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Scott Shane  
Case Western Reserve University

Sharon Dolmans  
Eindhoven University of Technology, s.a.m.dolmans@tue.nl

Joseph Jankowski  
Case Western Reserve University

Isabelle Reymen  
Eindhoven University of Technology

Georges Romme  
Eindhoven University of Technology

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WHICH INVENTORS DO TECHNOLOGY LICENSING OFFICERS FAVOR FOR START-UPS?

Scott Shane, Case Western Reserve University, USA
Sharon Dolmans, Eindhoven University of Technology, the Netherlands
Joseph Jankowski, Case Western Reserve University, USA
Isabelle Reymen, Eindhoven University of Technology, the Netherlands
Georges Romme, Eindhoven University of Technology, the Netherlands

Abstract

Technology licensing officers play an important role in influencing the commercialization of university inventions. Because the rights to inventions of faculty, staff and students at U.S. universities belong to the institutions where the inventions were made, technology licensing officers regulate which inventions are commercialized through the creation of spinoff companies. Anecdotal evidence indicates that licensing officers are influenced by the characteristics of the inventors who disclose those inventions. To examine the effect of faculty member characteristics on the support licensing officers give to spinoff company creation, we conducted a randomized experiment with 239 technology licensing officers at 88 Carnegie I research universities in the United States. Our experiment reveals that licensing officers are negatively disposed to (disclosures by) female inventors and positively disposed to (disclosures by) Chinese-named Asian inventors with industry experience who are easy to work with. We discuss the implications of these findings for university technology commercialization.

Introduction

Technology licensing offices play an important role in the commercialization of university inventions (Clarysse, Wright, Lockett, Van de Velde, & Vohora, 2005; Owen-Smith & Powell, 2003; Thursby & Thursby, 2002). Because the property rights to inventions made by faculty, staff and students belong to the institutions where these inventions were developed, technology licensing officers often regulate which inventions should be commercialized through the creation of spinoff companies. Anecdotal evidence indicates that technology licensing officers are influenced by the characteristics of the inventors who disclose those inventions (Shane, 2004, 2005). However, systematic evidence of this relationship has yet to be established. This study explores whether inventor characteristics influence the support that technology licensing officers give to the creation of spinoff companies.

We conducted an experiment with 239 technology licensing officers at 88 universities. The licensing officers were asked to evaluate identical invention disclosures, to which we randomly assigned different inventor characteristics. We found statistically significant differences in the rate at which the licensing officers recommended spinoff company creation, depending on the inventor characteristics. Our findings are important to researchers and practitioners in several ways. First, they provide insight into the influence that inventor attributes have on the creation of university spinoffs, rebalancing the literature’s focus on the attributes of the inventions themselves. Second,
they help us to better understand the decisions of technology licensing officers about university inventions, providing insight into how these individuals influence the process of technology commercialization (Shane, 2004; Siegel et al., 2007). Third, the results identify the preferences of licensing officers for particular types of inventors, suggesting the attributes that will help inventors to increase their odds of founding a spinoff.

**Theory**

Why do some university inventions, like the Google search algorithm, lead to the creation of new companies, while others, like the sports drink Gatorade, get licensed to existing companies? To date, the answer has focused largely on the characteristics of the inventions themselves. Research has shown that only a few are sufficiently important, general purpose, disruptive, early stage, or with sufficient patent protection, to be appropriate for the formation of a new company (Pressman, 2002; Shane, 2004). However, anecdotal evidence suggests that inventor characteristics also influence whether a spinoff will be founded (Shane, 2004). Spinoffs demand that inventors undertake additional technology development (Jensen & Thursby, 2001), acquire resources (Shane & Cable, 2002) and establish new organizations (Grandi & Grimaldi, 2003; Nicolaou & Birley, 2003; Burg, Romme, Gilsing, & Reymen, 2008), all of which are facilitated by certain inventor attributes.

