.0294) |
| <i>PAST_PIRACY</i> | 0.118*** (0.0201) | 0.118*** (0.0201) | 0.119*** (0.0201) | 0.119*** (0.0201) | 0.117*** (0.0202) | 0.117*** (0.0202) | 0.118*** (0.0202) | 0.118*** (0.0203) |
| <i>COLLEAGUES_PIRACY_PERCEPTION</i> | 0.146*** (0.0237) | 0.147*** (0.0237) | 0.143*** (0.0238) | 0.146*** (0.0238) | 0.142*** (0.0240) | 0.143*** (0.0239) | 0.142*** (0.0240) | 0.142*** (0.0240) |
| <i>TEACHING_LOAD</i> | 0.149 (0.168) | 0.155 (0.169) | 0.155 (0.167) | 0.175 (0.171) | 0.127 (0.197) | 0.123 (0.197) | 0.123 (0.196) | 0.131 (0.196) |
| <i>INSTITUTIONAL_TRAINING</i> | 0.0376 (0.0416) | 0.0371 (0.0415) | 0.0390 (0.0417) | 0.0378 (0.0415) | 0.0384 (0.0419) | 0.0364 (0.0419) | 0.0378 (0.0419) | 0.0366 (0.0418) |
| <i>UNETHICAL_PUBLISHERS</i> | 0.298*** (0.0927) | 0.294*** (0.0929) | 0.307*** (0.0931) | 0.295*** (0.0928) | 0.273*** (0.0936) | 0.267*** (0.0938) | 0.275*** (0.0936) | 0.274*** (0.0936) |
| <i>ACADEMIC_BREACH</i> | 0.154*** (0.0407) | 0.224*** (0.0518) | 0.214*** (0.0454) | 0.209*** (0.0570) | | | | |
| <i>JUNIOR_DISCONTENT (PC1)</i> | | | | | 0.222*** (0.0362) | 0.272*** (0.0459) | 0.241*** (0.0400) | 0.282*** (0.0509) |
| <i>COLLEAGUES_BEHAVIOUR (PC2)</i> | | | | | 0.00560 (0.0400) | 0.00878 (0.0400) | 0.00626 (0.0400) | 0.00715 (0.0402) |
| <i>SENIOR_DISCONTENT (PC3)</i> | | | | | -0.0260 (0.0411) | -0.0275 (0.0412) | -0.0285 (0.0412) | -0.0337 (0.0414) |
| <i>LACK_OF_TIME (PC4)</i> | | | | | 0.168*** (0.0486) | 0.169*** (0.0487) | 0.171*** (0.0485) | 0.163*** (0.0487) |
| <i>FEMALE=1 X ACADEMIC_BREACH</i> | | -0.173** (0.0790) | | | | | | |
| <i>FOREIGN=1 X ACADEMIC_BREACH</i> | | | -0.307*** (0.0996) | | | | | |
| <i>FACULTY=1 X ACADEMIC_BREACH</i> | | | | -0.115 (0.0795) | | | | |
| <i>FEMALE=1 X JUNIOR_DISCONTENT (PC1)</i> | | | | | | -0.117* (0.0700) | | |
| <i>FOREIGN=1 X JUNIOR_DISCONTENT (PC1)</i> | | | | | | | -0.0905 (0.0878) | |
| <i>FACULTY=1 X JUNIOR_DISCONTENT (PC1)</i> | | | | | | | | -0.128* (0.0727) |
| <i>COUNTRY</i> | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| <i>ERC</i> | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| <i>UNIVERSITY</i> | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| <i>OBSERVATIONS</i> | 2701 | 2701 | 2701 | 2701 | 2701 | 2701 | 2701 | 2701 |

Notes: Models are estimated using a logit model and the coefficients are reported. Robust standard errors in parentheses.
Legend: *p<0.1; **p<0.05; ***p<0.01

5. Discussion

Our results highlight the relationship between ideology-based psychological contract breach and deviant behaviour towards relevant academic third parties. While using Sci-Hub does not directly harm universities, they should prevent it because of the associated reputational and technical costs. Besides the potential security concern that illegal downloads pose to their digital infrastructure¹³, Sci-Hub usage is pretty unnoticed by universities. Illegal access to scientific literature through Sci-Hub can be considered a mild deviant behaviour. However, we document its pervasiveness as almost half of the scholars in top European universities download papers illegally using Sci-Hub. This broad diffusion suggests acceptance of such deviant behaviour beyond reasons of “simple” journal access. While transgressions towards third parties might be easily overlooked, they diffuse quickly. They might precede the emergence of a slippery slope causing more serious deviant behaviours. Focusing attention on such minor transgressions and designing effective prevention policies could be effective in avoiding subsequent major transgressions.

