

The Role of Justice Perceptions in Formal and Informal University Technology Transfer

David A. Waldman¹, Manuel J. Vaulont², Rachel M. Balven¹, Donald S. Siegel³, and Deborah E. Rupp⁴

¹ Department of Management and Entrepreneurship, Arizona State University

² Department of Management, The Hong Kong University of Science and Technology

³ School of Public Affairs, Arizona State University

⁴ Department of Psychology, George Mason University

We extend organizational justice theory by investigating the justice perceptions of academic entrepreneurs regarding interactions with their universities. We assess how these justice perceptions influence the propensity of academic entrepreneurs to engage in different forms of commercialization, as well as the moderating role of entrepreneurial identity and prosocial motivation. We test our predictions using data from 1,329 academic entrepreneurs at 25 major U.S. research universities. Our results indicate that organizational justice is positively associated with intentions to engage in formal (i.e., sanctioned) technology transfer, and negatively associated with intentions to engage in informal (unsanctioned and noncompliant) technology transfer, which we characterize as a form of organizational deviance. Our findings also show that entrepreneurial identity and prosocial motivation (i.e., a focus on oneself vs. others) amplify and attenuate, respectively, the relationship between justice perceptions and technology transfer intentions. Finally, although intentions to engage in formal technology transfer predict subsequent behavior, intentions to engage in informal technology transfer do not.

Keywords: organizational justice, entrepreneurial identity, prosocial motivation, technology transfer, entrepreneurship

Academic entrepreneurs are university scientists, engineers, and other researchers who engage in innovation and commercialization activities (Siegel & Wright, 2015a). These individuals have been central to numerous innovations (e.g., insulin, penicillin, pacemakers, computers, the internet, smartphones, magnetic resonance imaging, HIV antiviral therapies, artificial intelligence, lasers) that have significantly improved and extended our lives (Price & Siegel, 2019). Through a process known as *technology transfer*, universities work with academic entrepreneurs to transform innovations into products and services that benefit society. This process may include activities such as patenting and collaborations with firms external to the university. For example, the Pfizer/BioNTech and Oxford/AstraZeneca vaccines were based on university research from the University of Mainz and Oxford University, respectively (Thomas & Colin-Jones, 2021). Academic entrepreneurs may also start companies in partnership with their universities. For instance, Professor

Robert Langer of MIT is a cofounder of Moderna, which developed the NIH/Moderna COVID-19 vaccine.

Like conventional entrepreneurs, academic entrepreneurs attempt to create novel products or services. However, the channels through which academic entrepreneurs commercialize their work differ. One such channel occurs when they disclose inventions to their universities, which can then patent and license those innovations to existing companies or start-up firms. This is referred to in the remainder of this article as *formal* technology transfer. Another channel occurs when academic entrepreneurs do not disclose inventions to their universities and engage in illicit, backdoor agreements with private entities, thus violating university and/or federal policies (referred to herein as *informal* technology transfer). Scholars have recently considered the fairness-related reasons that researchers engage in either form of technology transfer (Balven et al., 2018). This represents an important extension of organizational justice scholarship, which tends to generalize across contexts and not consider more nuanced ways that justice perceptions manifest specific behaviors within specific contexts (e.g., Erdogan et al., 2006; Wang et al., 2015; Zhang et al., 2014). By directly implementing context specificity into our theorizing (Johns, 2006; Schminke et al., 2015) and exploring these linkages empirically, we hope to shed light on a highly impactful organizational behavior—that of technology transfer.

Indeed, academic entrepreneurs who engage in informal, illicit technology transfer may detract from potential societal benefits because their innovations may be less likely to come to fruition without university backing (Siegel et al., 2003). As a result of these counterproductive forms of informal technology transfer, universities experience revenue and prestige-related losses that are amplified

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Correspondence concerning this article should be addressed to David A. Waldman, Department of Management and Entrepreneurship, W. P. Carey School of Business, Arizona State University, P.O. Box 874006, Tempe, AZ 85827, United States. Email: waldman@asu.edu

by the loss to public benefit. Managerial policies in universities that promote formal technology, and thus reduce the incidence of informal technology transfer, are likely to lead to more commercialization, which yields large societal benefits (Markman et al., 2005). Through such processes as education and communication, university technology transfer officials have become much more effective in working with academic entrepreneurs to commercialize their innovations (Bolzani et al., 2021). In addition, universities have developed units such as incubators/accelerators and science/technology parks with substantial resources to aid academic entrepreneurs in the commercialization of their innovations. These include not just physical resources, but a vast social network of academic entrepreneurs on campus and in the surrounding regions of the universities (Colombo et al., 2021). The bottom line is that, despite what some independent-minded, academic entrepreneurs might think, working through the university often leads to faster and more productive commercialization, as compared to working around the university (Weckowska, 2015).

It is important to note that there are numerous benefits to the university when academic entrepreneurs engage in formal technology transfer (Siegel & Wright, 2015b). These include additional revenue, equity in start-ups, new industry partnerships, and sponsored research. Formal technology transfer can promote economic development, firm growth, and job creation, which enhances the economic impact of the university and resonates with state and local politicians and other key university stakeholders. In addition, such activities can benefit students, through their participation in applied research, education about patenting and licensing, and enhanced job prospects. Furthermore, the university may get credit for addressing global challenges in health, the environment, and technology, all of which can lead to donations and grants.

In addition to exploring how organizational justice perceptions influence these different channels to technology transfer, we consider individual difference characteristics that serve as boundary conditions on these decisions. That is, we leverage our theoretical framework to argue that individual differences representing self-concerns versus concern for others that are relevant to the technology transfer context—namely, *entrepreneurial identity* and *prosocial motivation* (Bolino & Grant, 2016; Navis & Glynn, 2011)—will influence the extent to which organizational justice perceptions lead to formal versus informal technology transfer.

This article makes three key contributions. First, we contribute to an understanding of why and how academic entrepreneurs may comply with or circumvent university policies when commercializing their work. Thus, we add to technology transfer research that has largely overlooked psychological variables such as organizational justice. This dearth of research is unfortunate given that such factors may determine the success of technology transfer efforts for universities, organizations, and society as a whole. Second, we leverage the unique context of university technology transfer to contribute to research on organizational justice. By focusing on entrepreneurial identity and prosocial motivation as moderating variables, we demonstrate how the impact of justice perceptions on outcomes may be strengthened and weakened by specific, context-relevant individual characteristics (Johns, 2006). Third, our work has practical implications. Specifically, we shed light on how universities—and thus the public—may benefit from paying attention to the dynamics surrounding the fair treatment of academic entrepreneurs.

Technology Transfer and Organizational Justice

The hypotheses that we develop below are grounded in organizational justice theory. Organizational justice characterizes employees' perceptions of whether the outcomes, procedures, information, and interpersonal treatment to which they are exposed are fair, referred to as distributive, procedural, informational, and interpersonal justice, respectively (Colquitt, 2001). These aspects of justice can be considered individually, or as an overall construct as we treat it herein (Ambrose et al., 2015). Decades of research point to the impact of justice perceptions on attitudes and behaviors, with negative implications for employees and organizations when justice perceptions are low, and positive implications when they are high (Colquitt et al., 2013; Rupp et al., 2014).

Justice research has considered three essential elements surrounding employees' justice concerns, which can influence reactions to justice (Cropanzano, Rupp, et al., 2001). First, justice concerns can be instrumental (i.e., self-focused) in nature, and pertain to maximizing one's personal outcomes (Greenberg & Colquitt, 2005). Conversely, justice concerns can be deontic in nature, and pertain to one's concern for the welfare of others and compliance with moral duties (Folger & Glerum, 2015; Korsgaard et al., 2015). Finally, justice perceptions are imperative for the building of relationships, which often manifests in the form of organizational identification and perceived social exchange with the organization (Blader & Tyler, 2015; Cropanzano & Rupp, 2008). In this article, we ground our predictions in this framework in a way that is tailored specifically to the context of academic entrepreneurs engaging in technology transfer.

When academic entrepreneurs seek to commercialize intellectual property, they are required by law and university policy to disclose their inventions to the university, which then evaluates those inventions for potential commercialization. We propose that academic entrepreneurs' perceptions of their treatment by the university and its representatives may influence their propensity to either engage in commercialization *through the university* (i.e., formal technology transfer) or to *bypass* formally sanctioned procedures (i.e., informal technology transfer). We argue that the technology transfer process is rife with opportunities for academic entrepreneurs to evaluate their treatment, especially when discrepancies arise between how they, versus how their universities, value innovations. More generally, we hypothesize that academic entrepreneurs' justice perceptions are shaped by their interactions with university officials, and that these perceptions are likely to influence their desire to engage in both formal and informal technology transfer.

