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Author

Fairlie, Robert

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Entrepreneurship Training, Risk Aversion and Other Personality Traits: Evidence from a Random Experiment

Robert W. Fairlie
University of California, Santa Cruz, IZA and RAND
rfairlie@ucsc.edu

William Holleran
University of California, Santa Cruz
whollera@ucsc.edu

Abstract

A growing literature examines the relationship between personality traits and entrepreneurship, but no previous studies explore whether personality or psychological traits predispose individuals to benefit more from entrepreneurship training. To address selection issues, we use novel data from the largest-ever randomized control experiment providing entrepreneurship training in the United States. We find evidence indicating that individuals who are more risk tolerant benefit more from entrepreneurship training than less risk tolerant individuals. We find some limited evidence that individuals who have a preference for autonomy benefit more from entrepreneurship training in the short run, but we find no evidence of longer-term effects and no evidence of differential effects of entrepreneurship training for individuals who are more innovative.

1. Introduction

Promoting entrepreneurship is viewed as a national priority by governments around the world. The interest is driven primarily by evidence that small businesses create a disproportionate share of new jobs in the economy, represent an important source of innovation, increase national productivity and alleviate poverty (see Birch 1979; Reynolds 2005; OECD 2006 for example).¹ The self-employed are also unique in that they create jobs for themselves, representing more than ten percent of total employment in the United States and many other countries. Business ownership is the main alternative to wage/salary employment for making a living, and thus has important implications for earnings and wealth inequality (Bradford 2003; Bucks, Kennickell, and Moore 2006).

Policies to promote entrepreneurship through loans, training, and/or technical assistance, especially among disadvantaged groups, are widespread (Aspen Institute 2005). Many European countries have programs providing financial and other assistance to the unemployed to start businesses, and several states in the United States have programs promoting self-employment as a way to leave the unemployment insurance and welfare rolls (OECD 1992; Vroman 1997; Kosanovich et al. 2001; Guy, Doolittle, and Fink 1991; Raheim 1997; U.S. Department of Labor 2010).

The desire for entrepreneurship is strong in many countries around the world. A large percentage of people report that they would prefer "being self-employed" or "being an employee" (Blanchflower, Oswald and Stutzer 2001).¹ In many countries, more than half of all individuals reported a desire for self-employment. Interest in self-employment

¹ In his inaugural address (January 20, 2009), President Obama stressed the importance of entrepreneurs for leading the country out of the recession by stating that "it has been the risk-takers, the doers, the makers of things ... who have carried us up the long, rugged path towards prosperity and freedom."

is also strong among disadvantaged or underrepresented groups (Kourilsky and Walstad 1998; Koellinger and Minniti 2006). Although many individuals possess a strong desire for entrepreneurship, they ultimately do not start successful businesses because of a lack of entrepreneurial skills and knowledge of business opportunities in addition to oft-identified human, social and financial capital constraints. These potential entrepreneurs may lack the knowledge and ability to identify markets, acquire financing, conduct effective marketing, navigate through regulations, and understand tax laws as well as other aspects of starting and operating successful businesses.

In this paper, we examine whether entrepreneurship training helps individuals start businesses using a randomized control experiment recently conducted by the U.S. Department of Labor and Small Business Administration.² The Growing America through Entrepreneurship (GATE) program provided entrepreneurship training and other services at no cost to a random sample of more than four thousand individuals across seven sites in three states representing the largest experiment ever providing entrepreneurship training in the United States.³ An initial evaluation of the program indicates that entrepreneurship training has a small positive, but significant, impact on business ownership (Benus, et al. 2008). We focus on whether entrepreneurship training has differential effects on individuals based on their personality or psychological characteristics. The unemployed were found to benefit the most from entrepreneurship training possibly because of a stronger desire for self-employment (Benus and

² We have communicated with the U.S. Department of Labor for the past few years to obtain the data. The most recent wave was released in early 2010. We thank Jonathan Simonetta at DOL for helping to provide access to the experimental data.

³ The GATE program differs from previous self-employment training programs in that the program was not limited to a specific population such as the unemployed or welfare recipients. It also did not provide participants with lump sum payments, but instead provided all training and services at no cost.

Michaelides 2010), but we know little about whether would-be-entrepreneurs who are more risk tolerant, have a preference for autonomy, or are innovative benefit more from entrepreneurship training than potential entrepreneurs without these characteristics.

Personality characteristics such as tolerance for risk, preference for autonomy, and innovativeness are important to study because of the emphasis the theoretical literature places on these characteristics in the decision between entrepreneurship and wage/salary work.⁴ Furthermore, a relatively new and growing empirical literature examines whether the personality or psychological characteristics of individuals are important determinants of entrepreneurship in addition to the more traditionally-identified determinants such as education, family business experience and access to financial capital. These studies find some evidence that attitudes toward risk, entrepreneurial ability, preferences for autonomy, and locus of control are important in determining who starts and operates businesses (Caliendo, Fossen and Kritikos 2010b; Zhao and Seibert 2006). But, the previous literature has not examined whether individuals with these "pro-entrepreneurship" personality characteristics benefit more from entrepreneurship training. It is possible that some individuals possess the psychological attributes that predispose them for success in business ownership, but do not attempt business ownership because of a lack of business exposure, information and expertise. On the other hand, individuals with personality characteristics that predispose them for business success might not benefit from entrepreneurship training, or least not benefit any more from entrepreneurship training than individuals who do not possess these personality characteristics.

⁴ See Knight (1921); Schumpeter (1911); Kihlstrom and Laffont (1979); Rees and Shah (1986); Lucas (1978); Jovanovic (1982); Blau (1987); Evans and Jovanovic (1989); Holtz-Eakin, Joulfaian, and Rosen (1994b); Dunn and Holtz-Eakin (2000); Blanchflower and Oswald (1998b).

Empirically testing this hypothesis is extremely difficult because of selection into training programs. Individuals who possess the personality characteristics predisposing them for business success may be more likely to select into entrepreneurship training when they know these programs will benefit them the most. Thus, separating the causal effects of entrepreneurship training for this group from the selection effects would be very difficult. The GATE experiment removes the concern that personality characteristics affect who receives entrepreneurship training because training is decided randomly.⁵ Using the experimental data we can estimate differential effects of entrepreneurship training by the personality or psychological traits of the would-be-entrepreneurs.