Our results suggest that, while designing policies preventing academic digital piracy, administrators and policymakers should consider the role of academic values and the connected intrinsic ideological currency so crucial for academics. Any university policy attempting to restore academic values (i.e. promoting freedom of research, releasing pressure from bibliometric indicators) might produce a policy spillover into preventing academic piracy. To date, there are no systematic policies to restore academic values or decrease the emphasis on bibliometric indicators. However, the economics of science literature has started investigating at least three intervention areas to lift some “publish or perish” pressure. These are i) moving beyond bibliometric measures, ii) incentives for funding risky research, and iii) the PhD job market.

Concerning alternative metrics, a large stream of research highlighted the need for developing metrics based on better data (Mas-Bleda & Thelwall, 2016; Molas-Gallart & Ràfols, 2018). Many advocates for using better algorithms to address problematic issues of bibliometric databases such as name disambiguation (Han, Giles, Zha, Li, & Tsioutsoulis, 2004; Sanyal, Bhowmick, & Das, 2021), self-citations (Schreiber, 2007; Szomszor, Pendlebury, & Adams, 2020), citations meaning (Budi & Yaniasih, 2022), and authors’ contribution (Shen & Barabási, 2014). Others advocate for incorporating job-market-based measures in university rankings (Cowan & Rossello, 2018; González-Sauri & Rossello, 2022; Wapman, Zhang, Clauset, & Larremore, 2022). Beyond the scientific effort to correct biases in diffused bibliometric indicators, publishers still retain a central role in developing better metrics. Their improvements and a more critical use accounting for their limitations can restore more trustworthy relations between academic management, publishers, and scholars (Biagioli, 2020). Utrecht University is undergoing an experiment to reduce the emphasis on bibliometric indicators. In June 2021, the University formally abandoned the journal impact factor metric when making faculty hiring and promotion decisions. While it will take some time to evaluate all the effects of this bold decision, some scholars are already sceptical about the decision as the University has yet to identify an alternative measure of scientific performance (Singh Chawla, 2021).

Concerning funds for risky research, the economics of science literature (Franzoni, Stephan, & Veugelers, 2022; Wang, Veugelers, & Stephan, 2017) has highlighted funding

¹³See, for example, the article of Alexander Martin, a Technology reporter for Sky News. Available at <https://news.sky.com/story/police-warn-students-and-universities-against-using-the-pirate-bay-of-science-12250407>; last access November 2022

agencies' risk aversion and bias against novelty. Established in 2007, ERC grants should fund curiosity-driven (i.e. characterised by high risk and high gain) research; however, their implementation systematically disadvantages novel and high-risk proposals of young scholars (Franzoni et al., 2022). Incentivising curiosity-driven research through their funding might help to restore academic values. Comparing two funding schemes in life sciences (NIH vs HHMI), Azoulay, Graff Zivin, and Manso (2011) find that funding schemes and incentives matter. The HHMI funding, which emphasises research freedom and creativity, having a long-term focus, promoting intellectual experimentation, and providing feedback, generates more breakthrough innovations than traditional funding (NIH). Moreover, the effect on innovative performance is significant, as predicted by the idea that academic values matter to scholars. Indeed, research freedom and the ability to pursue curiosity-driven research are valuable for scholars and affect their behaviour, performance and eagerness towards CWB.

Finally, concerning PhD job market and early career employment, the field of economics provides a test bed for trying to overcome early bibliometric assessment (Coles et al., 2010).¹⁴ The economics job market does not consider bibliometric indicators for hiring young scholars. Instead, the Faculty evaluate candidates' potential by reading their "job market paper", which is often not published and, therefore, peer-reviewed. Such policy attenuates the emphasis on quantitative bibliometrics indicators and an early quest for publishability. However, this recruitment mechanism is limited at the early career phase and experiments such as the one by Utrecht University are still to come.

Even if not strictly related to workplace policies evaluation, our findings help scientific publishers and universities design measures against academic piracy besides relying on copyright law sanctions threats. We highlight the link between a deterioration of academic values and digital piracy, hinting at novel ways to address academic piracy. Beyond improving access to scientific resources, diminishing the emphasis on bibliometric indicators, promoting risky and curiosity-driven research, and developing new career evaluation tools will decrease the likelihood of experiencing an ideology-based psychological contract breach of academic values and break the negative spiral between academic discontent and deviant behaviour.