On the one hand, the academic entrepreneur and university may agree on the commercial potential and need for the expediency of an innovation. In that case, the individual may recognize and appreciate the support of the university in filing a patent, as well as negotiating licensing agreements, thereby promoting formal technology transfer and preventing informal technology transfer. On the other hand, low justice perceptions may be an obstacle to formal technology transfer and promote informal technology transfer. For example, some individuals may believe in the commercial potential of their innovations, while their universities may conclude otherwise. These disagreements can lead to situations where the university refuses to allocate time and resources (e.g., expenditures on filing a patent) to commercialize an innovation. Similarly, academic entrepreneurs may become frustrated if they think that the university is too

slow in commercializing their innovations, thus mirroring the passion of conventional entrepreneurs (Lex et al., 2020; Uy et al., 2020).

We consider *formal* technology transfer as a form of an extra-role, organizational citizenship behavior (OCB; Dekas et al., 2013; Hoffman et al., 2007; Organ, 1997). As such, formal technology transfer on the part of academic entrepreneurs are behaviors that help their universities pursue strategic objectives (Brebels et al., 2014; Campbell, 2012), and does so in a manner that is compliant with organizational policy (Coleman & Borman, 2000; Podsakoff et al., 2000). We characterize this behavior as extra role for academic entrepreneurs because entrepreneurship is typically not considered a central job requirement. That is, their traditional work role is more limited in scope and directs them to conduct scholarly research, secure grants, teach and mentor students, and engage in service for their academic departments and the profession. Although engagement in technology transfer may be sponsored, initiated, and encouraged by the institution, it goes beyond the basic activities of a university faculty member.

In contrast, we consider *informal* technology transfer as a form of organizational deviance (Jennings et al., 2015; Mitchell et al., 2018) because it involves illicit actions aimed at circumventing formal procedures when attempting to commercialize (Markman et al., 2008). For example, informal technology transfer includes pursuing patents through means other than the university (Thursby et al., 2009). Such bypassing of the formal system can also occur when an academic entrepreneur decides to leave the university to form a start-up company (without the university having an equity stake in the business), thereby commercializing an innovation that originated within the university. Furthermore, informal technology transfer can pertain to indirect sidestepping of formal technology transfer processes, such as the commercialization of research via consulting or other types of engagement with industry (see Huyghe et al., 2016). Bypassing the university in this fashion is a form of organizational deviance because it constitutes intentional behaviors that violate organizational norms, and has adverse effects on the organization (Hollinger, 1986; Robinson & Bennett, 1995).

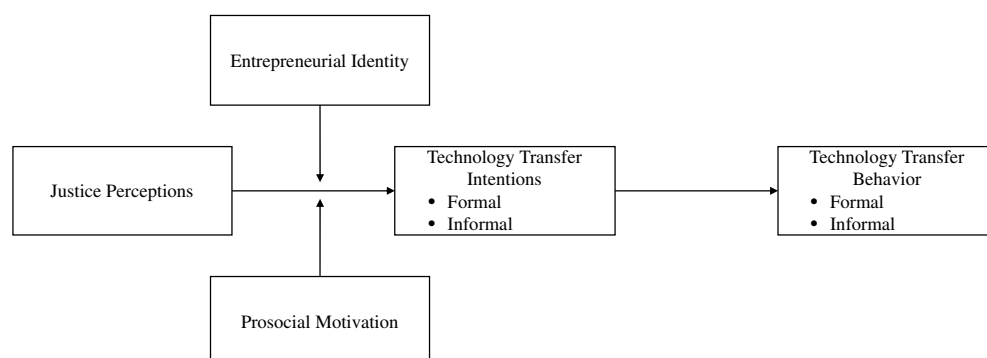
As shown in Figure 1, our theorizing highlights the importance of justice perceptions in relation to both formal and informal technology transfer. In this context, distributive justice perceptions pertain to the fairness of outcomes, such as employees' perceptions of whether or not they receive a fair share of the rewards associated

with commercialization (e.g., royalties). There is indeed disparity among universities regarding the allocation of licensing revenues or royalties (Siegel et al., 2003) because royalty distribution formulas are established at the university level. Procedural justice manifests in this context as the consistency by which technology transfer policy is administered; the amount of voice that academic entrepreneurs have regarding technology transfer policies and procedures; and whether they are able to appeal decisions regarding the commercial potential of their work. Furthermore, both interpersonal and informational aspects of organizational justice stand to play key roles within technology transfer. For example, academic entrepreneurs might perceive that they are not being treated fairly if they believe that the university's conduct toward them lacks dignity and respect (e.g., by suggesting that their innovations are unimportant), or if policies and procedures relating to commercialization are not widely available or adequately explained. Consistent with past research (e.g., Ambrose & Schminke, 2009; Jones & Martens, 2009; Zhang et al., 2014), we treat distributive, procedural, interpersonal, and informational justice as collectively relevant in terms of academic entrepreneurs' *overall justice perceptions pertaining to technology transfer*.

As noted, academic entrepreneurs are supposed to interact with the university's technology transfer office (TTO) to commercialize their research (Siegel & Wright, 2015a). If academic entrepreneurs perceive the handling of technology transfer to be fair, past research suggests that this may engender positive organizational identification and social exchange between them and their universities (Blader & Tyler, 2015; Cropanzano & Rupp, 2008). That is, when academic entrepreneurs perceive their university to be fair in terms of its TTO practices, they are more likely to trust that the university will support the commercialization of their ideas in a mutually beneficial and nonexploitive way. In turn, this trust manifests in willingness to cooperate with the university through the intended use of the formally prescribed technology transfer process. However, if academic entrepreneurs experience low levels of justice pertaining to technology transfer, identification and social exchange may be threatened, potentially increasing their propensity or intentions to "work around" or bypass the system by engaging in informal technology transfer. In summary, we propose that

Hypothesis 1a: There is a positive relationship between academic entrepreneurs' justice perceptions pertaining to

Figure 1
Theoretical Model



technology transfer and their intentions to engage in formal technology transfer.

Hypothesis 1b: There is a negative relationship between academic entrepreneurs' justice perceptions pertaining to technology transfer and their intentions to engage in informal technology transfer.

Moderating Effects of Self Versus Others Concerns

As mentioned above, we invoke an organizational justice framework in this article that recognizes that, in addition to relational factors playing a role in how individuals react to perceived justice, individuals' concerns for both themselves and others play a role (Korsgaard et al., 2015; Skitka, 2003). In considering the specific context of technology transfer and academic entrepreneurship, we identify entrepreneurial identity and prosocial motivation as constructs that are representative of these concerns.

Entrepreneurial Identity

Entrepreneurial identity refers to the extent to which an individual sees the entrepreneurial role as an integral part of one's self (Navis & Glynn, 2011). Several studies have found that academic entrepreneurs differ in their levels of entrepreneurial identity (Jain et al., 2009; Shepherd & Haynie, 2009). In the context of technology transfer, entrepreneurial identity is especially consequential because an individual who identifies strongly as an entrepreneur may prioritize entrepreneurial activities over other work responsibilities, and therefore be particularly attuned and reactive to issues of justice surrounding technology transfer. Given that entrepreneurial identity is associated with the desire for personal independence and individual achievement, an academic entrepreneur with a high entrepreneurial identification can be considered more self-oriented, and thus, more instrumentally concerned about justice issues pertaining to technology transfer, which in turn will influence their reactions (i.e., formal vs. informal technology transfer) to their justice perceptions.

In other words, we argue that when encountering justice issues within the technology transfer context, academic entrepreneurs with stronger entrepreneurial identities will be more likely to be affected by their justice perceptions. That is, if being an entrepreneur is central to one's identity, then justice pertaining to technology transfer may be more important to that individual because the process of commercialization would be need fulfilling (Cropanzano, Byrne, et al., 2001). Thus, perceived justice in the technology transfer process is likely to lead to intentions to work with the organization for commercialization purposes. In contrast, academic entrepreneurs with weaker entrepreneurial identities are expected to be less reactive to perceived justice because entrepreneurship is relatively less salient to their sense of self. Such individuals are expected to be less sensitive to high or low levels of perceived justice, and thus less likely to respond to perceived justice via heightened intentions to engage in formal technology transfer behaviors. In summary, we propose that entrepreneurial identity moderates the magnitude of the effect of justice perceptions on subsequent behavioral intentions. In this case, the process described in Hypothesis 1a is expected to be strengthened for those with stronger entrepreneurial identities:

Hypothesis 2a: The extent to which justice perceptions pertaining to technology transfer positively predict academic entrepreneurs' formal technology transfer intentions will be moderated by entrepreneurial identity. Specifically, the positive relationship will be stronger for those whose entrepreneurial identity is high.