Because inventor attributes affect the formation of spinoff companies, licensing officers often assess the inventor as well as the technology when they evaluate invention disclosures (Franklin, Wright, & Lockett, 2001; Shane, 2004, 2005; Vohora, Wright, & Lockett, 2004). Existing research suggests several inventor characteristics that could influence technology licensing officer evaluations: *gender, immigrant status, industry experience* and the *ease of working with the inventor*. Below we develop specific hypotheses about the influence of each of these characteristics on technology licensing officers’ recommendation of invention disclosures for spinoff company creation.

**Inventor Gender**

Female academics are less likely than their male counterparts to engage in the commercialization of science (Bunker Whittington & Smith-Doerr, 2005; Ding, Murray, & Stuart, 2006), whether that commercialization is measured by number of inventions, patents, licenses, or start-up companies (Bunker Whittington & Smith-Doerr, 2005; Ding et al., 2006; Murray & Graham, 2007). First, female professors are less likely to disclose inventions. In a study of researchers at 11 leading research universities, Thursby and Thursby (2005) found that 8.7 percent of male faculty members disclose inventions, but only 6.7 percent of female academics do so, despite statistically similar publication records. Low levels of patenting parallel the low rate of invention disclosure among female academics. Azoulay et al. (2007) found that the patenting rate for female researchers was half that of their male counterparts. Similarly, Ding et al. (2006) found that 7.8 percent of women in the life sciences have at least one patent as compared to 25.1 percent of men. And every year after obtaining their PhD, male academics are more likely than their female counterparts to obtain patents on the outputs of their academic research, leading the gender gap to increase with the number of years since the awarding of the PhD (Ding et al., 2006). Despite producing patents with equivalent citation counts, breadth and originality, Bunker Whittington and Smith-Doerr (2005) found that male life scientists are more than twice as likely as female life scientists to have ever patented an invention and generate just less than twice as many patents per year since getting their doctorates.
Female academics are also less likely than male academics to license their inventions to industry. Link et al. (2007) found that male faculty members are more likely than their female counterparts to engage in commercial knowledge transfer, whether through licensing or consulting. Finally, male academics are more likely than female academics to start companies to commercialize their inventions. In a survey of 1554 university researchers in Canada, Landry et al. (2006) found that being a man increases the likelihood of creating a spinoff.

Researchers have offered several explanations for the gender gap in academic patenting and licensing, including under representation of women in senior positions, views of money and the commercialization of science, exposure to business, research foci, and their other personal and professional responsibilities (Ding et al., 2006; Murray & Graham, 2007; Stephan & El-Ganainy, 2007). Fox (2005) explains that women are less likely to be at the top end of the publishing distribution and high level publications enhance academic commercialization. Moreover, women tend to be underrepresented in those academic positions from which commercial activity is most possible (Stephan & El-Ganainy, 2007). Murray and Graham (2006) argue that exclusion of women from commercial science in the early days of their careers leaves them with lesser commercial science skills than their male counterparts. Similarly, female scientists have fewer contacts with industry (which makes it more difficult for them to patent), because they are more likely to believe that commercial activity would adversely affect their careers (Ding et al., 2006). Still others argue that female faculty members conduct different types of research than their male counterparts, which makes it more difficult for them to engage in commercialization (Stephan & El-Ganainy, 2007).

While these explanations may all be valid, we focus on another possible (and complementary) explanation: the way that technology licensing officers perceive the inventions of female faculty members. Because technology licensing officers influence which inventions are patented, licensed and become the basis for spinoff companies, they play a gate-keeping role, which can lead to gender differences in spinoff company creation if they are biased in their recommendations. While previous researchers have not directly addressed the question of technology licensing officer bias, they have discussed the possibility that those evaluating university inventions may favor the inventions of male academics. Stephan and El-Ganainy (2007) question whether women receive the same support of their technology licensing offices as men. And Bunker Whittington and Smith-Doerr (2005: 366) raise the question whether “universities and their technology licensing offices … fail to support initial commercialization for female scientists.” We thus hypothesize:

**H1:** Technology licensing officers favor the inventions of male faculty members over the inventions of female faculty members for the creation of spinoff companies.