Finally, our investigation of moderating factors also contributes to designing effective prevention policies by identifying worker characteristics that impact the likelihood of engaging in academic piracy. Historically marginalised categories in the job market and academia respond differently to ideology-based contract breaches. Their experience of discrimination and resilience when experiencing academic discontent makes these groups less sensitive and prone to deviant behaviour.

These different responses to the academic discontent call for targeting specific prevention policies for these categories. For example, a piracy prevention policy accompanied by an inclusion policy promoting the participation of women and foreigners in academia might generate an environment less prone to such behaviours. Finally, our results indicate specific patterns for non-tenured scholars that should guide targeted prevention policies. Any policy designed to reduce job insecurity (e.g. career counselling, planning of staff turnover) might help prevent such forms of mild deviant behaviours.

6. Conclusion

The academic profession has changed dramatically in the last decades. The increase of bureaucratic control, the implementation of performance-based evaluation measures, the pres-

¹⁴The last report about the US PhD job market in Economics is available in (Cawley et al., 2022)

sure on publishing, teaching, funding, and the increasing role of commercial activities might threaten the academic profession's cornerstones. These changes have generated a growing sense of discontent. Kathleen R. Brewer, in a recent article in the Financial Times, describes the increasing emphasis and "power" of non-academic staff at universities as a Management Bloat, a "*distraction from their central focus on teaching and research*" that "*undermines the function of universities*".¹⁵ After a massive strike at UK universities last February, Elizabeth Gibney documented some testimony of scholars' discontent in Nature (Gibney, 2022). In the article, Prof. Felicity Callard, Geographer at Glasgow University, says "*This is a sector that has reached the end of the road. The conditions under which people are working are unsustainable*".

In this paper, we use organisational psychology to document how changes in the academic profession that have jeopardised its core values relate to mild DWBs, such as copyright violations. The focus on academia provides an interesting case of ideology-based psychological contract breach, underlining the need to investigate profession-specific issues concerning DWB prevention. We find that experiencing an ideology-based psychological contract breach related to the deterioration of academic values increases the likelihood of indulging in deviant behaviour against publishers (i.e. using Sci-Hub to download the scientific literature) with a sizeable effect.

This paper makes both theoretical and empirical contributions. Regarding the theory, we bridge the organisational psychology literature with the literature on the economics of science to examine the role of ideology-based psychological contract breaches in eliciting deviant behaviours in the specific context of academia. This context is particularly interesting because it is documented how academic researchers value adherence to such values and because deviant behaviour targets scientific publishers rather than the employing organisation. Scientific publishers are relevant third parties as they certify the quality of research with their journals and can be perceived as co-responsible for the diffusion of the "publish-or-perish" paradigm corresponding to academic values deterioration. Furthermore, the increasing relevance of the publishability of research results reduces the scholars' freedom to pursue curiosity-driven research and undermines the academic values and fundamental principles of scientific research.

Our results also contribute to the empirical literature on preventing DWB in three ways. First, we shed light on a mild transgression, examining its antecedents and determinants. We analyse a form of deviant behaviour that goes unnoticed because using Sci-Hub for downloading scientific papers violates copyrights and harms (mostly) scientific publishers. Second, we examine the role of ideology-based psychological contract breaches in eliciting mild deviant behaviours. We test whether the perceived deterioration of academic values prompts using Sci-Hub. The analysis of ideology-based psychological contract breaches helps to define deviant behaviour prevention policies based on profession-specific needs and characteristics. Any policy aiming to restore the core of academic values might also have the unintended but desirable effect of reducing copyright violations. Third, we investigate whether group factors such as demographic or contract characteristics moderate the link between deviant behaviour and ideology-based psychological contracts breach. We test if potentially discriminated groups in the job market (i.e. females and foreign) and those with job security (i.e. faculty members) are less responsive in terms of deviant behaviour when they experience ideology-based psychological contract breach. Identifying groups of workers more/less resilient to the effect of contract breach in eliciting deviant behaviours might help define target groups for prevention policies.

Overall, our results underline that some demographic and contextual characteristics, such as job insecurity, moderate the relationship between a psychological contract breach of aca-

¹⁵<https://www.ft.com/content/338d7321-bc87-4573-885e-565f34a80b30>

democratic values and Sci-Hub use. These results give new insights into the link between ideology-based psychological contract breaches and the behaviour toward relevant third parties. In explaining such behaviours in the workplace, the complex relationship with demographic and contextual factors suggests the need for context-specific approaches and considering intrinsic motives (such as the increasing dystonia between journal copyright and academic values) to tackle this behaviour. In particular, our study suggests using context-specific and profession-specific approaches to prevent workplace deviant behaviour from spreading.