In addition, entrepreneurial identity should magnify the negative relationship between justice perceptions and *informal* technology transfer intentions. On the one hand, individuals with favorable justice perceptions and stronger entrepreneurial identity may be averse to the notion of pursuing informal technology transfer. On the other hand, low levels of perceived justice in the technology transfer process would be need threatening for those with a strong entrepreneurial self-concept, and thus, induce intentions to bypass the university when commercializing one's work.

Accordingly, the *negative* relationship between justice and informal technology transfer intentions should intensify (i.e., become more negative) for individuals who have a stronger entrepreneurial identity. That is, these academic entrepreneurs will be more reactive toward a lack of justice pertaining to technology transfer because such perceptions are particularly threatening to their self-concept. Furthermore, if they believe that they are not being treated fairly by the university, they are more likely to engage in actions to restore justice (Goodstein & Aquino, 2010). Such individuals are likely to feel justified in bypassing sanctioned technology procedures (Gollwitzer et al., 2005). Accordingly, we expect the negative effect of perceived justice pertaining to technology transfer on informal technology transfer intentions to be more negative among those who have a stronger entrepreneurial identity:

Hypothesis 2b: The extent to which justice perceptions pertaining to technology transfer negatively predict academic entrepreneurs' informal technology transfer intentions will be moderated by entrepreneurial identity. Specifically, the negative relationship will be stronger for those whose entrepreneurial identity is high.

Prosocial Motivation

Prosocial motivation refers to an individual's desire to exert effort to benefit others (Grant, 2008). As prosocial motivation underscores altruistic behaviors (Bolino & Grant, 2016), individuals who are higher in prosocial motivation inherently have a stronger other-focus, prioritizing the needs of others, while deferring their own personal pursuits (Grant & Wrzesniewski, 2010). As described by Balven et al. (2018), academic entrepreneurs can vary in prosocial motivation, which can influence how they react to technology transfer-related work experiences. Given academic entrepreneurs' unique position when it comes to commercializing innovations that have the potential to improve the lives of others, their prosocial motivation may be especially important in shaping reactions to technology transfer-related justice perceptions.

We expect that academic entrepreneurs with higher prosocial motivation will be less sensitive to justice-related experiences that they might perceive during the technology transfer process. Because prosocially motivated individuals may be less likely to respond to justice pertaining to themselves, they may focus on how their technology transfer efforts could benefit others. This would be

reflected in a weakening of the respective positive and negative effects of justice perceptions on formal and informal technology transfer intentions. We do not expect such an attenuation effect among those employees with lower levels of prosocial motivation because such individuals would be less other-orientated. These individuals will not be driven by other-concerns in the way that individuals with strong prosocial motivation are (De Dreu & Nauta, 2009) and thus, may be more attuned to responding to justice perceptions. In summary, we predict that

Hypothesis 3a: The extent to which justice perceptions pertaining to technology transfer positively predict academic entrepreneurs' formal technology transfer intentions will be moderated by prosocial motivation. Specifically, the positive relationship will be weaker for those whose prosocial motivation is high.

Hypothesis 3b: The extent to which justice perceptions pertaining to technology transfer negatively predict academic entrepreneurs' informal technology transfer intentions will be moderated by prosocial motivation. Specifically, the negative relationship will be weaker for those whose prosocial motivation is high.

Intentions to Engage in Actual Technology Transfer Behavior

Although attitudes and intentions do not always lead to performed behaviors, research supports that intentions oftentimes facilitate behaviors (Kraus, 1995; Sheeran et al., 2014). For example, research has consistently shown a link between turnover intentions and voluntary turnover (Podsakoff et al., 2007; Steel & Ovalle, 1984). Within the context of technology transfer, we expect that intentions to engage in technology transfer are an important first step toward actual technology transfer behavior. These behaviors may include meeting with people from industry or private foundations to pursue commercialization, conducting clinical trials, filing invention disclosures and patents, and securing licensing agreements (Bercovitz & Feldman, 2004; Siegel et al., 2003). Thus, we hypothesize the following:

Hypothesis 4a: Intentions to engage in formal technology transfer predict subsequent formal technology transfer behavior.

Hypothesis 4b: Intentions to engage in informal technology transfer predict subsequent informal technology transfer behavior.

Conditional Indirect Effects of Justice Perceptions on Technology Transfer Behavior

Integrating our above hypotheses, we suggest that entrepreneurial identity moderates the extent to which academic entrepreneurs' justice perceptions pertaining to technology transfer influence their (in)formal technology transfer behavior via (in)formal technology transfer intentions. Similarly, we suggest that prosocial motivation may influence this indirect effect. Thus, we argue that entrepreneurial identity and prosocial motivation serve as two first-stage moderators in a moderated mediation model. In summary, we expect that

Hypothesis 5a: Entrepreneurial identity serves as a first-stage moderator of the indirect effect of justice perceptions pertaining to technology transfer on formal technology transfer behavior via formal technology transfer intentions. The indirect effect is stronger when entrepreneurial identity is high.

Hypothesis 5b: Entrepreneurial identity serves as a first-stage moderator of the indirect effect of justice perceptions pertaining to technology transfer on informal technology transfer behavior via informal technology transfer intentions. The indirect effect is stronger when entrepreneurial identity is high.

Hypothesis 6a: Prosocial motivation serves as a first-stage moderator of the indirect effect of justice perceptions pertaining to technology transfer on formal technology transfer behavior via formal technology transfer intentions. The indirect effect is weaker when prosocial motivation is high.

Hypothesis 6b: Prosocial motivation serves as a first-stage moderator of the indirect effect of justice perceptions pertaining to technology transfer on informal technology transfer behavior via informal technology transfer intentions. The indirect effect is weaker when prosocial motivation is high.

Method

Participants and Procedure

As part of a broader data collection effort, we collected survey data at three points in time: August 2016, April 2017, and April 2020, respectively. Our research was approved by the Arizona State University Office of Research Integrity and Assurance under the title, "Assessing the Impact of Organizational Justice on Academic Entrepreneurship" (FP00001385). Survey respondents were identified from listservs of university researchers at 25 U.S. leading research (public and private) universities. We initially contacted 18,573 researchers in departments that had at least some possibility of including individuals who potentially had interests in engaging in technology transfer. The first survey was designed to attract and be completed by individuals who either had engaged in technology transfer activities, or who could envision themselves doing so in the foreseeable future. The survey measured justice perceptions as well as demographic and control variables. In total, 1,329 (7.2%) initial surveys were returned. This low response rate needs to be considered in light of the fact that many survey recipients may not have been familiar with, or interested in, engaging in technology transfer (e.g., many social scientists).

In the initial survey, we asked respondents to provide their email addresses for a follow-up survey of which 984 (74%) respondents agreed. We did not find differences in justice perceptions between participants who provided their email addresses versus participants who did not ($\Delta = .08$, $z = 1.45$, $p = .15$). Eight months after the initial survey, we sent out the 2nd survey. This survey included the measures of entrepreneurial identity, prosocial motivation, and intentions to engage in formal and informal technology transfer. We received a total of 399 responses, resulting in a response rate of approximately 41%. Three years after the 2nd survey, we sent out our 3rd survey to the 399 remaining participants. This survey contained measures of formal and informal technology transfer behavior targeting the 3-year period between the 2nd and 3rd surveys. We waited 3 years to accrue enough time for actual

technology transfer activities to occur. We received a total of 230 respondents (57.6%). Our full sample thus consists of individuals that filled out at least one survey. Participants (25% women) were on average 53.8 years of age ($SD = 13.4$) and represented engineering (27.6%), medicine (12.4%), life sciences (30.4%), physical sciences (18.5%), social sciences (5.2%), humanities (0.9%), and other sciences (4.9%). Our sample includes full professors (51.5%), associate professors (19.4%), assistant professors (16.7%), post-doctoral researchers (3.9%), and others (8.7%). The majority of participants (64.6%) reported that they had received tenure. Participants had different racial/ethnic backgrounds, African American (1.5%), American Indian (0.2%), Asian other (2.8%), Chinese Asian (4.9%), Hispanic (2.8%), Indian Asian (3.9%), Native Hawaiian (0.1%), Pacific Islander other (1.0%), and White (83.0%).