**Inventor Immigrant Status**

Immigrant researchers may be more likely than other researchers to found spinoff companies. Krabel et al. (2010) find that academic researchers who are foreign-born and educated are more likely to start companies than native-born researchers, perhaps because self-selection leads immigrants to be more inventive and entrepreneurial (Hunt, 2009; Stephan & Levin, 2001). Stephan and Levin (2001) show that foreign-born individuals are disproportionately overrepresented among the academics that have played a key role in launching biotechnology firms. Immigrants are also more likely to commercialize and license inventions. Hunt (2009) found that immigrants who originally entered the United States on temporary work visas or on student/trainee visas outperform native college graduates in commercializing and licensing patents.
University technology licensing officers may be aware of these patterns and thus favor for startups those technologies being exploited by immigrant faculty members. These arguments lead to our third hypothesis:

\[ H2: \text{Technology licensing officers favor the inventions of immigrant faculty members over the inventions of native faculty members for the creation of spinoff companies.} \]

**Inventor Industry Experience**

To create companies to commercialize their inventions, academics need information and expertise from the business world (Landry et al., 2006). However, the experience and social networks of most researchers tend to be limited to academia (Mosey & Wright, 2007). This pattern suggests that those academics with greater access to business information would be better able to start companies to commercialize their inventions than other academics. Some research supports this argument. Industry experience helps inventors to understand the difference between business and academia and gives them useful skills for starting companies (Shane, 2004). Moreover, industry experience provides insight into the workings of the industry in which the invention would be applied, helps to position a start-up appropriately within that industry, and gives the founders information about potential customers (Shane, 2004, 2005). By interacting with industry, academics gain a network of potential suppliers, customers and investors (Roberts & Malone, 1996; Shane, 2004; Shane & Cable, 2002) that is helpful for starting a business (Grandi & Grimaldi, 2003, 2005; Nicolaou & Birley, 2003). Moreover, Vohora et al. (2004) argue that academic entrepreneurs without industry experience concentrate too much on technical issues at the expense of commercial ones (Franklin et al., 2001; Daniels and Hofer, 1993).

Prior research indicates that inventors with ties to investors or business, or industry experience are more likely to engage in spinoff activity. Landry et al. (2006) show that the likelihood of launching a university spinoff increases if researchers have consulting experience. In addition, they find that the intensity of the researcher’s linkages with private sector professionals increases the probability of spinoff creation. Similarly, Krabel and Mueller (2009) find that academic scientists with close ties to industry, in the form of experience in research cooperation with private firms, are more likely to become spinoff company founders.

University technology licensing officers may be aware of these patterns and favor for startups those technologies being exploited by inventors with industry experience. Shane (2005) finds that technology license office directors regard spinoff companies as more appropriate when the academic inventor has industry experience. Similarly, Franklin et al. (2001) found that licensing officers believe that the main disadvantage of having an academic inventor lead a spinoff company is lack of commercial experience. These arguments lead to our second hypothesis:

\[ H3: \text{Technology licensing officers favor the inventions of faculty members with industry experience over the inventions of faculty members without industry experience for the creation of spinoff companies.} \]

**Ease of Working with the Inventor**

Previous research suggests that academic inventors who are easy to work with are more likely to start companies. To create a spinoff, researchers need to work with many different actors, including
investors, suppliers and customers (Mustar, 1997; Walter, Auer, & Ritter, 2006). Inventors who are difficult to work with could have problems in raising money, attracting suppliers, and finding employees, because external stakeholders may choose to avoid such inventors (Shane, 2005). University technology licensing officers may be aware of these patterns and therefore favor for start-ups those technologies being exploited by inventors that are (perceived to be) easy to work with. Interviews with technology licensing office directors indicate that they find inventors who are easy to work with more appropriate for creating spinoff companies (Shane, 2005). These arguments lead to our fourth hypothesis:

**H4: Technology licensing officers favor the inventions of faculty members who are easy to work with over the inventions of faculty members who are difficult to work with for the creation of spinoff companies.**

**Methodology**

Previous studies have mainly relied on anecdotal evidence to suggest that technology licensing officers are influenced by inventor characteristics. To establish a causal relationship between inventor characteristics and the degree of support that technology licensing officers give to spinoff creation, we conducted an experiment in which inventor gender, immigrant status, industry experience and their ease of working with were randomly assigned to the same invention disclosures. We asked technology licensing officers to evaluate the inventions on their appropriateness as the basis of a spinoff company.