2. Random Experiment

Growing America through Entrepreneurship (Project GATE) was a program implemented by the U.S. Department of Labor and U.S. Small Business Association designed to help individuals start or grow a business (see Benus et al. 2008 for more details). The program was open to anyone 18 years of age or older, who was legally able to work in the United States. Project GATE was administered between September 2003 and July 2005 at seven sites: Philadelphia, Pittsburgh, Minneapolis/St. Paul, Duluth, Minnesota, Virginia, Minnesota, Portland, Maine, Lewiston, Maine, and Bangor, Maine. These sites include both urban and rural areas. In contrast to most self-employment assistance programs, Project GATE utilized an extensive outreach campaign including paid marketing, public service announcements, and flyers and posters at One-Stop Career

⁵ One concern, which is standard with random experiments, is that we have to be careful about generalizing the results to the full population. Although personality characteristics cannot affect the random assignment of entrepreneurship training they are likely to affect who participates in the study.

Centers. The goal of this advertising campaign was to reach a broad group of potential entrepreneurs interested in receiving training.

To participate in the program applicants needed to first attend an orientation meeting held at a One-Stop Career Center that outlined the GATE program. In total there were 21 One-Stop Career Centers where the applicants and program participants would receive assistance. Anyone who attended the orientation meeting was then eligible to fill out and return a nine-page application, which outlined his or her business idea.⁶ After reviewing the applications the program coordinators randomly assigned individuals with a probability of 0.5 to the treatment group to receive GATE services and all others to the control group, who received no further assistance from the program. Individuals in the control group were not prevented from seeking assistance from any self-employment center, but they would have to pay for the services themselves and were not referred by Project GATE coordinators.⁷ In total 4,198 individuals completed the application process to be included in the program and randomly assigned. After the application both treatment and control groups were sent additional surveys at 6, 18 and 60 months from the random assignment date to measure outcomes covering from 2004 to 2009.

The Project GATE sample appears roughly similar to the U.S. entrepreneurial population when looking at demographic characteristics (Benus et al., 2008). But, study participants are a self-selected group of individuals who received information about the program from One-Stop Career Centers and other sources. They may differ from the

⁶ Applicants are informed that there is not enough “space for everyone” and that a “lottery or random drawing” will decide whether they can enter the program.

⁷ We find that among the control group 36 percent received training services and 19 percent received counseling outside the GATE program. Similar to most social experiments in which the control group cannot be prevented from receiving similar services outside the experiment, we must interpret the results as providing evidence on the effects of offering the GATE program instead of the effects of receiving any entrepreneurship training or counseling services.

entrepreneurial population or visitors to One-Stop Career Centers along many dimensions. These differences have implications for our ability to generalize the results based on study participants to broader populations of interest, which is a common concern of randomized control experiments. We should note, however, that individuals who applied for the GATE program, for many of whom face obstacles in the labor market, are a population of interest for any policy intervention involving the provision of free or subsidized entrepreneurship training.

As part of the GATE program, treatment group members were first instructed to undertake an evaluation meeting with a counselor to determine their specific needs. Group members were then assigned to a GATE training provider where they could receive classroom training and/or one-on-one business counseling. In the classroom there were a variety of courses specialized to the needs and experience level of the participants ranging from an introductory course for those who had never run a business to software training for business owners. The one-on-one counseling sessions provided the participants access to advice from experienced business consultants on starting or running a small business. Because participants were not randomly assigned to these two types of services provided by GATE we cannot evaluate their separate effects.

Comparability of Treatment and Control Groups

As one would expect there are only minor differences between treatment and control groups due to random assignment. We condition on those who are not self-employed at application because one of our goals is to determine the effect of entrepreneurship training on individuals with psychological characteristics that

predispose them for self employment, but have potentially struggled to start their own business before completing the Project GATE training. We report the means at wave 1 for individuals who were not self-employed at application in Table 1. We only find two differences. There is a statistically significant difference in the mean age for the two groups, with a difference of about 6 months. There is also a statistically significant difference in the mean education levels, but the difference is only 0.1 years of education. The overall similarity of the mean values of individual characteristics from the application survey confirms that the randomization created comparable treatment and control groups for the experiment. We control for all of these baseline characteristics in the regression analysis.

3. Entrepreneurship Training and Business Ownership and Starts

We start by examining treatment and control differences in self-employed business ownership and start rates. A brief discussion of these results provides an overview of the evidence on the effectiveness of entrepreneurship training on business ownership before turning to the differential estimates by personality traits. Table 2 reports estimates. At Wave 1, 26.7 percent of the treatment group owns a business in which they work 15 or more hours per week.⁸ This rate of business ownership is 6.3 percentage points higher than the control group rate of 20.4 percent. At Wave 2, the treatment group has a 3.1 percentage point higher business ownership rate than the control group, but by Wave 3, which is 60 months after the initial application, the

⁸ We condition on working 15 or more hours per week in the business to rule out small-scale, part-time activities following the convention used in previous studies reporting business ownership rates (see Fairlie and Robb 2008 for example). Business owners are required to work roughly two days of week in their businesses. The results are similar if we condition on full-time work effort measured by 30 or more hours per week.

difference disappears. We find that the treatment group is no more likely than the control group to report owning a business in the long run.

The data also allow one to examine whether an individual starts a business by the survey date for each wave. In this case we do not measure whether an individual is a business owner at the survey date for each wave, but instead measure whether they ever started a business with the required minimum work effort by the survey date (15 or more hours per week). Table 2 reports estimates for this more inclusive measure of starting a business. By wave 1, we find that 27.2 percent of the treatment group starts a business compared with 20.7 percent of the control group. The estimates are similar to those for when we measure business ownership at the time of each survey.⁹ By wave 2, 40.3 percent of the treatment group starts a business which is 6.9 percentage points higher than the rate of starting a business among the control group. By wave 3, more than half of the treatment group starts a business. The treatment group is 4.6 percentage points more likely to try self-employed business ownership by wave 3 than the control group. The higher rate of starting a business for the treatment group, however, occurs entirely in the short run after the training program. The treatment/control difference is larger at waves 1 and 2 than at wave 3.

Overall, GATE has positive impacts on business ownership rates and business start rates.¹⁰ The benefits appear to be focused in the first two waves with longer-run impacts being difficult to identify.¹¹ These results provide a useful starting point for

⁹ Any small differences are due to individuals who try business ownership in the 6 months between the application and wave 1, but are not business owners at the time of the wave 1 survey.

¹⁰ The estimates of treatment/control differences are similar after controlling for baseline differences in individual characteristics.

¹¹ This time pattern of estimated effects does not appear to be influenced substantially by potential lock-in effects because the use of self-employment services through the GATE program was

analyzing whether there are differential impacts of entrepreneurship training by personality and psychological characteristics. Some would-be-entrepreneurs may benefit substantially more from entrepreneurship training than others.