Measures

All measures employed a 5-point Likert-type response scale (1 = *strongly disagree*, 5 = *strongly agree*) unless otherwise noted below. We list all survey items in the [Appendix](#).

Justice perceptions were measured using an abbreviated and context-specific form of [Colquitt's \(2001\)](#) scale. [Colquitt \(2001\)](#) suggested that his measure should be adapted to align with the context in which justice perceptions are assessed. Accordingly, we adapted our measure to the technology transfer context (see also [Hansen et al., 2013](#)). Participants indicated the extent to which they perceived their university to be distributively, procedurally, interpersonally, and informationally fair. In the university context, the TTO is the designated organizational unit for protecting and commercializing the research of university scientists and engineers, and thus, scientists and engineers must engage with the TTO for the purpose of potential commercialization. Accordingly, TTO personnel are mentioned in some (but not all) of the items in the [Appendix](#) because they represent a key contact point for would-be academic entrepreneurs. Sample items include "For a given commercialization effort, faculty outcomes related to technology transfer are justified, given the performance of the faculty member(s) involved" and "Technology transfer personnel treat faculty with respect." To allow participants to express uncertainty regarding their justice perceptions, we included a "not sure" option that was subsequently coded as a missing value ([Allison, 2001](#)). Consistent with past research ([Johnson & Lord, 2010](#); [Zhang et al., 2014](#)) and given that our construct of interest was overall justice perceptions, item-level scores were aggregated to create an overall measure of justice perceptions ($\alpha = .92$).

Entrepreneurial identity was assessed using a modified version of the four-item scale by [Brenner et al. \(2014\)](#). A sample item is "I think of myself as an 'entrepreneur'" ($\alpha = .95$).

Prosocial motivation was measured with the four-item measure developed by [Grant \(2008\)](#). In line with our context, participants indicated the extent to which they wanted to contribute to the welfare of others, specifically through their research efforts (e.g., "I want my research to have a positive impact on others"; $\alpha = .94$).

Technology transfer intentions were assessed using two three-item scales, respectively. We created these items after conducting preliminary interviews of 27 academic entrepreneurs engaging in various forms of technology transfer. The interviews revealed specific instances of, or intentions to engage in, both formal and informal technology transfer behavior. A sample item for *formal*

technology transfer intentions is "I intend to work with my university's technology transfer office to commercialize my research in the future" ($\alpha = .87$), and a sample item for *informal* technology transfer intentions is "I plan to work with others outside my university (e.g., companies, former students) to commercialize my research instead of using my university's technology transfer office" ($\alpha = .87$).

Formal and informal technology transfer behavior were assessed using a checklist approach. Our aim was to assess whether participants had actually engaged in technology transfer activities in the 3 years between the 2nd and 3rd survey administrations. To develop checklists, we first, based largely on prior literature (e.g., [Balven et al., 2018](#); [Siegel et al., 2003](#)), constructed initial items for both formal and informal technology transfer activities. Second, we interviewed a new sample of 40 academic entrepreneurs from two universities and four federal laboratories. During these interviews, we showed these individuals our initial checklists and asked for feedback in terms of (a) whether the item made sense as an aspect of formal/informal technology transfer, (b) whether and how the item might be reworded, and (c) potential items that could be added to the respective checklists.

Based on this process, we derived an 11-item checklist for *formal* technology transfer and a 7-item checklist for *informal* technology transfer. Instructions for the *formal* checklist were "with the involvement (or knowledge) of either the technology transfer office or other university officials, have you engaged in any of the activities stated below after the time of our last survey (April 2017)?" Instructions for the *informal* checklist were "without the involvement (or knowledge) of either the technology transfer office or other university officials, have you engaged in any of the activities stated below after the time of our last survey (April 2017)?" A sample item is "Conducting clinical trials (or other forms of 'translational research') to determine the commercial viability of an invention." Responses were either *yes* (1) or *no* (0). We averaged the responses of both checklists ($\alpha = .88$ and $\alpha = .76$, respectively).

Control variables. We controlled for gender, age, age squared (to allow for curvilinear effects), university department (e.g., engineering, medical, or sciences), fixed effects based on participants' self-reported email addresses to capture institutional affiliation, academic rank, agreement regarding the term "invention" (three-item scale, $\alpha = .69$, e.g., "In my field of research, it is not always clear as to what constitutes an 'invention' for the purpose of disclosure to the technology transfer office"), and prior technology transfer activity (two-item scale, $\alpha = .84$, e.g., "I have been involved in technology transfer in the past"). We controlled for these variables because they have been shown in prior research to influence the propensity of academics to engage in technology transfer (for a review, see [Siegel & Wright, 2015a](#)). For example, [Bercovitz and Feldman \(2008\)](#) showed that gender, academic rank, and prior exposure to technology transfer processes affected the probability of faculty members disclosing inventions. Furthermore, [Link et al. \(2015\)](#) demonstrated that the amount of university technology transfer varies by scientific field.

Results

Data Preparation, Descriptive Statistics, and Analyses

[Table 1](#) shows the mean values, standard deviations, reliabilities, and intercorrelations of the measured variables. To account for any

Table 1
Descriptive Statistics, Reliabilities, and Zero-Order Correlations Among Study Variables

| Study variable | <i>M</i> | <i>SD</i> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|----------|-----------|------------|------------|------------|------------|------------|------------|------------|--------|--------|--------|------|-------|------------|------------|
| 1 Justice perceptions | 3.59 | 0.78 | .92 | | | | | | | | | | | | | |
| 2 Entrepreneurial identity | 2.57 | 1.13 | .16** | .95 | | | | | | | | | | | | |
| 3 Prosocial motivation | 4.37 | 0.61 | .12* | .26** | .94 | | | | | | | | | | | |
| 4 Formal technology transfer intentions | 3.49 | 1.13 | .38** | .40** | .15** | .87 | | | | | | | | | | |
| 5 Informal technology transfer intentions | 2.09 | 0.97 | -.35** | .07 | -.11* | -.28** | .87 | | | | | | | | | |
| 6 Formal technology transfer behavior | 0.26 | 0.29 | .11 | .43** | .05 | .53** | .18* | .88 | | | | | | | | |
| 7 Informal technology transfer behavior | 0.09 | 0.18 | .00 | .33** | .15* | .18* | .07 | .43** | .76 | | | | | | | |
| 8 Gender | 1.25 | 0.43 | -.08** | -.14** | .08 | -.07 | -.10 | -.07 | -.08 | | | | | | | |
| 9 Age | 53.79 | 13.38 | -.01 | .11* | .00 | -.04 | .02 | .01 | .06 | -.19** | | | | | | |
| 10 Engineer | 0.28 | 0.45 | .06* | .16** | -.05 | .19** | -.06 | .33** | .23** | -.15** | .02 | | | | | |
| 11 Medical | 0.12 | 0.33 | .01 | .05 | .16** | -.01 | .09 | .08 | .03 | .13** | -.02 | -.23** | | | | |
| 12 Academic rank | 1.99 | 1.27 | .05 | .01 | .05 | .01 | .06 | -.09 | .04 | .07* | -.42** | -.06* | .00 | | | |
| 13 Agreement term invention | 3.38 | 0.82 | -.23** | -.05 | -.02 | -.04 | .26** | -.10 | -.08 | -.01 | -.11* | .02 | -.05 | .07 | .69 | |
| 14 Prior technology transfer activity | 3.07 | 1.48 | .03 | .50** | .09 | .58** | -.04 | .66** | .25** | -.14** | .13** | .28** | -.05 | -.13* | -.03 | .84 |

Note. Numbers in bold on the diagonal represent coefficient α values. Mean values, standard deviations, and reliabilities are based on the observed data. $N = 230$ –1,280. Gender was measured with 1 = men, 2 = women.
* $p < .05$. ** $p < .01$ (two-tailed).

biases through sample attrition, we included the full data set from all three waves into our analyses (Graham, 2009). We grand-mean centered our predictors and moderating variables before creating interaction terms. We created dummy variables reflecting gender and university department. To test our study hypotheses, we used Mplus 8.5 (Muthén & Muthén, 2017) and a robust maximum likelihood estimator to account for nonnormality of the data (Walker et al., 2017). We addressed any missing data through multiple imputation (Allison, 2001; Graham, 2009; Newman, 2014; see also Egan et al., 2017; Park & Rogan, 2019). This strategy is superior to listwise deletion because it provides unbiased estimates and neither discards information nor reduces statistical power (Allison, 2001; Graham, 2009). Exceeding past recommendations (Allison, 2001; Graham, 2009), we generated 100 data sets and averaged the derived estimated coefficients. Figure 2 shows the path coefficients of our full model. Given the difficulties associated with obtaining pooled fit indices (Enders, 2010), we assessed model fit by estimating our study model without imputed data and excluding institution affiliation fixed effects to facilitate model convergence, $\chi^2(23) = 39.75$, $p = .02$, RMSEA = .047, CFI = .96, SRMR = .03. Table 2 describes the path coefficients of the study variables and covariates.