**Sample**

To obtain subjects for the study we contacted the technology licensing office directors at 223 Carnegie I research universities in the United States and asked their offices to participate in the study. All offices that agreed to participate would receive a $50 gift card to as a token of our gratitude. Of the 223 offices contacted, 98 agreed to participate. At those offices that agreed to participate we asked the licensing office director for the number of licensing professionals at their institution and the name and email address of those licensing officers. We invited 352 licensing officers to participate in the experiment, which was conducted online. We sent each participant an email that included a password-protected link to the online experiment accompanied by a unique login code and password combination to gain access to the experiment. The unique login information ensured confidentiality of both the invention disclosures and the licensing officers’ responses. Participants were required to complete the entire experiment in a single session and were not able to modify or complete their answers at a later point in time. After sending out the invitations and several reminders, 239 licensing officers from 88 offices completed the experiment (giving a response rate of 67.9 percent). No statistically significant differences existed between those that participated and those that did not on whether they received the experimental or control treatment.

The sample of licensing officers included 155 male (64.9 percent) and 84 female licensing officers (35.1 percent), ranging in age from 25 to 78 years ($M = 43.9$). On average, the participants had been working 6.9 years as a university technology licensing officer. In terms of highest level of education, 105 licensing officers hold a PhD (43.9 percent), 108 hold a Master’s degree (45.2 percent) and 24 hold a Bachelor’s degree (10.0 percent). (Two licensing officers hold an Associate’s degree.) In terms of educational background, 104 licensing officers obtained their highest degree in life sciences (38.4 percent), 49 in engineering (18.1 percent), 44 in business (16.2 percent), 27
in law (10.0 percent), 24 in chemistry (8.9 percent), 6 in computer science (2.2 percent) and 17 licensing officers obtained their degree in other fields (6.3 percent).

Treatments and Comparison of Treatment and Control Groups

Each licensing officer was asked to look at four invention disclosures, one to examine each inventor characteristic: gender, immigrant status, industry experience, and how easy they were to work with. For each disclosure, we randomly assigned licensing officers to the treatment or control groups. Except for the specific treatment, both the treatment and control groups received identical invention disclosures and inventor descriptions. Our experiment included the following treatments and controls:

**Inventor gender** - The treatment group received a disclosure with a male name and male picture, while the control group received an invention disclosure with a female name and female picture.

**Inventor immigrant status** - The treatment group received a disclosure with a Chinese name and Asian picture, while the control group received an invention disclosure with an American name and Caucasian picture. We chose to operationalize immigrant scientists as scientists with a Chinese name and Asian picture because our experiment only allows for testing one type of immigrant scientist and Asian scientists make up the largest part of the foreign-born scientist population in the United States (Corley & Sabharwal, 2007; Lin, Pearce, & Wang, 2008) and Chinese scientists are the largest ethnic contributor to U.S. domestic and international patent applications (Kerr, 2008; Wadhwa, Jasso, Rissing, Gereffi, & Freeman, 2007).

**Inventor industry experience** - The treatment group received a disclosure where the inventor had industry experience. The control group received a disclosure where the inventor had no industry experience.

**Ease of working with the inventor** - The treatment group received a disclosure where the inventor was easy to work with. The control group received a disclosure where the inventor was difficult to work with.

To check the random assignment of licensing officers to treatment and control groups, we compared the treatment and control groups on the following licensing officer characteristics: age, experience, gender, technical field, and highest academic degree. As one would expect from random assignment, there are only small, non-significant differences between the treatment and control groups. Table 1 shows the means, standard deviations, and t-tests for the check of randomization.