4. Personality Characteristics and Entrepreneurship

The theoretical literature on entrepreneurship emphasizes the importance of personality characteristics such as risk tolerance, innovativeness, entrepreneurial ability, and preferences for autonomy, in the decision between self-employment and wage/salary work. The classic work of Frank Knight (1921) stresses the importance of risk in the entrepreneurial decision, and Joseph Schumpeter (1934) notes the importance of innovation. Partly drawing on Knight (1921), Kihlstrom and Laffont (1979) and Rees and Shah (1986) posit that less risk averse individuals are more likely to choose self-employment. Lucas (1978), Jovanovic (1982), Blau (1987), Evans and Jovanovic (1989), Holtz-Eakin, Joulfaian, and Rosen (1994), and Dunn and Holtz-Eakin (2000) create theoretical models in which entrepreneurial or managerial ability is a key determinant of self-employment. Models by Rees and Shah (1986) and Blanchflower and Oswald (1998) take into account “the flexibility associated with hours worked and the independence entailed” (Rees and Shah 1986, p. 97) and “the nonpecuniary utility from being independent and one’s own boss” (Blanchflower and Oswald 1998, p. 31) from self-employment, respectively.

A relatively new and growing literature examines whether the personality or psychological characteristics of individuals are important determinants of

highest after initial program assignment and declined substantially over time.

entrepreneurship in addition to the more traditionally-identified determinants such as education, family business experience and access to financial capital.¹² The most studied personality characteristic in the context of entrepreneurship is risk tolerance. Business ownership is inherently risky and it stands to reason that individuals who are more risk tolerant are more likely to become entrepreneurs. Several previous studies find that less risk averse individuals are more likely to become entrepreneurs although there is some disagreement about the magnitude and possible non-linearities in the relationship (see Rauch and Frese 2007; Caliendo, Fossen and Kritikos 2009, 2010a, 2010b; Hartog, et al. 2010; Fairlie 2002; Van Praag and Cramer 2001; Puri and Robinson 2005 for a few examples).

One of the key characteristics of business ownership is having autonomy in decision making. It is perhaps not surprising then that previous studies find that having a preference for autonomy is important in determining entrepreneurship (Rauch and Frese 2007; Blanchflower and Oswald 1998; Fairlie 2002). Related to this finding, there is some evidence that having an internal locus of control is also an important determinant of entrepreneurship (Caliendo, Fossen and Kritikos 2010b; Evans and Leighton 1989). Individuals who have a high internal locus of control are ones that believe that they will determine their performance and future outcomes by their own actions instead of external forces. Being innovative has also been found to contribute to entrepreneurial success (Rauch and Frese 2007).

Previous studies have examined the relationship between several additional personality and psychological traits and entrepreneurship generally finding mixed results.

¹² See Caliendo, Fossen and Kritikos (2010), Parker (2009), and Zhao and Seibert (2006) for reviews of the literature on personality and psychological traits and entrepreneurship.

Caliendo, Fossen and Kritikos (2010b) provide a recent comprehensive analysis of these personality characteristics including the "Big Five" (extraversion, emotional stability, agreeableness, openness to experience, and conscientiousness). In addition to finding that risk attitudes and locus of control explain entrepreneurship they also find that openness to experience and extraversion predict entrepreneurship.

But, the previous literature has not examined whether these characteristics help predict which individuals will benefit more or less from entrepreneurship training. GATE participants were provided with several types of entrepreneurship services including classes, workshops, seminars, one-on-one counseling, business counseling, mentoring, and/or peer support or networking (Benus et al. 2008). Individuals who are more risk tolerant, have a preference for autonomy and/or are innovative might benefit more from entrepreneurship training and services because these personality traits may predispose them to entrepreneurship. Because of these characteristics they might be more motivated to start a business after receiving some initial level of training and support. If some individuals who possess entrepreneurial traits are originally constrained by a lack of exposure, information and expertise in business they might not start a business even if they possess the psychological traits that predispose them to entrepreneurial success. Entrepreneurship training may remove these barriers to business entry and allow them to succeed. One area of potential improvement is in the participant's knowledge of what it takes to be an entrepreneur. By receiving more information about entrepreneurship through the training program individuals who possess entrepreneurial personality traits may be more likely to ultimately try self-employment than individuals who do not possess these characteristics. But, even with a pre-disposition towards entrepreneurship

the effects may be small or non-existent as studies of previous entrepreneurship training and education programs do not provide clear evidence of positive overall effects (see Karlan and Valdivia 2010; Oosterbeek, van Praag and Ijsselstein 2010 for example).

In the analysis we focus on the effects of entrepreneurship training across three major personality or psychological characteristics related to entrepreneurship -- risk tolerance, preference for autonomy, and innovativeness. These characteristics have been identified theoretically or empirically as important determinants of entrepreneurship. Although it would be interesting to examine additional personality characteristics these are the only measures that we have clear and relevant information from our data. There is the possibility that there exist other unobservable personality traits that are correlated with these traits and contribute to the some of the estimated direct and interaction effects.

Personality Characteristics

At the time of application, which is before random assignment, all GATE participants were asked to describe some personality and psychological characteristics about themselves. They were specifically asked to report on a scale of 1 to 5 whether statements about themselves were true, with 1 being very true and 5 being very untrue. For example, participants were asked to rate the "trueness" of the following statement: "I'm only willing to take a risk if I am sure everything will work out." We use this question and an additional one asking "I am not prepared to risk my savings for my business" to create a measure of risk aversion.¹³ To measure preference for autonomy we

¹³ We are limited in measuring risk attitudes by what is available on the questionnaire. Previous research indicates that a somewhat similar self-reported measure of risk attitudes is highly correlated with an individual's experimentally determined level of risk tolerance (Dohmen, et al. 2005). Their risk attitude question is worded as follows: "Are you generally a person who is fully prepared to take risks or do you try

use a question with the same rating scale, "I enjoy working independently." Innovation is measured by combining the ratings from three separate questions: "I have innovative ideas," "If something "can't be done," I find a way," and "I often find more than one solution to a problem."

All of these variables are standardized by subtracting their total mean and dividing by the standard deviation. Thus, these normalized variables have mean zero and standard deviation one for the full sample. Aggregate measures are created by averaging the specific measures in each category. Table 3 reports all of the questions and how they are aggregated to create the three measures of personality characteristics -- autonomy, risk tolerance, and innovativeness.