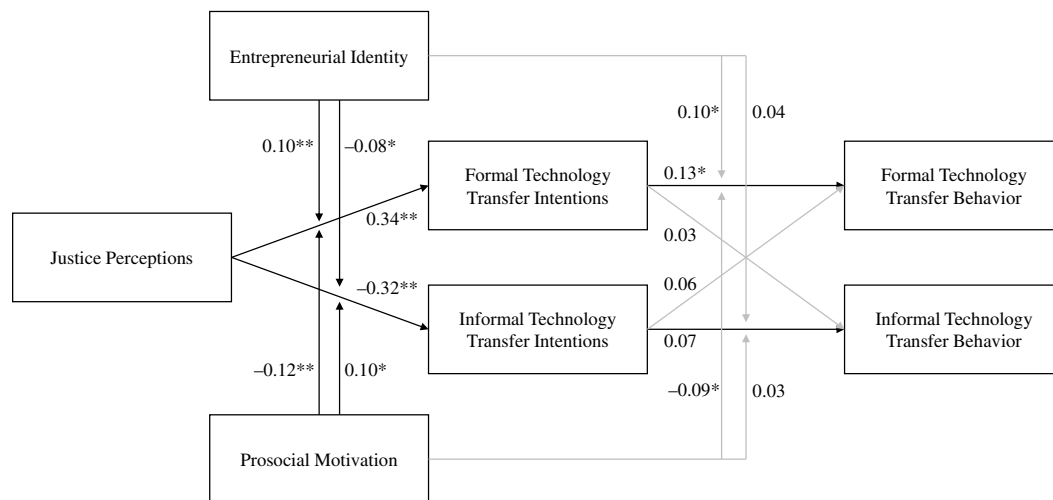
Hypothesis Testing

Consistent with Hypothesis 1a, we found a significant, positive direct effect of justice perceptions on formal technology transfer intentions ($\beta = 0.34$, $p < .001$). Conversely, we found a significant negative direct effect of justice perceptions on informal technology transfer intentions ($\beta = -0.32$, $p < .001$), thus providing support for Hypothesis 1b.

Regarding the moderating effects of entrepreneurial identity, as shown in Table 2, we found a significant interaction effect on intentions to engage in formal technology transfer ($\beta = 0.10$, $p = .01$) and on intentions to engage in informal technology transfer ($\beta = -0.08$, $p = .04$). To further probe the nature of these moderating effects, we plotted the simple slopes of our simple main effects of interest at ± 1 SD from the mean. As shown in Figure 3a, the positive effect of justice perceptions on formal technology transfer intentions was stronger when entrepreneurial identity was high (simple slope = 0.44, $p < .001$) than when entrepreneurial identity was low (simple slope = 0.24, $p < .001$), thus providing support for Hypothesis 2a. As shown in Figure 3b, the negative effect of justice perceptions on informal technology transfer intentions was stronger when entrepreneurial identity was high (simple slope = -0.41 , $p < .001$) than when entrepreneurial identity was low (simple slope = -0.24 , $p < .001$), thus providing support for Hypothesis 2b.

Regarding the moderating effect of prosocial motivation, as shown in Table 2, the Justice perceptions \times Prosocial motivation interaction term was negative and significant ($\beta = -0.12$, $p < .01$) for formal technology transfer. This interaction was positive and significant for informal technology transfer ($\beta = 0.10$, $p = .03$). Figure 4 shows the simple slopes of justice perceptions on formal and informal technology transfer intentions, respectively. As shown in Figure 4a, the positive effect of justice perceptions on formal technology transfer intentions was weaker when prosocial motivation was high (simple slope = 0.22, $p < .001$) than when prosocial motivation was low (simple slope = 0.46, $p < .001$), thereby providing support for Hypothesis 3a. As shown in Figure 4b, the

Figure 2
Results of Path Modeling



Note. Justice perceptions were collected at Time 1. Entrepreneurial identity, prosocial motivation, and technology transfer intentions were collected at Time 2. Technology transfer behavior was collected at Time 3. Standardized path coefficient estimates are reported. Hypothesized paths are depicted in black. Nonhypothesized paths are depicted in gray. Direct effects of the independent variable on the dependent variables, as well as the direct effects of the moderating variables and control variables, are omitted. $N = 1,329$.

* $p < .05$. ** $p < .01$ (one-tailed).

negative effect of justice perceptions on informal technology transfer intentions was weaker when prosocial motivation was high (simple slope = -0.23 , $p < .001$) than when prosocial motivation was low (simple slope = -0.42 , $p < .001$), therefore providing support for Hypothesis 3b.

Regarding the effects of (in)formal technology transfer intentions on (in)formal technology transfer behavior, as shown in Table 2, formal technology transfer intentions predicted subsequent formal technology transfer behavior ($\beta = 0.13$, $p = .02$). Thus, Hypothesis 4a was supported. However, informal technology transfer intentions did not predict informal technology transfer behavior ($\beta = 0.07$, $p = .14$). Thus, Hypothesis 4b was not supported.

We then examined whether entrepreneurial identity and prosocial motivation serve as first-stage moderators of the indirect effects by computing the 95% confidence intervals of the conditional indirect effects using the Markov Chain Monte Carlo (MCMC) approach (Preacher & Selig, 2012) using 100,000 resamples. As shown in Table 3, high levels of entrepreneurial identity strengthened the indirect effect between justice perceptions and formal technology transfer behavior, indirect effect_{High} = 0.056, 95% CI [0.034, 0.079]. In turn, low levels of entrepreneurial identity weakened the indirect effect, indirect effect_{Low} = 0.030, 95% CI [0.017, 0.045]. These effects were different, $\Delta = 0.026$, 95% CI [0.013, 0.041]. Thus, Hypothesis 5a was supported. With regards to prosocial motivation, we found that high levels of prosocial motivation weakened the indirect effect between justice perceptions and formal technology transfer behavior, indirect effect_{High} = 0.027, 95% CI [0.016, 0.041]. In turn, low levels of prosocial motivation strengthened the indirect effect, indirect effect_{Low} = 0.058, 95% CI [0.036, 0.082]. These effects were different, $\Delta = -0.031$, 95% CI [-0.048, -0.017]. Thus, Hypothesis 5b was supported.

Turning toward the conditional indirect effects on informal technology transfer behavior, we found that entrepreneurial identity moderated the indirect effects, indirect effect_{High} = -0.027 , 95% CI [-0.051, -0.003] and indirect effect_{Low} = -0.016 , 95% CI [-0.032, -0.002], respectively. These effects were different, $\Delta = -0.011$, 95% CI [-0.025, -0.001]. Thus, Hypothesis 6a was supported. With regards to prosocial motivation, we found a significant first-stage moderation effect, indirect effect_{High} = -0.015 , 95% CI [-0.030, -0.002] and indirect effect_{Low} = -0.028 , 95% CI [-0.054, -0.003], respectively. Again, these effects were different, $\Delta = 0.013$, 95% CI [0.001, 0.028]. Thus, Hypothesis 6b was supported.