**The Invention Disclosure**

The invention disclosures were modified from actual university invention disclosures submitted at the first author’s university. The modification was done in conjunction with the director of the technology licensing office to ensure that the disclosure was realistic and representative of the disclosures seen by university technology licensing officers. (The first author’s university did not participate in the study.) Before administration of the experiment, it was pre-tested by licensing officers from the technology transfer office at that university.
Measures

In conjunction with the director of the technology licensing office at the first author’s university, we designed two measures to capture licensing officers’ evaluations of the invention disclosure as the basis for spinoff company creation. The measures were formulated to realistically reflect how licensing officers would express their support or lack of support for spinoff company creation. The measures were designed to capture both positive and negative approaches to spinoff creation and were both measured on a five-point Likert scale. The first measure asks, “If the inventor wanted to start a company to commercialize this technology, how much would you try to dissuade the inventor?” (1= not at all, 5= as much as I could). The second asks, “How likely would you be to recommend a startup that exploited this invention to your university’s internal venture capital fund?” (1=very unlikely, 5= very likely).

Results

The basic results of our study are presented in Table 2, which gives an overview of the expected and actual effects of our treatments. As Table 2 shows, our results indicate that all tested inventor characteristics influence technology licensing officer decision-making in ways consistent with our predictions. However, not all inventor characteristics significantly affected both dependent variables we examined.

The results of our statistical analysis are presented in Table 3. Consistent with our predictions, the licensing officers who received random assignment of a female inventor were significantly more likely to dissuade the inventor from starting a company (M = 2.53, SD = 1.26), compared to the officers who received an invention disclosure with a male inventor (M = 2.09, SD =0.97), t(237) = 3.03, p = 0.0027, Cohen’s d = 0.39. However, there was no statistically significant difference in the recommendation of the start-up to the university’s internal venture capital fund (female inventors M =3.37, SD = 0.95; male inventors M =3.55, SD = 0.95, t(237) = 1.46, p =0.1456, Cohen’s d = 0.19.)

We observed a statistically significant difference in recommendation of the invention to the university’s internal venture capital fund based on the inventor’s immigrant status. Licensing officers were more likely to recommend the inventions of Chinese-named Asian inventors (M =2.42, SD =1.09) to their university’s venture capital fund compared to inventions of American-named Caucasian inventors (M =3.32, SD =0.97) t(237) = 2.34, p = 0.0201, Cohen’s d = 0.30. But there was no statistically significant difference in the degree of dissuasion from starting a business between the treatment group receiving an Chinese-named Asian inventor (M = 2.20, SD =1.19) and the control group receiving an American-named Caucasian inventor (M =2.42, SD =1.09), t(237) = 1.52, p = 0.1298, Cohen’s d = 0.19.

We found that licensing officers were significantly less likely to dissuade inventors with industry experience from starting a company (M = 2.02, SD =1.13) compared to inventors without industry experience (M =2.84, SD =1.34), t(237) = 5.09, p = 0.0000, Cohen’s d = 0.67. Moreover, licensing officers were more likely to recommend inventions by inventors with industry experience (M = 3.09, SD =1.07) to their university’s venture capital fund, compared those of inventors without industry experience (M =2.72, SD =1.13), t(237) = 2.60, p = 0.0099, Cohen’s d = 0.34.
Licensing officers were significantly less likely to dissuade inventors perceived as easy to work with ($M = 3.09$, $SD = 1.07$) from starting a company, compared to inventors who are difficult to work with ($M = 3.17$, $SD = 1.40$), $t(237) = 2.44$, $p = 0.0154$, Cohen’s $d = 0.32$. However, we did not observe a statistically significant difference in the likelihood that licensing officers would recommend a spinoff licensing the invention to the university’s internal venture capital fund between inventors who are easy to work with ($M = 2.38$, $SD = 1.02$) and inventors who are difficult to work with ($M = 2.30$, $SD = 1.15$), $t(237) = 0.52$, $p = 0.6035$, Cohen’s $d = 0.07$.

Robustness Checks

To confirm the robustness of the effects we found, we ran ordinary least squares regression models to predict our two dependent variables with licensing officer characteristics as control variables. Each regression model included a treatment as the main predictor variable and licensing officer age, experience, gender, technical field, and highest degree as control variables. As Table 4 shows, the results are robust to the inclusion of these additional controls.