The treatment and control groups do not differ by these personality characteristics. Random assignment is made independently of the characteristics of study participants so this is expected. The estimates reported in Table 3 indicate that the means are very similar for both groups and that none of the treatment/control differences for the personality variables are statistically significant.¹⁴ The full distributions of responses to each personality variable also do not indicate large differences between treatment and control groups (see Appendix).

We also find that the three concepts of personality or psychological characteristics are reasonably independent. Table 4 reports correlation coefficients for each personality trait. First examining the aggregate indices, we do not find any large correlations

to avoid taking risks?" The subjects are then asked to respond on a 0 to 10 scale to that question based on how risk averse or risk loving they are. The same subjects are then put through a lottery based determination of their risk tolerance level, and the two scores are compared. Their results show that the responses to the risk attitude question are highly predictive of outcomes in the lottery, providing evidence that a self reported risk tolerance level is a good predictor of an individual's risk based behavior.

¹⁴ We also find no differences in personality traits between the treatment group receiving classroom training and the treatment group receiving one-one-one counseling. After an initial needs assessment, individuals in the treatment group are assigned classroom training and/or one-on-one counseling

between measures. The largest correlation is between innovativeness and autonomy, but the correlation coefficient is less than 0.2. Examining correlations for specific variables across categories we generally find much smaller correlations. The largest correlations are between the separate components of each aggregate personality concept, but these are not strongly correlated. Overall, the entrepreneurial personality characteristics that we can measure in the data are reasonably independent.

5. Estimating the Differential Impacts of Entrepreneurship Training by Personality Characteristics

We now turn to estimating differential treatment effects by the personality and psychological characteristics of would-be-entrepreneurs. To examine whether entrepreneurship training has differential effects, we estimate the following regression:

$$(5.1) Y_i = \alpha + \beta'X_i + \gamma'P_i + \delta T_i + \lambda'T_iP_i + \varepsilon_i,$$

where $Y_i=1$ if the individual owns a business, X_i includes baseline controls from the application survey, P_i is a vector of personality characteristics, $T_i=1$ if the individual is in the treatment group, and ε_i is the error term. The dependent variable, business ownership, is measured at wave 1 (6 months), wave 2 (18 months), and wave 3 (60 months) depending on the specification. The controls include the program site, gender, race/ethnicity, immigrant status, age, marital status, children, education level, family income, health problems, whether self-employed relatives or friends, whether worked for self-employed relatives or friends, managerial experience, bad credit history,

unemployment insurance, and employer provided health insurance.¹⁵ All of the controls are measured prior to random assignment.

The main treatment/control difference in business ownership is captured by the parameter, δ . Without the inclusion of the treatment/personality interaction variables this coefficient would capture the treatment-control differences reported in Table 2 (but without the controls). The vector of parameters, γ , captures the main effects of the personality characteristics on business ownership. Finally, the parameters, λ , are of primary interest. These coefficients provide evidence on whether individuals with certain personality characteristics benefit more from entrepreneurship training.

Table 5 reports estimates for (5.1). The equation is estimated using a linear probability model with heteroscedasticity-consistent standard errors. Marginal effects estimates from probit and logit models are very similar. Specification 1 and 2 report estimates for business ownership measured at wave 1, which is 6 months after random assignment. No controls are included in Specification 1 and all of the controls are included in Specification 2. The main treatment effect is large, positive and statistically significant which is consistent with the estimates reported in Table 1.¹⁶ The coefficient estimate on the treatment/autonomy index interaction is large, positive and has a p-value of 0.07 in Specification 2. The treatment/risk tolerance innovation index interaction coefficient is also positive and large, but not statistically significant at conventional

¹⁵ These controls have been found in previous studies to affect business ownership and performance. See Parker (2009), van Praag (2005) and Fairlie and Robb (2008) for reviews of the literature.

¹⁶ In general, the main treatment estimate might differ considerably after the inclusion of treatment interactions, but because the personality variables are normalized to have mean zero it is similar.

levels. In contrast to these positive point estimates, we find a coefficient estimate on the treatment/innovativeness index interaction that is essentially zero.

In Specification 3 and 4, we examine the effects of entrepreneurship training on business ownership after 18 months. We do not find evidence of a treatment interaction with preference for autonomy or the innovativeness index. Risk tolerance, however, interacts with the treatment effect. We find that individuals who are more risk tolerant benefit more from entrepreneurship training than less risk tolerant individuals. The estimate reported in Specification 4 implies that individuals who have a one standard deviation higher level of risk tolerance experience a 4.79 percentage point higher increase in business ownership from receiving the treatment than individuals with the lower level of risk tolerance. Entrepreneurship training might benefit risk tolerant individuals more because they are pre-disposed to be more likely to take the risk of becoming a business owner and perhaps because the increased information leads more risk averse individuals to reconsider business ownership.

Sixty months after treatment, risk tolerant individuals appear to continue to benefit more from entrepreneurship training. The treatment/risk tolerance index coefficient estimates are positive, large, and similar to the ones for wave 1, but are not statistically significant. The sample sizes become smaller for this long-term estimate, which may be responsible for the lack of significance. At wave 3 we do not find evidence of treatment interaction effects for the autonomy index or the innovativeness index. Interestingly, the main treatment effect disappears after sixty months. In the long run, the benefits of entrepreneurship training for owning a business for the average person seem to disappear. This may be due to individuals who have average levels of risk tolerance

realizing that self-employment may not be for them. Entrepreneurship training might encourage them to try business ownership in the short run, but it does not provide a viable long-run alternative.

The results for the short-, medium- and long-term treatment/personality trait effects do not appear to be sensitive to being correlated with other characteristics. Although not reported, we estimate several additional specifications in which we include treatment interactions with observable characteristics such as previous self-employment experience, age, gender, race, and education level. The inclusion of these treatment interactions has little effect on the treatment/personality trait interactions suggesting that they are not simply proxying for differential treatment effects by other individual characteristics. The stronger benefits of treatment for risk tolerant individuals, for example, do not appear to be due to a correlation with other measurable individual characteristics and their interaction with treatment.

The evidence provided by the estimates reported in Table 5 on the direct effects of autonomy, innovativeness, and risk tolerance on business ownership is not clear. We find many positive and reasonably large point estimates, but in no case do we find a statistically significant effect.¹⁷ It is possible that these personality traits have a large impact on who becomes an entrepreneur, but our sample is not well designed to explore this hypothesis. We are examining a group of individuals who all agreed to participate in the study, and thus expressed at least some interest in entrepreneurship. Personality characteristics such as preference for autonomy, innovativeness and risk tolerance might

¹⁷ We find positive and statistically significant coefficient estimates for risk tolerance, however, when the treatment interaction terms are not included.

have a larger effect on predicting who becomes a business owner in the general population than in our sample.