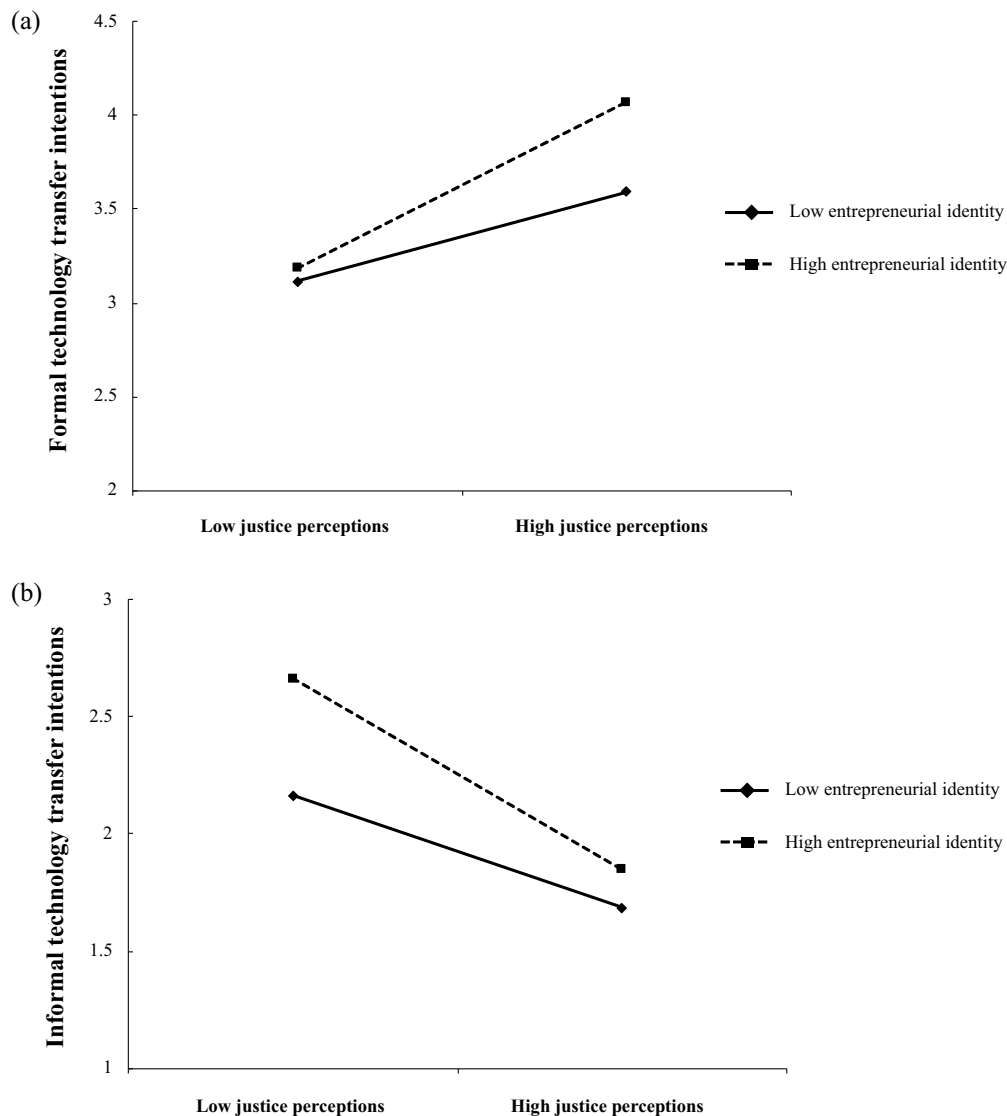
Discussion

In this study, we examined organizational justice within the context of university technology transfer. We focused on academic entrepreneurs' perceptions of justice surrounding technology transfer and the effects of those perceptions on both formal and informal technology transfer intentions and behaviors. In addition to demonstrating the effect of justice perceptions on technology transfer intentions, we found that entrepreneurial identity and prosocial motivation influenced this relationship. As predicted, high levels of entrepreneurial identity strengthened the effect of justice perceptions on technology transfer intentions, whereas the high levels of prosocial motivation weakened it. Hence, we found evidence for the notion that for those who strongly identify with being an entrepreneur, and are lower in prosocial motivation, justice perceptions are quite relevant to subsequent intentions to engage in both forms of technology transfer. These intentions may be important, given the discretionary work environment of academic entrepreneurs.

Table 2
Path Modeling Results

| Study variable | Formal technology transfer intentions | | Informal technology transfer intentions | | Formal technology transfer behavior | | Informal technology transfer behavior | |
|--|---------------------------------------|----------------|---|----------------|-------------------------------------|----------------|---------------------------------------|----------------|
| | Model 1 | Model 2 | Model 1 | Model 2 | Model 1 | Model 2 | Model 1 | Model 2 |
| Gender | -0.02 (0.04) | -0.02 (0.04) | -0.09* (0.04) | -0.09* (0.04) | 0.01 (0.04) | 0.01 (0.04) | -0.03 (0.06) | -0.03 (0.05) |
| Age | -0.15** (0.04) | -0.16** (0.04) | 0.03 (0.06) | 0.03 (0.05) | -0.07 (0.05) | -0.08* (0.05) | -0.01 (0.06) | -0.01 (0.06) |
| Age squared | -0.13 (0.09) | -0.15 (0.09) | 0.13 (0.11) | 0.14 (0.11) | -0.32** (0.11) | -0.34** (0.11) | -0.24* (0.14) | -0.24* (0.14) |
| Engineer | 0.04 (0.04) | 0.03 (0.04) | -0.09* (0.05) | -0.08* (0.05) | 0.18** (0.04) | 0.18** (0.04) | 0.17** (0.06) | 0.17** (0.06) |
| Medical | -0.09* (0.05) | -0.09* (0.04) | 0.11* (0.06) | 0.12* (0.06) | 0.16** (0.05) | 0.16** (0.05) | 0.12* (0.06) | 0.12* (0.06) |
| Academic rank | 0.02 (0.04) | 0.02 (0.04) | -0.01 (0.06) | 0.00 (0.06) | 0.02 (0.05) | 0.01 (0.05) | 0.10 (0.06) | 0.10 (0.06) |
| Agreement term invention | 0.06 (0.04) | 0.06 (0.04) | 0.18** (0.05) | 0.18** (0.05) | -0.11** (0.04) | -0.11** (0.04) | -0.18** (0.05) | -0.18** (0.05) |
| Prior technology transfer activity | 0.51** (0.04) | 0.51** (0.04) | -0.05 (0.05) | -0.06 (0.05) | 0.42** (0.06) | 0.44** (0.06) | 0.05 (0.08) | 0.05 (0.08) |
| Institution affiliation fixed effects | Included | Included | Included | Included | Included | Included | Included | Included |
| Justice perceptions | 0.33** (0.04) | 0.34** (0.04) | -0.32** (0.05) | -0.32** (0.05) | 0.00 (0.05) | 0.03 (0.05) | -0.12* (0.07) | -0.12* (0.07) |
| Entrepreneurial identity | 0.14** (0.05) | 0.14** (0.05) | 0.17** (0.06) | 0.17** (0.06) | 0.13** (0.05) | 0.13** (0.05) | 0.22** (0.08) | 0.22** (0.08) |
| Prosocial motivation | 0.00 (0.04) | 0.00 (0.04) | -0.05 (0.05) | -0.05 (0.05) | -0.05 (0.04) | -0.05 (0.04) | 0.14* (0.06) | 0.15** (0.06) |
| Justice perceptions × Entrepreneurial identity | | 0.10** (0.04) | | -0.08* (0.05) | | 0.10* (0.05) | | 0.04 (0.06) |
| Justice perceptions × Prosocial motivation | | -0.12** (0.04) | | 0.10* (0.05) | | -0.09* (0.05) | | 0.03 (0.06) |
| Formal technology transfer intentions | | | | | 0.16** (0.06) | 0.13* (0.06) | 0.03 (0.07) | 0.03 (0.08) |
| Informal technology transfer intentions | | | | | 0.05 (0.05) | 0.06 (0.05) | 0.07 (0.06) | 0.07 (0.06) |
| R ² | 63.1% | 65.2% | 41.8% | 43.4% | 69.8% | 71.4% | 47.0% | 47.7% |

Note. Standardized coefficients and standard errors (*SEs*, in parentheses) are reported. Model 1 is the main-effect only model and Model 2 adds the moderating effects. $N = 1,329$. * $p < .05$. ** $p < .01$ (one-tailed).

Figure 3*Interaction Effects of Entrepreneurial Identity on Technology Transfer Intentions*

Note. (a) Interaction effect on formal technology transfer intentions. (b) Interaction effect on informal technology transfer intentions.

However, whether or not such intentions translate into actual behavior was only evident for formal technology transfer.