The study has some limitations that will spark future research. First, given the cross-sectional nature of the data, our ability to draw causal conclusions is limited. Future research, possibly using different methods, might address this issue. Second, given the cross-sectional nature of the data, we measure academic discontent at a specific point in time and not its evolution over time. Finally, it addresses a specific type of deviant behaviour towards third parties. However, our analysis does not rule out the breach of academic values may affect other types of DWBs.

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Appendix A. List of universities

| Name | N. emails | Country | City | Founded | THE Rank | Res. Rank | C/I Rank | N. Students | Student/Staff | % Int Students | Soc. Sci. | Hum. | Life Sci. | Eng. | Med. |
|--|-----------|-------------|------------|---------|-----------|-----------|----------|-------------|---------------|----------------|-----------|------|-----------|------|------|
| Heidelberg University | 9597 | Germany | Heidelberg | 1386 | 42 | 71 | 52 | 20,020 | 14.5 | 18% | 1 | 1 | 1 | 1 | 1 |
| Humboldt University of Berlin | 4633 | Germany | Berlin | 1810 | 80 | 54 | 428 | 33,388 | 56.3 | 18% | 1 | 1 | 1 | 1 | 1 |
| LMU Munich | 1996 | Germany | Munich | 1472 | 32 | 34 | 161 | 34,249 | 33.6 | 17% | 1 | 1 | 1 | 1 | 1 |
| Technical University of Munich | 4793 | Germany | Munich | 1868 | 41 | 42 | 209 | 23,377 | 39.8 | 31% | 1 | 1 | 1 | 1 | 1 |
| University of Hamburg | 2657 | Germany | Hamburg | 1724 | 100+ | 988 | 1169 | 19,415 | 17.7 | 11% | 1 | 1 | 1 | 1 | 1 |
| Technical University of Denmark | 2635 | Denmark | Copenhagen | 1782 | 100+ | 988 | 1169 | 19,415 | 17.7 | 11% | 1 | 1 | 1 | 1 | 1 |
| University of Technology and Economics | 2655 | Hungary | Budapest | 1825 | 100+ | 988 | 1169 | 19,415 | 17.7 | 11% | 1 | 1 | 1 | 1 | 1 |
| Eotvos Lorand University | 2687 | Hungary | Budapest | 1635 | 601-800 | 747 | 768 | 27,199 | 14.8 | 10% | 1 | 1 | 1 | 1 | 1 |
| University of Debrecen | 1084 | Hungary | Debrecen | 1538 | 801-1000 | 1201 | 1038 | 26,938 | 14.1 | 21% | 1 | 1 | 1 | 1 | 1 |
| Delft University of Technology | 7065 | Netherlands | Delft | 1842 | 78 | 72 | 60 | 19,594 | 17.1 | 31% | 1 | 1 | 1 | 1 | 1 |
| University of Pecs | 2657 | Hungary | Pecs | 1912 | 601-800 | 1183 | 844 | 16,798 | 11.7 | 24% | 1 | 1 | 1 | 1 | 1 |
| University of Szeged | 1434 | Hungary | Szeged | 1792 | 1001-1200 | 1201 | 1038 | 26,938 | 14.1 | 21% | 1 | 1 | 1 | 1 | 1 |
| National University of Ireland, Galway | 1489 | Ireland | Galway | 1897 | 401-500 | 405 | 425 | 18,007 | 28.6 | 12% | 1 | 1 | 1 | 1 | 1 |
| National University of Ireland, Galway | 1187 | Ireland | Galway | 1845 | 301-350 | 336 | 405 | 14,453 | 26.6 | 18% | 1 | 1 | 1 | 1 | 1 |
| Trinity College Dublin | 5437 | Ireland | Dublin | 1592 | 155 | 169 | 296 | 17,154 | 21.4 | 32% | 1 | 1 | 1 | 1 | 1 |
| University College Cork | 1423 | Ireland | Cork | 1845 | 301-350 | 344 | 230 | 17,051 | 17.6 | 19% | 1 | 1 | 1 | 1 | 1 |
| University College Dublin | 1633 | Ireland | Dublin | 1854 | 251-300 | 245 | 353 | 23,148 | 23.2 | 30% | 1 | 1 | 1 | 1 | 1 |
| Sapienza University of Rome | 6586 | Italy | Roma | 1303 | 201-250 | 202 | 224 | 77,496 | 22.9 | 7% | 1 | 1 | 1 | 1 | 1 |
| University of Bologna | 3252 | Italy | Bologna | 1088 | 351-400 | 309 | 362 | 46,900 | 21.7 | 7% | 1 | 1 | 1 | 1 | 1 |
| University of Milan | 8602 | Italy | Milano | 1222 | 251-300 | 321 | 289 | 46,900 | 21.7 | 7% | 1 | 1 | 1 | 1 | 1 |
| University of Padua | 3252 | Italy | Padova | 1222 | 251-300 | 321 | 289 | 46,900 | 21.7 | 7% | 1 | 1 | 1 | 1 | 1 |
| University of Trento | 3793 | Italy | Trento | 1962 | 301-350 | 339 | 333 | 13,180 | 20.1 | 7% | 1 | 1 | 1 | 1 | 1 |
| Erasmus University Rotterdam | 2224 | Netherlands | Rotterdam | 1913 | 72 | 91 | 41 | 26,453 | 26.8 | 22% | 1 | 1 | 1 | 1 | 1 |
| Leiden University | 4138 | Netherlands | Leiden | 1575 | 70 | 60 | 214 | 30,178 | 19 | 18% | 1 | 1 | 1 | 1 | 1 |
| University of Amsterdam | 4532 | Netherlands | Amsterdam | 1575 | 70 | 60 | 214 | 30,178 | 19 | 18% | 1 | 1 | 1 | 1 | 1 |
| University of Utrecht | 6232 | Netherlands | Utrecht | 1612 | 86 | 102 | 142 | 27,777 | 14.8 | 24% | 1 | 1 | 1 | 1 | 1 |
| Karolinska Institute | 191 | Sweden | Stockholm | 1686 | 75 | 75 | 14 | 32,022 | 14.7 | 10% | 1 | 1 | 1 | 1 | 1 |
| Lund University | 9214 | Sweden | Lund | 1810 | 36 | 47 | 66 | 7,696 | 8.8 | 20% | 1 | 1 | 1 | 1 | 1 |
| Stockholm University | 3879 | Sweden | Stockholm | 1666 | 103 | 100 | 202 | 27,443 | 11.3 | 19% | 1 | 1 | 1 | 1 | 1 |
| University of Gothenburg | 2726 | Sweden | Gothenburg | 1878 | 183 | 130 | 235 | 27,200 | 19.1 | 10% | 1 | 1 | 1 | 1 | 1 |
| Uppsala University | 6115 | Sweden | Uppsala | 1891 | 191 | 210 | 94 | 19,616 | 9.8 | 13% | 1 | 1 | 1 | 1 | 1 |
| | | | | 1477 | 111 | 98 | 212 | 25,112 | 15.8 | 18% | 1 | 1 | 1 | 1 | 1 |