Differential Treatment Impacts on Starting a Business

Table 6 reports regression estimates for the probability of starting a business by the survey date for each wave. This more-inclusive dependent variable measures whether the individual started any business with the required minimum work effort by the survey date. Thus, this measure represents an approximate cumulative measure of business ownership by the specified wave. Using this new measure, we find that the main effects of entrepreneurship training on business starts are large, especially in the short- and medium-run. These results are similar to those reported in Table 2.

For business starts, there is clear evidence indicating that individuals who are more risk tolerant benefit substantially more from entrepreneurship training than individuals who are less risk tolerant. The treatment/risk tolerance index coefficients are large and positive for all waves. After 18 months, we find that individuals who have a one standard deviation higher level of risk tolerance experience a 3.82 percentage point higher increase in the likelihood of starting a business from receiving the treatment than individuals with the lower level of risk tolerance. After 60 months we find that a one standard deviation higher level of risk tolerance leads to a 5.32 percentage point larger increase in the probability of starting a business. Risk tolerant individuals clearly benefit more from entrepreneurship training in terms of starting businesses. Furthermore, the relative size of the coefficient for Wave 2 compared to the coefficient for Wave 3

suggests that most of the treatment/risk tolerance interaction effect on the probability of starting a business occurs in the short- to medium-run.

For all three waves, we do not find evidence that individuals who are more innovative benefit more from entrepreneurship training in terms of starting businesses. The coefficients are small and insignificant in all specifications. For autonomy, we find large, positive treatment interactions in the first wave, but not in waves 2 and 3. For wave 1, the coefficient estimate implies that individuals who have a one standard deviation higher level of having a preference for autonomy experience a 2.63 percentage point higher increase in the likelihood of starting a business from receiving the treatment than individuals who have less of a preference for autonomy.

Alternative Measures of Innovativeness and Risk Tolerance

To create the measures of innovativeness and risk tolerance we use information from all available questions and aggregate the results. Innovativeness is based on the responses to three separate survey questions, and risk tolerance is based on the responses to two questions. Although the responses to these questions within each category are correlated they are not strongly correlated as shown in Table 4. To further investigate whether entrepreneurship training has different effects based on the personality characteristics of individuals we estimate regressions with the responses to each separate question on the survey.

Table 7 reports estimates for regressions that include main variables and treatment interactions for each separate question used to create the aggregate risk tolerance and innovativeness indices. Separate regressions are estimated for each question with controls

included for the other aggregate indices in addition to all of the individual controls. For example, the first set of rows reported in Table 7 reports estimates for a regression that includes only responses to the question "I have innovative ideas" as the measure of innovativeness. This regression also includes the main variables and treatment interactions for the aggregate index for risk tolerance and the autonomy index used before in Tables 5 and 6. Although each of the individual variables is chosen because of its relevance to the personality trait in question there might be some differences by question.

Using the three separate measures of innovativeness does not change our conclusion regarding the no treatment interaction for this personality trait. Similar to when we use the aggregate index for innovativeness we find no evidence that individuals who are more innovative benefit more from entrepreneurship training than individuals who are less innovative. The coefficient estimates are generally small and are inconsistent in sign across specifications.

We find positive estimates for the treatment/risk tolerance interactions when we examine the two separate measures of risk tolerance available in our data.¹⁸ The slightly stronger results occur for the specific question "I'm only willing to take a risk if I am sure everything will work out." This is a preferable measure of risk tolerance over the alternative question "I am not prepared to risk my savings for my business." Respondents might differ in how they answer this variable based on their income and/or available resources from their spouse and family. In any case, the results presented above for the

¹⁸ To make it easier to compare the estimates to those for the aggregate risk tolerance index we measure each risk aversion variable so that higher risk tolerance is associated with a larger value.

aggregate index of risk tolerance are robust to estimating the model using the separate components of this index.

Table 8 reports estimates for a similar set of regressions for business starts that include separate questions for innovativeness and risk tolerance. For innovativeness we do not find evidence that entrepreneurship training has a differential effect on the probability of starting a business by each wave. The treatment interactions for risk tolerance, however, are positive thus supporting the finding for the aggregate index of risk tolerance. Individuals who are more risk tolerant based on these specific measures benefit more from entrepreneurship training than less risk tolerant individuals.

6. Conclusions

Previous research indicates that risk tolerance, preference for autonomy, and innovativeness are empirically and theoretically important in determining who becomes an entrepreneur. The literature provides scant evidence, however, on whether individuals with "pro-entrepreneurial" personality characteristics benefit more or less from entrepreneurship training. To address the inherent selection problems associated with determining who receives entrepreneurship training, we provide novel evidence from the largest randomized control experiment providing entrepreneurship training ever conducted in the United States. We find that individuals who are more risk tolerant benefit more from entrepreneurship training than individuals who are less risk tolerant. The estimated interaction effects are large: averaging our estimates across the three waves implies that individuals who have a one standard deviation higher level of risk tolerance experience a 2.9 percentage point larger increase in business ownership and a

3.7 percentage point larger increase in the likelihood of starting a business from receiving the treatment than individuals with the lower level of risk tolerance. Entrepreneurship training might benefit risk tolerant individuals more because they are pre-disposed to take the risk of becoming a business owner and perhaps because the increased information from the training program leads more risk averse individuals to reconsider business ownership. These results contribute to the growing interest in the importance of risk tolerance for entrepreneurship (Rauch and Frese 2007; Caliendo, Fossen and Kritikos 2009, 2010a, 2010b; Hartog, et al. 2010; Fairlie 2002; Van Praag and Cramer 2001; Puri and Robinson 2005).

The evidence is not as strong for whether there exist differential treatment effects by preference for autonomy and innovativeness. We find some suggestive evidence of a larger treatment effect for individuals who have a stronger preference for autonomy six months after entrepreneurship training, but the effects disappear after that initial wave. We find no evidence that individuals who are more innovative benefit more from entrepreneurship training than individuals who are less innovative.