DISCUSSION

Understanding how inventor characteristics influence technology licensing officers’ support for spinoff creation is critical to the theory as well as practice of academic spinoff creation (O'Shea, Chugh, & Allen, 2008; O'Shea, Allen, O’Gorman, & Roche, 2004). While previous research suggests that inventor attributes influence technology licensing officers’ views of the appropriateness of spinoffs as a commercialization vehicle, our experiments provide the first evidence of the causal effect of inventor attributes. Specifically, licensing officers are more positively disposed to spinoffs when the inventions are made by male, Chinese-named Asian inventors, as well as by inventors with industry experience and those perceived as easy to work with. Inventors with these attributes will be more likely to create spinoff companies than the characteristics of their inventions alone would suggest.

Our results suggest that technology licensing officer attitudes may influence who starts spinoff companies. For example, women are underrepresented as founders of spinoff companies (Rosa & Dawson, 2006; Landry et al., 2006). Our study indicates that the random assignment of a female faculty member to an invention disclosure makes licensing officers less likely to encourage the formation of a spinoff company, suggesting that university licensing officer attitudes account for some of the underrepresentation of women among start-up company founders. Any efforts to address this underrepresentation will therefore have to include interventions targeting the attitudes of technology licensing officers toward female faculty members as the founders of spinoff companies. Because technology licensing officers serve a gate-keeping function in the marketplace for university inventions, their dispositions need to be addressed in future efforts to reduce the gender imbalance in spinoff company creation.

However, some licensing officer attitudes (toward inventors) may be quite valid and universities might choose to respond to these preferences by further encouraging it. Consider the case of inventor industry experience. Our results indicate that licensing officers are more likely to recommend (for spinoff creation) invention disclosures submitted by inventors with industry experience. This pattern suggests that institutions interested in boosting their output of spinoff companies should hire faculty members with industry experience and/or put in place programs that enhance
the industry experience of faculty members, such as exchange programs with industry research laboratories and networking events (Nicolaou & Birley, 2003). Moreover, our results support the recommendation of those observers who have called for a more active role of technology licensing officers in facilitating industry interaction among academics lacking such connections as a way to encourage spinoff company creation (Mustar, Wright, & Clarysse, 2008; Nicolaou & Birley, 2003; Vohora et al., 2004). To this end, our findings support the creation and expansion of recent federal funding initiatives, such as the “NSF Innovation Corps Program”, designed to establish academic-to-corporate partnerships that integrate graduate students, academic inventors and corporate/entrepreneurial mentors.

This study clearly points at licensing officer preferences for certain types of inventors, but the research method adopted implies we cannot distinguish bias from rational decision-making. In a study on decision-making processes within technology licensing offices, Tello, Latham and Kijewski (2010) show that licensing officers rely on a variety of decision-making models ranging from rational choice to decision-making shaped by individual heuristics and biases. Their findings demonstrate that individual heuristics (and biases) play a significant role in the decision to support technology commercialization. Tello and co-authors argue that when technology licensing officers rely more on personal heuristics and biases, the outcomes of the commercialization process are likely to be characterized by a higher level of failure (see also Kahneman & Tversky, 1979). However, they also argue heuristics can be useful as the insights that technology licensing officers obtain through years of work experience may increase the probability of successful commercialization. Therefore, we encourage future research to look into the desirability of licensing officer preferences for particular inventors, for example by linking inventor characteristics to the performance of university spinoffs.