Table A1. List of Universities

Appendix B. Principal components analysis

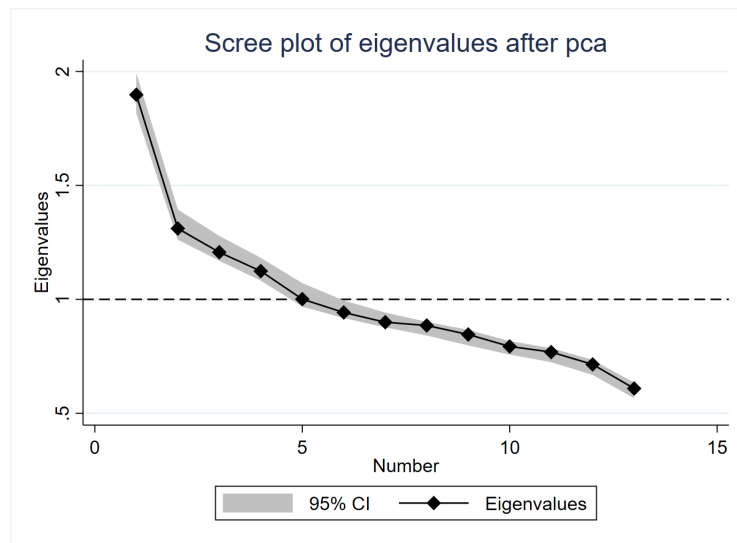


Figure B1. Screeplot of the Principal Component Analysis on the 13 items, with 95% heteroskedastic bootstrap confidence intervals.