The findings from our analysis of the random experiment contribute to the knowledge of the effectiveness of entrepreneurship training programs. In general, we know relatively little about the effectiveness of these types of programs. Identifying specific groups that may benefit more or less from these types of programs is extremely important for directing scarce resources in an efficient way. For example, our findings indicate that risk tolerant individuals benefit the most from entrepreneurship training suggesting that groups typically not targeted for entrepreneurship programs might benefit. Some of the most disadvantaged groups such as at-risk youth and individuals

with a criminal background have high levels of risk tolerance, and thus might benefit more for entrepreneurship training than more traditional job training programs (Myers 1989; Balkin 1989; Fairlie 2002). These groups may possess the personality characteristics needed for entrepreneurship, but ultimately do not start businesses because of a lack of knowledge of business opportunities, business exposure, human capital, and financial capital. More generally, however, these constraints may limit the creation of new businesses by any risk-tolerant individuals. Entrepreneurship training may thus remove barriers for risk tolerant entrepreneurs to create hi-risk, but potentially hi-growth and job creating businesses. More research is clearly needed on the effectiveness of entrepreneurship programs and their potential for assisting different groups of the population in starting their own businesses.

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Appendix: Histograms for Personality and Psychological Characteristics from Survey

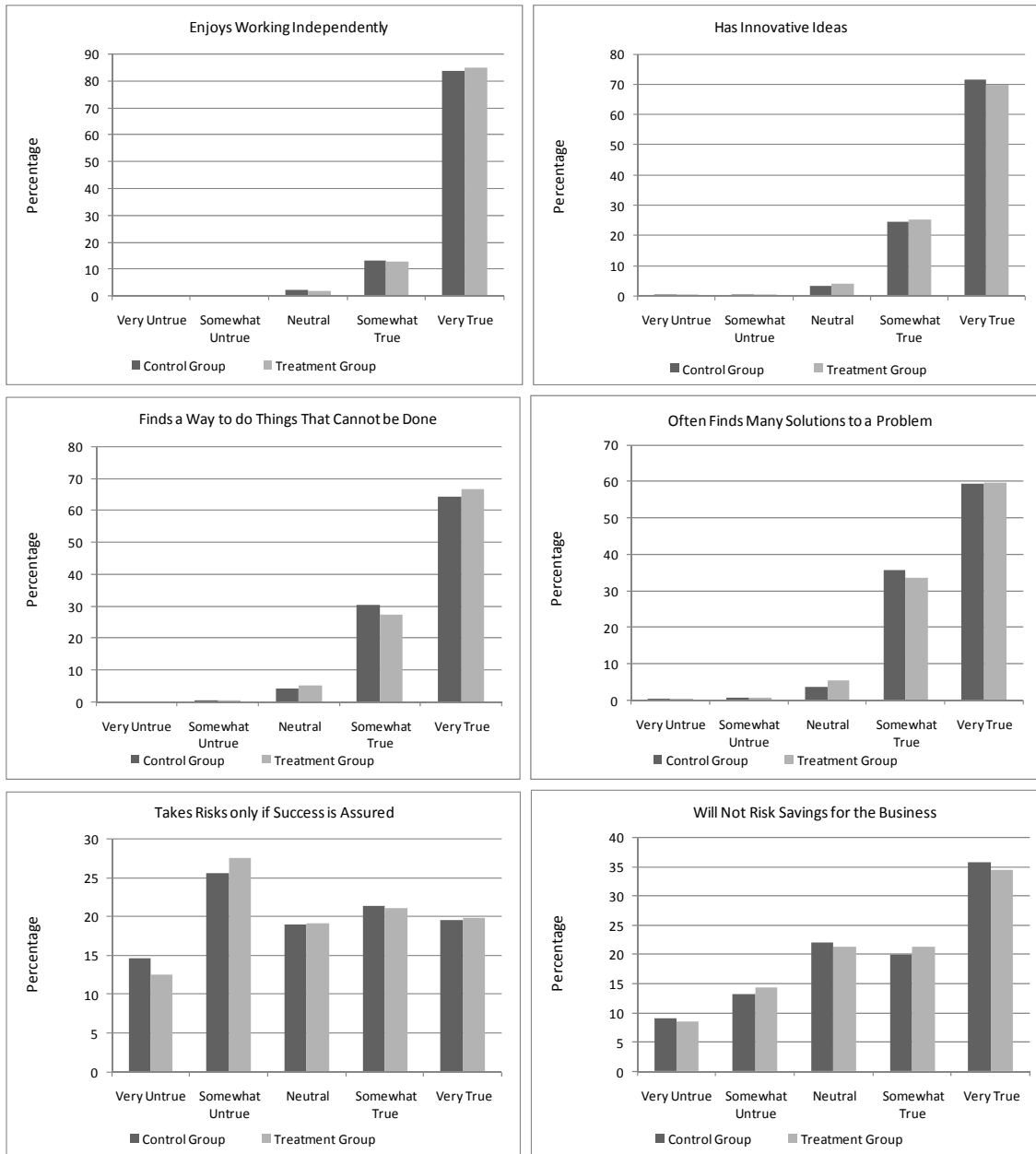


Table 1
Treatment/Control Comparison of Background Characteristics for GATE
Experiment

	Control Group	Treatment Group	P-Value for Treatment/ Control Difference
Pittsburgh	15.4%	14.5%	0.357
Minneapolis-St. Paul	39.1%	39.5%	0.557
Duluth	5.2%	5.0%	0.453
Maine	14.8%	13.4%	0.271
Female	46.9%	47.7%	0.619
Black	29.8%	29.3%	0.416
Latino	5.4%	5.8%	0.592
Asian	3.4%	3.7%	0.559
Other	7.2%	7.1%	0.478
Not US Born	9.9%	8.7%	0.283
Age	43.18	42.28	0.000
Married	48.5%	49.8%	0.685
Has Children	45.1%	45.1%	0.499
Highest Grade Completed	14.56	14.45	0.025
Household Income \$25,000-49,999	35.5%	34.0%	0.297
Household Income \$50,000-74,999	16.9%	18.5%	0.752
Household Income \$75,000-99,999	7.8%	7.2%	0.387
Household Income \$100,000 or more	7.7%	7.2%	0.402
Has a health problem	9.0%	9.0%	0.502
Has relatives or friends who have been previously self-employed	70.6%	70.4%	0.470
Ever worked for relatives or friends who are self-employed	32.0%	30.9%	0.337
Has managerial experience	61.2%	61.1%	0.473
Has a bad credit history	43.5%	42.8%	0.394
Currently receiving UI benefits	43.7%	44.5%	0.617
Has health insurance from current employer	19.1%	18.8%	0.448
Sample Size	1,308	1,384	

Note: The sample includes individuals who are not self-employed business owners at time of application and are surveyed at wave 1.