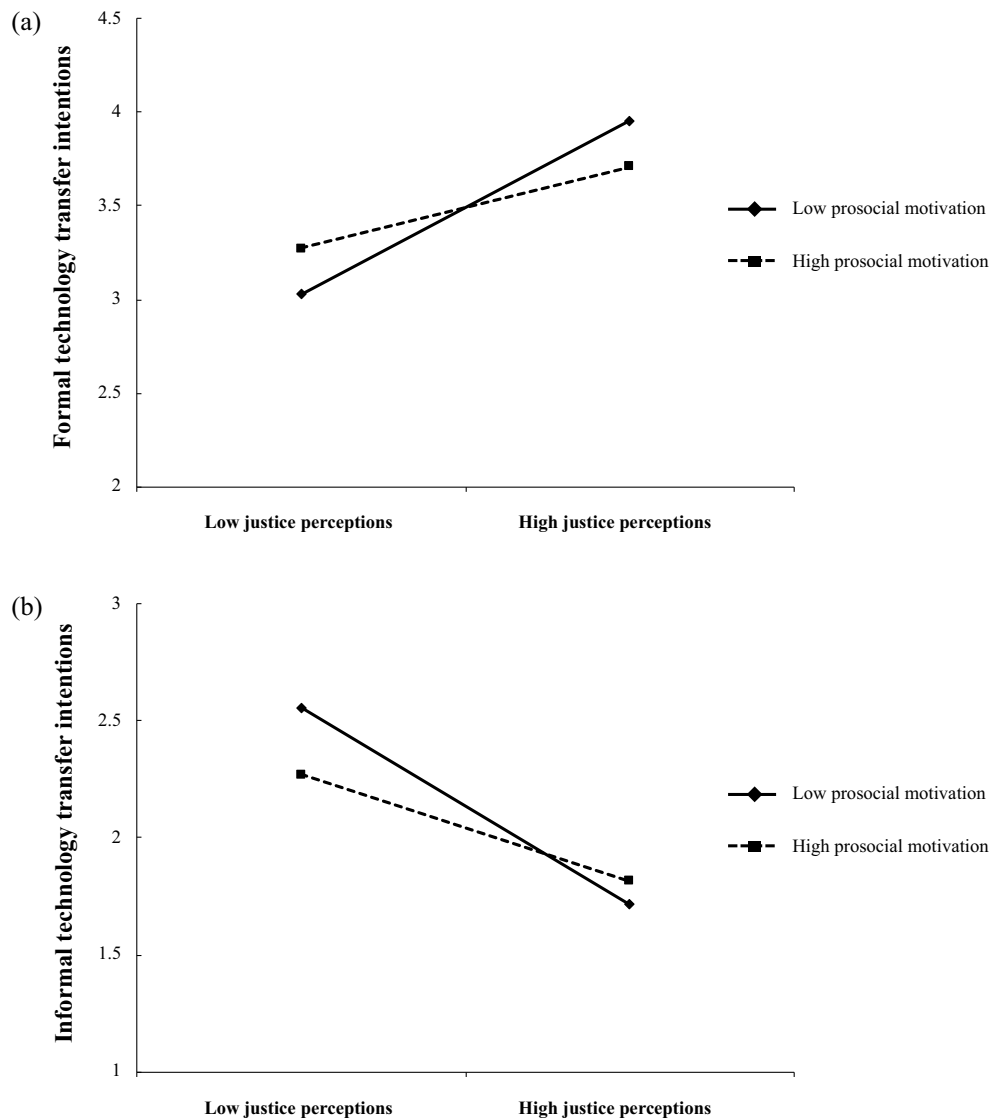
One explanation for our pattern of results is the effect of risk appraisals on the link between intended behavior and behavioral manifestations of these intentions. As predicted by Hypothesis 4, scholars tend to find a strong link between intentions and behaviors. However, this connection is strained or even severed when individuals perceive a risk involved in their potential actions (Bagozzi et al., 1989; Sheeran & Webb, 2016; Webb & Sheeran, 2006). Because informal attempts to commercialize technology are risky, and there exists the possibility of negative ramifications from the university, academic entrepreneurs who intend to engage in informal technology transfer may either switch to a formal route, simply not engage in any commercialization efforts, or act in deviant ways that are unrelated to technology transfer.

Theoretical Contributions and Practical Implications

Prior investigations of the outcomes of organizational justice have largely been either entirely cross-sectional (e.g., Ehrhart, 2004; Kirkman et al., 2009) or with a small time lag (e.g., Colquitt, 2001; Colquitt et al., 2002; Lavelle et al., 2018). Our study uses three separate surveys covering almost 4 years to shed light on the longer-lasting consequences of organizational justice on an activity that not only affects universities but also society at large. Specifically, our study makes three distinct contributions that span both the theoretical and practical purviews.

First, we extend the literature on both technology transfer and organizational justice by considering the role of justice perceptions, as well as juxtaposing the effects of entrepreneurial identity and prosocial motivation as variables that represent antithetical justice

Figure 4
Interaction Effects of Prosocial Motivation on Technology Transfer Intentions



Note. (a) Interaction effect on formal technology transfer intentions. (b) Interaction effect on informal technology transfer intentions.

concerns. Whereas entrepreneurial identity is self-focused and involves maximizing personal gain (Greenberg & Colquitt, 2005), prosocial motivation is other-focused and relates to concern for the welfare of others (Folger & Glerum, 2015; Korsgaard et al., 2015). By investigating these two variables as a reflection of dispositional responsiveness to justice, we support the notion that these distinct individual difference variables work independently to either strengthen or weaken the effect of justice perceptions on subsequent intentions to engage in technology transfer. We further add to the scholarship on the relational aspects of organizational justice. Specifically, we answer a call for research on how justice perceptions are associated with relational dynamics (Blader & Tyler, 2015) by investigating how the justice perceptions and dispositional orientations of academic entrepreneurs influence their relationships with

their universities—as indicated in their propensity to work with or circumvent their universities in the commercialization process.

Second, we utilize the unique context of technology transfer as a medium through which to shape the meaning of constructs and their relationships (Johns, 2006) within the justice framework. In addition to our moderating variables, our context enabled us to identify informal technology transfer as a previously unconsidered, but nevertheless potentially important, form of organizational deviance (and formal technology transfer as a unique citizenship behavior). As contemporary definitions of organizational deviance posit the intention to harm as a primary motivation (Carpenter & Berry, 2017; Hollinger, 1986; Robinson & Bennett, 1995), we proposed a more nuanced, novel approach that considers how justice perceptions may propel employees to consider engaging in such damaging behaviors.

Table 3
Conditional Indirect Effects

| Conditional indirect effect | Formal technology transfer behavior | | Informal technology transfer behavior | |
|-------------------------------|-------------------------------------|------------------|---------------------------------------|------------------|
| | Estimate | 95% CI | Estimate | 95% CI |
| High entrepreneurial identity | 0.056 | [0.034, 0.079] | −0.027 | [−0.051, −0.003] |
| Low entrepreneurial identity | 0.030 | [0.017, 0.045] | −0.016 | [−0.032, −0.002] |
| Δ entrepreneurial identity | 0.026 | [0.013, 0.041] | −0.011 | [−0.025, −0.001] |
| High prosocial motivation | 0.027 | [0.016, 0.041] | −0.015 | [−0.030, −0.002] |
| Low prosocial motivation | 0.058 | [0.036, 0.082] | −0.028 | [−0.054, −0.003] |
| Δ prosocial motivation | −0.031 | [−0.048, −0.017] | 0.013 | [0.001, 0.028] |

Note. Standardized estimates are reported. The 95% MCMC confidence intervals based on 100,000 resamples.

Our theory was based on the relational dynamics between academic entrepreneurs and their universities (see also [Blader & Tyler, 2015](#); [Cropanzano & Rupp, 2008](#)). We posited that it might be possible for academic entrepreneurs to find alternative means for commercializing their innovations when their relationship with the university feels threatened ([Gollwitzer et al., 2005](#)). That said, although justice perceptions may engender intentions to engage in informal technology transfer, we found no evidence that academic entrepreneurs actually follow through with such behavior.

A third contribution of our article focuses on the important managerial and policy implications of our results for universities. Given that universities are increasingly encouraging their faculty members to consider the commercial potential of their research ([Siegel & Wright, 2015a](#)), it is clear that TTO directors and other administrators (e.g., chairs, deans) need to consider justice perceptions that may foster or impede formal commercialization efforts. If instances of low justice are unaddressed, universities may fail to acquire substantial licensing revenue and equity in start-ups, as well as experience losses in economic impact and public recognition. More importantly, the potential benefits to society may not materialize. It is estimated that university technology transfer has bolstered U.S. economic output by approximately \$1.9 trillion, supported nearly six million jobs, and helped launch more than 13,000 start-up businesses since 1980 ([Association of University Technology Managers, 2018](#)). Our research suggests that even greater gains might be realized if TTO directors and university administrators take academic entrepreneurs' justice perceptions into account.

To address this potential problem, university officials should strive to ensure that would-be academic entrepreneurs perceive the university as an ally in commercializing their work, as opposed to a bureaucratic obstacle that can reduce perceptions of fairness. These officials may assume that for the purpose of maximizing entrepreneurial efforts, royalty formulas are perceived as fair by academic entrepreneurs, information is adequately presented to them, and procedures are appropriately followed. However, the academic entrepreneurs themselves may perceive otherwise. Indeed, a key implication of our research is that various university officials (e.g., TTO directors, deans, VPs of research) should be more in tune to justice perceptions of academic entrepreneurs. Although there may be limits as to what university officials can or should do to deal with justice concerns, it is important that they periodically gauge such perceptions through dialogue (e.g., focus groups) and other information collection efforts (e.g., employee surveys), as well as be

attentive to researchers' individual differences (i.e., their entrepreneurial identity and prosocial motivation).