Our study has several limitations. First, our decision to conduct a randomized experiment to examine the causal effect of inventor attributes on licensing officer support for spinoff creation resulted in a stylized research setting. Although we took several measures to make our experiment realistic, the licensing officers were asked to conduct a simplified and time-constrained evaluation process in place of a more iterative multistage selection process (Shane, 2004). Moreover, inventor attributes are typically not contained in the invention disclosure document. Therefore, our experimental design might have made a clearer association between those attributes and the invention itself than is normally the case when university licensing officers evaluate invention disclosures. While we have no evidence to suggest that our results are an artifact of the stylized nature of research design, it is possible that the patterns we observed were either over- or understated as a result of it. Second, we operationalized immigrant inventors as Chinese. As a result, our measure confounds race and immigrant status and we cannot be sure which of the two characteristics accounts for the patterns we observe. Third, for some treatments we found support for only one of the two outcome measures we examined. These partial results might reflect differences in how licensing officers respond to inventor attributes when they are asked to take positive (recommendation of a spinoff to a venture capital fund) and negative (dissuading inventors from starting a spinoff company) actions. Alternatively, the partial results may simply represent measurement error that comes from the imprecision of using scale scores to understand licensing officer recommendations. Fourth, our findings may not be generalizable to technology transfer offices outside the US. Although we have no evidence to suggest that our results would not generalize to other countries, additional research would be needed to show that they would. Cultural differences, for instance, might lead licensing officers elsewhere to respond differently to the experimental treatments we employed.
In short, technology licensing officers play an important role in influencing the commercialization of university inventions because they must often make recommendations about which inventions should be commercialized through the creation of spinoff companies. Our randomized experiment confirmed anecdotal evidence that these recommendations are influenced by the characteristics of the inventors who disclose the inventions. While licensing officer attitudes about which inventors are appropriate for spinoff companies might be problematic or desirable (depending on how university officials and other stakeholders assess these preferences), our results clearly demonstrate the direct effect of inventor attributes on licensing officer decisions about the commercialization of university technology through the formation of spinoff companies.

CONTACT: Sharon Dolmans; s.a.m.dolmans@tue.nl; (T): +31(0)402473046; Eindhoven University of Technology, School of Industrial Engineering, P.O. Box 513, 5600 MB Eindhoven, The Netherlands.

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REFERENCES


### TABLE 1
Randomization check

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<td>0.19</td>
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<td>0.24</td>
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<td>0.21</td>
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<td>0.71</td>
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<td>1.15</td>
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</tr>
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<td>Life Sciences</td>
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<td>0.51</td>
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<td>1.17</td>
<td>1.17</td>
<td>2.31*</td>
<td>2.31*</td>
<td>1.28</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>0.17</td>
<td>0.23</td>
<td>0.17</td>
<td>0.22</td>
<td>0.17</td>
<td>0.23</td>
<td>0.20</td>
<td>0.20</td>
</tr>
<tr>
<td>t-value</td>
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<td>1.04</td>
<td>1.04</td>
<td>1.23</td>
<td>1.23</td>
<td>0.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* p<0.05; **p<0.01; ***p<0.001; ****p<0.0001
### TABLE 2

**Expected and Actual Effects of the Treatments**

<table>
<thead>
<tr>
<th>Treatments - Inventor characteristics</th>
<th>Expected Effects</th>
<th>Actual Effects</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Dissuade inventor from starting a company</td>
<td>Recommend to university venture capital fund</td>
</tr>
<tr>
<td>Male</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Chinese-named</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Industry experience</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Easy to work with</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>

* p<0.05; **p<0.01; ***p<0.001; ****p<0.0001

### TABLE 3

**Comparison of the Experimental and Control Groups**

<table>
<thead>
<tr>
<th>Treatments - Inventor characteristics</th>
<th>N</th>
<th>Dissuade inventor from starting a company t-value d*</th>
<th>Recommend to university venture capital fund t-value d*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>119</td>
<td>2.09 (0.97)</td>
<td>3.55 (0.95)</td>
</tr>
<tr>
<td>Female</td>
<td>120</td>
<td>2.53 (1.26)</td>
<td>3.37 (0.95)</td>
</tr>
<tr>
<td>American-named</td>
<td>123</td>
<td>2.42 (1.09)</td>
<td>3.32 (0.97)</td>
</tr>
<tr>
<td>Chinese-named</td>
<td>116</td>
<td>2.20 (1.19)</td>
<td>3.60 (0.92)</td>
</tr>
<tr>
<td>Industry Experience</td>
<td>121</td>
<td>2.02 (1.13)</td>
<td>3.09 (1.07)</td>
</tr>
<tr>
<td>No Industry Experience</td>
<td>118</td>
<td>2.84 (1.34)</td>
<td>2.72 (1.13)</td>
</tr>
<tr>
<td>Easy to Work With</td>
<td>117</td>
<td>2.75 (1.25)</td>
<td>2.38 (1.02)</td>
</tr>
<tr>
<td>Diff. to Work With</td>
<td>122</td>
<td>3.17 (1.40)</td>
<td>2.30 (1.15)</td>
</tr>
</tbody>
</table>