Table 2
Treatment/Control Comparison of Business Ownership and Starts for GATE Experiment

	Treatment Group	N	Control Group	N	Treatment/ Control Difference	Standard Error
Business owner at wave 1	26.7%	1,377	20.4%	1,297	6.3%	1.6%
Business owner at wave 2	28.0%	1,212	24.9%	1,121	3.1%	1.7%
Business owner at wave 3	22.5%	981	22.8%	891	-0.3%	1.8%
Start any business by wave 1	27.2%	1,351	20.7%	1,273	6.4%	1.6%
Start any business by wave 2	40.3%	1,212	33.5%	1,126	6.9%	2.0%
Start any business by wave 3	53.2%	1,023	48.6%	908	4.6%	2.3%

Notes:(1) The sample includes individuals who are not self-employed business owners at time of application. (2) The wave 1, wave 2 and wave 3 surveys are conducted at 6, 18, and 60 months after time of application.

Table 3
Personality and Psychological Characteristics from Survey

	Treatment	Control	P-Value for Difference
Autonomy			
"I enjoy working independently"	0.0213	-0.0215	0.2189
Innovation index	-0.0080	0.0081	0.6451
"I have innovative ideas"	-0.0244	0.0247	0.1597
"If something "can't be done," I find a way"	0.0169	-0.0170	0.3306
"I often find more than one solution to a problem"	-0.0107	0.0108	0.5382
Risk tolerance index (less risk averse)	0.0006	-0.0006	0.9719
"I'm only willing to take a risk if I am sure everything will work out"	0.0089	-0.0090	0.6092
"I am not prepared to risk my savings for my business"	-0.0056	0.0057	0.7477
Sample size	1,646	1,671	

Notes: (1) Study participants are asked to rate how much they agree with each statement on a scale of 1 to 5 where a 1 denotes "very true" and a 5 denotes "very untrue." All variables are normalized by subtracting the mean and dividing by the standard deviation for the full sample. (2) Variables are reordered so that a higher score represents more of the characteristic when they are aggregated into summary measures.

Table 4
Correlation between Personality Measures

	Autonomy	Innovation	Has Innovative Ideas	Finds Many Solutions	Finds a Way	Risk Tolerance	Is Risk Averse	Will Not Risk Savings
Autonomy	1.000	0.190	0.139	0.157	0.133	0.045	0.006	0.063
Innovation	0.190	1.000	0.711	0.761	0.767	0.122	0.014	0.174
Has Innovative Ideas	0.139	0.711	1.000	0.301	0.329	0.098	0.009	0.142
Finds Many Solutions	0.157	0.761	0.301	1.000	0.383	0.111	0.041	0.130
Finds a Way	0.133	0.767	0.329	0.383	1.000	0.064	-0.022	0.120
Risk Tolerance	0.045	0.122	0.098	0.111	0.064	1.000	0.789	0.786
Is Risk Averse	0.006	0.014	0.009	0.041	-0.022	0.789	1.000	0.241
Will Not Risk Savings	0.063	0.174	0.142	0.130	0.120	0.786	0.241	1.000

Note: See Table 3 for more details on survey questions.

Table 5
Self-Employed Business Ownership Regressions

	Self-Employed Business Owner at:					
	Wave 1		Wave 2		Wave 3	
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	0.0620 ** (0.0166)	0.0595 ** (0.0164)	0.0324 * (0.0185)	0.0279 (0.0186)	-0.0024 (0.0198)	-0.0124 (0.0202)
Treatment*Autonomy Index	0.0221 (0.0145)	0.0255 * (0.0141)	-0.0153 (0.0160)	-0.0128 (0.0164)	-0.0183 (0.0184)	-0.0133 (0.0192)
Treatment*Innovation Index	0.0000 (0.0166)	0.0013 (0.0162)	0.0132 (0.0190)	0.0117 (0.0188)	-0.0163 (0.0206)	-0.0207 (0.0213)
Treatment*Risk Tolerance Index	0.0248 (0.0166)	0.0209 (0.0165)	0.0517 ** (0.0190)	0.0470 ** (0.0189)	0.0233 (0.0207)	0.0175 (0.0213)
Autonomy Index	0.0025 (0.0099)	-0.0004 (0.0098)	0.0226 ** (0.0105)	0.0194 * (0.0112)	0.0189 (0.0122)	0.0168 (0.0135)
Innovation Index	-0.0106 (0.0114)	-0.0082 (0.0112)	-0.0116 (0.0138)	-0.0077 (0.0140)	0.0118 (0.0150)	0.0139 (0.0156)
Risk Tolerance Index	0.0157 (0.0114)	0.0183 (0.0115)	0.0057 (0.0136)	0.0049 (0.0139)	0.0136 (0.0150)	0.0167 (0.0157)
Individual Controls Included	No	Yes	No	Yes	No	Yes
Mean of dependent variable	0.2376	0.2380	0.2671	0.2676	0.2279	0.2291
Sample Size	2,597	2,487	2,265	2,171	1,821	1,750

Notes: (1) The dependent variable is whether the individual is operating a small business at the time of the survey. (2) The wave 1, wave 2 and wave 3 surveys are conducted at 6, 18, and 60 months after time of application. (3) Individual controls include program site, gender, race/ethnicity, immigrant status, age, marital status, children, education level, family income, health problems, whether self-employed relatives or friends, whether worked for self-employed relatives or friends, managerial experience, bad credit history, unemployment insurance, and employer provided health insurance. (4) * and ** denote statistical significance at the 0.10 and 0.05 levels, respectively.

Table 6
Business Starts Regressions

	Started a business by:					
	Wave 1		Wave 2		Wave 3	
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	0.0634 ** (0.0169)	0.0618 ** (0.0167)	0.0674 ** (0.0201)	0.0647 ** (0.0201)	0.0431 * (0.0230)	0.0334 (0.0232)
Treatment*Autonomy Index	0.0222 (0.0146)	0.0263 * (0.0142)	-0.0017 (0.0184)	-0.0015 (0.0183)	-0.0058 (0.0230)	0.0009 (0.0229)
Treatment*Innovation Index	0.0001 (0.0168)	0.0013 (0.0163)	0.0076 (0.0204)	0.0085 (0.0201)	0.0054 (0.0235)	0.0003 (0.0235)
Treatment*Risk Tolerance Index	0.0253 (0.0169)	0.0201 (0.0168)	0.0419 ** (0.0207)	0.0382 * (0.0206)	0.0588 ** (0.0237)	0.0532 ** (0.0241)
Autonomy Index	0.0034 (0.0099)	0.0004 (0.0099)	0.0169 (0.0121)	0.0142 (0.0128)	0.0152 (0.0157)	0.0111 (0.0165)
Innovation Index	-0.0104 (0.0116)	-0.0081 (0.0113)	-0.0033 (0.0147)	-0.0004 (0.0147)	0.0056 (0.0172)	0.0080 (0.0174)
Risk Tolerance Index	0.0158 (0.0116)	0.0192 (0.0117)	0.0297 ** (0.0147)	0.0292 * (0.0152)	0.0234 (0.0171)	0.0213 (0.0179)
Individual Controls Included	No	Yes	No	Yes	No	Yes
Mean of dependent variable	0.2423	0.2727	0.3724	0.3731	0.5115	0.5122
Sample Size	2,547	2,439	2,269	2,171	1,877	1,798