Limitations and Future Research

Four primary limitations to this study should be noted, each of which highlights opportunities for future research. First, our study design involved the disclosure of potentially negative evaluations of university policies and officials, as well as intentions to, and actual engagement in, potentially punishable behaviors (i.e., informal technology transfer). Despite efforts to stress confidentiality, the nature of our survey questions may have restricted variance in our dependent variables out of respondents' fear of negative repercussions. As a result of this range restriction, our effect sizes may be underestimated. Furthermore, in our initial survey, we targeted a broad swath of university researchers, including many individuals for whom academic entrepreneurship was not relevant. Future research employing unobtrusive measures and targeting only active academic entrepreneurs may overcome these issues. Related to this limitation, it is possible that deviance on the part of scientists or engineers who perceive a lack of justice could reveal itself in other ways. For example, an individual might lessen service activities for the university, discourage others' attempts to work toward commercialization through formal means, or even discourage others from joining the university. All of these possibilities could be addressed in future research.¹

Second, we relied on self-reported data, which could induce common method variance, and also potentially impact responses due to social desirability effects ([Fernandes & Randall, 1992](#)). First, we sought to minimize any potential common methods bias by temporally separating the measurement of our independent, mediating, and dependent variables. Furthermore, common method bias is less of a concern when testing interaction effects ([Podsakoff et al., 2012](#); [Siemsen et al., 2010](#)). With regard to low base rates, our low means are consistent with prior research investigating deviant behavior (e.g., [Koopman et al., 2020](#)) and technology transfer-related behavior in general ([Huyghe et al., 2016](#)). That said, future research should consider obtaining information from multiple sources such as department heads and deans, as well as objective data on technology transfer behavior (e.g., meetings with the TTO, patents filed, spin-offs created, court disputes).

¹ We wish to thank an anonymous reviewer for pointing out these possibilities.

A third limitation is that some paths in our model showed relatively small effects, namely, the relationship between formal technology transfer intentions and behaviors after controlling for prior engagement in technology transfer. However, by controlling for this variable, we reduce the unique variance that can be attributed to formal intentions at Time 2. As such, we may actually be underestimating the true effect of justice perceptions, in that one's prior engagement in technology transfer could have been affected by prior perceptions of justice. Although our findings should not be overstated, it is important to point out the limits of our design and the possibility that we may underestimate the ongoing effects of justice perceptions on technology transfer. A longitudinal design that included multiple assessments of justice perceptions could help tease out potentially stronger effects.

A final limitation involves whether and to what extent our findings generalize to other organizational contexts that employ high-level, knowledge workers. Would-be entrepreneurs in other types of organizations (e.g., researchers at federal labs or in pharmaceutical, defense, or information technology industries) may respond in a similar manner to justice perceptions. For example, in private corporations, internal entrepreneurs with low justice perceptions may engage in deviant behaviors to circumvent their firms, instead of commercializing their research through those firms (Heavey & Simsek, 2013; Simsek & Heavey, 2011). Similarly, responses to justice perceptions may be affected by factors other than entrepreneurial identity or prosocial motivation. For instance, institutional-level forces may play a part in impacting technology transfer. Thus, we call for more research on the dynamics pertaining to justice perceptions among would-be entrepreneurs in other contexts.

Conclusion

Technology transfer is important for universities and society. However, little entrepreneurship research has examined under what circumstances individuals engage in formal or informal technology transfer. At the same time, little justice research has examined individual differences that may shape the extent to which individuals respond to justice perceptions, or the unique contexts influencing how justice perceptions manifest. This article draws on justice theory to contribute to these two literatures by showing how academic entrepreneurs may (or may not) end up taking steps to commercialize their research either formally or informally.

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(Appendix follows)

Appendix

Study Items

Justice Perceptions

The below items were adapted from Colquitt's (2001) scale, which includes four dimensions of justice. Our adapted scale offers additional language that is specific to the context of technology transfer, and each subset of measures was shortened. Questions related to distributive justice include Questions 1–3; Colquitt's (2001) subscale had four items. Questions related to procedural justice include Questions 4–6; the original subscale had seven items. Interpersonal justice questions are reflected in Items 7–9; the original subscale had four items. Finally, informational justice items are reflected in Questions 10–12; the original subscale had five items.

1. The rewards (licensing revenue, equity ownership in a start-up firm, or nonfinancial rewards, such as credit toward promotion and tenure) a faculty member receives from an invention reflect the effort put into creating and commercializing that invention.
2. The rewards to a faculty member who creates an invention reflect his or her personal contribution, in terms of time and effort.
3. For a given commercialization effort, faculty outcomes related to technology transfer are justified, given the performance of the faculty member(s) involved.
4. University technology transfer procedures are applied consistently.
5. University technology transfer procedures are based on accurate information.
6. Faculty member(s) are able to appeal the outcome(s) arrived at by university technology transfer procedures.
7. Technology transfer personnel treat faculty in a polite manner.
8. Technology transfer personnel treat faculty with respect.
9. Technology transfer personnel refrain from improper remarks or comments.
10. Technology transfer personnel explain procedures thoroughly.
11. Explanations provided by technology transfer personnel regarding commercialization (patenting, licensing, start-ups) procedures are reasonable.
12. Technology transfer personnel seem to tailor their communication to individual faculty members' specific needs.

Entrepreneurial Identity

The below items were adapted from a measure put forward by Brenner et al. (2014) to measure one's identity as a scientist. Our adaptation replaced the word "scientist" in the original scale with the word "entrepreneur" to more closely capture entrepreneurial identity.

1. Being an entrepreneur is an important part of my self-image.
2. Being an entrepreneur is an important reflection of who I am.
3. I think of myself as an "entrepreneur."
4. I have a strong sense of belonging to the community of entrepreneurs.

Prosocial Motivation

The below items were adapted from Grant's (2008) four-item prosocial motivation scale. Although the stem of the items are the same, we added language ("through my research" and "my research") to reflect the context of our study.

1. I care about benefiting others through my research.
2. I want to help others through my research.
3. I want my research to have a positive impact on others.
4. It is important to me to do good for others through my research.

Formal Technology Transfer Intentions

1. I intend to work with my university's TTO to commercialize my research in the future.
2. I would be comfortable using my university's TTO to commercialize my research.
3. I plan to work with my university's TTO to commercialize my research.

Informal Technology Transfer Intentions

1. I would feel comfortable excluding my university's TTO when commercializing my research in the future.
2. I plan to work with others outside my university (e.g., companies, former students) to commercialize my research instead of using my university's TTO.
3. I intend to commercialize my research without involving my university's TTO.

Prior Technology Transfer Activity

1. I have been involved in technology transfer in the past.
2. I am currently involved in technology transfer.

Agreement on the Term Invention

1. In my field of research, it is not always clear as to what constitutes an “invention” for the purpose of disclosure to the TTO.
2. It is possible for me to produce intellectual property in my research that might not be viewed as an “invention” by my university’s TTO.
3. In my field of research, there is a gray area between simply producing new knowledge versus producing an invention.

Formal Technology Transfer Behavior

1. Conducting clinical trials (or other forms of “translational research”) to determine the commercial viability of an invention
2. Meeting with people from industry (e.g., angel investors, entrepreneurs, former members of the lab, or venture capitalists) to determine the commercial viability of an invention
3. Meeting with a private foundation to further commercialization activities
4. Developing software or equipment that other researchers can use for research or commercialization
5. Working on a sponsored research agreement to further the commercialization of a technology
6. Filing an invention disclosure

7. Filing a patent
8. Securing a licensing agreement based on a university patent
9. Securing a material transfer agreement
10. Securing a confidential disclosure agreement
11. Involvement with the creation of university-based start-up

Informal Technology Transfer Behavior

1. Conducting a clinical trial (or other forms of “translational research”) to determine the commercial viability of an invention
2. Meeting with people from industry (e.g., angel investors, entrepreneurs, former members of the lab, or venture capitalists) to determine the commercial viability of an invention
3. Meeting with a private foundation to further commercialization activities
4. Developing software or equipment that other researchers can use for research or commercialization
5. Filing a patent
6. Securing a licensing agreement based on a nonuniversity patent
7. Involvement with the creation of a non-university-based start-up

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