* p<0.05; **p<0.01; ***p<0.001; ****p<0.0001

* Cohen’s d (Cohen, 1988, 1992) as a measure of effect size, calculated using the pooled standard deviation:

\[
d = \frac{|X_1 - X_2|}{\sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2}}}
\]

<table>
<thead>
<tr>
<th>Cohen’s d effect size (t-test difference in means)</th>
<th>Small</th>
<th>Medium</th>
<th>Large</th>
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<tr>
<td></td>
<td>.20</td>
<td>.50</td>
<td>.80</td>
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### TABLE 4  
OLS Regressions including licensing officer controls

<table>
<thead>
<tr>
<th>Model</th>
<th>Dependent Variable</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
<th>VI</th>
<th>VII</th>
<th>VIII</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Diss.</td>
<td>Recom. for VC</td>
<td>Diss.</td>
<td>Recom. for VC</td>
<td>Diss.</td>
<td>Recom. for VC</td>
<td>Diss.</td>
<td>Recom. for VC</td>
</tr>
<tr>
<td>Treatments&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Male</td>
<td>-0.43**</td>
<td>0.13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Chinese-named)</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
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<tr>
<td></td>
<td>Industry experience</td>
<td>-0.81****</td>
<td>0.34*</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>(Easy to work with)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TLO controls</td>
<td>Gender (male TLO)</td>
<td>0.17</td>
<td>0.03</td>
<td>0.17</td>
<td>0.01</td>
<td>-0.16</td>
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<td>0.28</td>
</tr>
<tr>
<td></td>
<td>Age (in years)</td>
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<td>-0.01*</td>
<td>0.02*</td>
<td>-0.01*</td>
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<td>-0.00</td>
<td>0.01</td>
<td>-0.01</td>
</tr>
<tr>
<td></td>
<td>Experience (in years)</td>
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<td>0.01</td>
<td>-0.02</td>
<td>0.00</td>
<td>-0.01</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>Education&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.07 (0.12)</td>
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<td>0.10</td>
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<td>-0.08</td>
<td>0.31**</td>
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<tr>
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<td>Law or Business&lt;sup&gt;c&lt;/sup&gt;</td>
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<td>0.06</td>
<td>0.03</td>
<td>0.07</td>
<td>-0.24</td>
<td>0.09</td>
<td>-0.42*</td>
<td>0.26</td>
</tr>
<tr>
<td></td>
<td>Engineering&lt;sup&gt;c&lt;/sup&gt;</td>
<td>-0.34</td>
<td>0.43*</td>
<td>-0.37</td>
<td>0.43*</td>
<td>-0.31</td>
<td>0.38</td>
<td>-0.36</td>
<td>0.08</td>
</tr>
<tr>
<td></td>
<td>Life Sciences&lt;sup&gt;c&lt;/sup&gt;</td>
<td>-0.03</td>
<td>0.33*</td>
<td>-0.11</td>
<td>0.36*</td>
<td>0.19</td>
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</tr>
<tr>
<td>Constant</td>
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<td>3.69****</td>
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<td>3.86****</td>
<td>3.19****</td>
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<td>2.21****</td>
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<td>(0.48)</td>
<td>(0.40)</td>
<td>(0.48)</td>
<td>(0.40)</td>
<td>(0.52)</td>
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<td>(0.56)</td>
<td>(0.46)</td>
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<tr>
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<td>1.86</td>
<td>1.66</td>
<td>2.35*</td>
<td>4.49****</td>
<td>3.21**</td>
<td>2.51*</td>
<td>1.19</td>
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<tr>
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<td>0.02</td>
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<td>0.11</td>
<td>0.07</td>
<td>0.05</td>
<td>0.01</td>
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</tr>
</tbody>
</table>

<sup>a</sup> Dummy variable equal to 1 for treatment group

<sup>b</sup> Categorical variable representing highest education level licensing officer; 0 = Associate degree; 1 = BSc degree; 2 = MSc degree; 3 = PhD

<sup>c</sup> Dummy variable indicating whether the licensing officer’s educational background includes this field

* p<0.05; **p<0.01; ***p<0.001; ****p<0.0001