Notes: (1) The dependent variable is whether the individual has started a business by the time of the survey. (2) The wave 1, wave 2 and wave 3 surveys are conducted at 6, 18, and 60 months after time of application. (3) Individual controls include program site, gender, race/ethnicity, immigrant status, age, marital status, children, education level, family income, health problems, whether self-employed relatives or friends, whether worked for self-employed relatives or friends, managerial experience, bad credit history, unemployment insurance, and employer provided health insurance. (4) * and ** denote statistical significance at the 0.10 and 0.05 levels, respectively.

Table 7
Business Ownership Regressions using Specific Personality Component Questions

	Self-Employed Business Owner at:		
	Wave 1 (1)	Wave 2 (2)	Wave 3 (3)
1.A. "I have innovative ideas"			
Treatment*Has Innovative Ideas	0.0003 (0.0168)	0.0049 (0.0188)	-0.0139 (0.0215)
Has Innovative Ideas	-0.0070 (0.0121)	-0.0115 (0.0138)	0.0043 (0.0158)
Sample size	2,497	2,179	1,755
1.B. "If something "can't be done," I find a way"			
Treatment*Finds a Way	0.0010 (0.0158)	0.0263 (0.0179)	-0.0089 (0.0199)
Finds a Way	-0.0015 (0.0109)	-0.0070 (0.0132)	0.0186 (0.0147)
Sample size	2,508	2,189	1,760
1.C. "I often find more than one solution to a problem"			
Treatment*Finds many Solutions	0.0013 (0.0168)	-0.0040 (0.0190)	-0.0264 (0.0226)
Finds many Solutions	-0.0108 (0.0122)	0.0013 (0.0147)	0.0096 (0.0171)
Sample size	2,504	2,186	1,761
2.A. "I'm only willing to take a risk if I am sure everything will work out"			
Treatment*Is Risk Averse	0.0141 (0.0162)	0.0374 (0.0185)	** 0.0334 (0.0209)
Is Risk Averse	0.0061 (0.0110)	-0.0052 (0.0132)	-0.0110 (0.0154)
Sample size	2,496	2,179	1,757
2.B. "I am not prepared to risk my savings for my business"			
Treatment*Will not Risk Savings	0.0175 (0.0170)	0.0344 (0.0189)	* -0.0050 (0.0206)
Will not Risk Savings	0.0222 * (0.0123)	0.0130 (0.0137)	0.0341 ** (0.0152)
Sample Size	2,502	2,184	1,761

Notes: (1) The dependent variable is whether the individual is operating a small business at the time of the survey. (2) Each set of rows represents a separate regression. In 1.A, 1.B, and 1.C the main dummies and treatment interactions are included for the autonomy index and risk tolerance index, and in 2.A and 2.B the main dummies and treatment interactions are included for the autonomy index and innovativeness index. (3) The wave 1, wave 2 and wave 3 surveys are conducted at 6, 18, and 60 months after time of application. (4) All specifications include individual controls for program site, gender, race/ethnicity, immigrant status, age, marital status, children, education level, family income, health problems, whether self-employed relatives or friends, whether worked for self-employed relatives or friends, managerial experience, bad credit history, unemployment insurance, and employer provided

Table 8
Business Starts Regressions using Specific Personality Component Questions

	Self-Employed Business Owner at:		
	Wave 1 (1)	Wave 2 (2)	Wave 3 (3)
1.A. "I have innovative ideas"			
Treatment*Has Innovative Ideas	-0.0030 (0.0171)	-0.0025 (0.0204)	-0.0002 (0.0233)
Has Innovative Ideas	-0.0064 (0.0123)	-0.0050 (0.0149)	-0.0050 (0.0172)
Sample size	2,449	2,180	1,804
1.B. "If something "can't be done," I find a way"			
Treatment*Finds a Way	0.0029 (0.0160)	0.0211 (0.0191)	0.0235 (0.0226)
Finds a Way	-0.0020 (0.0111)	-0.0027 (0.0138)	0.0024 (0.0166)
Sample size	2,460	2,189	1,809
1.C. "I often find more than one solution to a problem"			
Treatment*Finds many Solutions	0.0024 (0.0170)	-0.0003 (0.0209)	-0.0241 (0.0246)
Finds many Solutions	-0.0105 (0.0124)	0.0059 (0.0161)	0.0198 (0.0187)
Sample size	2,456	2,186	1,809
2.A. "I'm only willing to take a risk if I am sure everything will work out"			
Treatment*Is Risk Averse	0.0145 (0.0164)	0.0328 (0.0203)	0.0507 ** (0.0239)
Is Risk Averse	0.0073 (0.0113)	0.0146 (0.0148)	0.0058 (0.0178)
Sample size	2,448	2,179	1,805
2.B. "I am not prepared to risk my savings for my business"			
Treatment*Will not Risk Savings	0.0159 (0.0173)	0.0242 (0.0207)	0.0278 (0.0238)
Will not Risk Savings	0.0223 * (0.0125)	0.0303 ** (0.0154)	0.0259 (0.0179)
Sample Size	2,454	2,184	1,809

Notes: (1) The dependent variable is whether the individual has started a business by the time of the survey. (2) Each set of rows represents a separate regression. In 1.A, 1.B, and 1.C the main dummies and treatment interactions are included for the autonomy index and risk tolerance index, and in 2.A and 2.B the main dummies and treatment interactions are included for the autonomy index and innovativeness index. (3) The wave 1, wave 2 and wave 3 surveys are conducted at 6, 18, and 60 months after time of application. (4) All specifications include individual controls for program site, gender, race/ethnicity, immigrant status, age, marital status, children, education level, family income, health problems, whether self-employed relatives or friends, whether worked for self-employed relatives or friends, managerial experience, bad credit history, unemployment insurance,