Entrepreneurship Education and Entry into Self-Employment Among University Graduates

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Summary. — Entrepreneurship education has the potential to enable youth to gain skills and create their own jobs. In Tunisia, a curricular reform created an entrepreneurship track providing business training and coaching to help university students prepare a business plan. We rely on randomized assignment of the entrepreneurship track to identify impacts on students' labor market outcomes one year after graduation. The entrepreneurship track led to a small increase in self-employment, but overall employment rates remained unchanged. Although business skills improved, effects on personality and entrepreneurial traits were mixed. The program nevertheless increased graduates' aspirations toward the future.
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Key words — entrepreneurship education, training, self-employment, skills, program evaluation, randomized control trial

1. INTRODUCTION

Entrepreneurship has long been considered a key element of the growth process (Baumol, 1968; Schumpeter, 1912). Some theories of entrepreneurship model individuals' decisions between entry into wage and self-employment. The theoretical literature highlights the role of wealth in shaping this decision in the presence of capital-market imperfections (Banerjee & Newman, 1993; Ghatak & Jiang, 2002). Heterogeneity in individual preferences (Kihlstrom & Laffont, 1979) as well as in ability or entrepreneurial skills (Jiang, Wang, & Wu, 2010) can also affect occupational choices. Since entrepreneurial ability is not necessarily innate, education and training programs that seek to shape these entrepreneurship skills are multiplying around the world. Still, the evidence that these programs can effectively facilitate entry into self-employment remains thin (Valerio, Parton, & Robb, 2014).

The role of entrepreneurship in the development process is eliciting increasing attention from policymakers and scholars (Naudé, 2014). In developing countries, only a small share of the labor-force is employed in wage jobs (Gindling & Newhouse, 2014). In economies with limited creation of private-sector wage jobs, entrepreneurship-support interventions are promising policy options for the creation of more attractive skilled jobs. In this context, many policymakers consider that entrepreneurship education has a strong potential to enable youth to gain skills and generate their own skilled jobs.

The Middle East and North Africa is one of the regions with the highest youth unemployment rates among university graduates (Gatti *et al.*, 2013; Groh, McKenzie, Shammout, & Vishwanath, 2015). In Tunisia, 46% of graduates of the 2004 class were still unemployed eighteen months after graduation (MFPE & World Bank, 2009). Unemployment among youths holding a university degree increased from 34% in 2005 to 62% in 2012. In this context, Tunisia has attempted various reforms aiming to promote employability or self-employment among university graduates. Among them, a new entrepreneurship track was introduced into the undergraduate (*licence appliquée*) curriculum in 2009. Students enrolled in the last year of their undergraduate degree were invited to apply to the entrepreneurship track, which entailed business training as well as personalized coaching sessions. Students could then graduate by writing and defending a business plan instead of a traditional undergraduate thesis.

In this paper, we analyze the impact of the entrepreneurship track on labor market outcomes by relying on randomized assignment of the program among applicants. The paper makes several contributions to the empirical literature on entrepreneurship education and training. First, we provide unique experimental evidence on the effectiveness of entrepreneurship education delivered in university in shaping employment outcomes among graduates. Moreover, it is the

first study providing such evidence outside OECD countries, and for the Middle East and North Africa in particular. Second, whereas most studies on entrepreneurship training have focused on its impacts on productivity of established entrepreneurs, our results complement the more limited literature analyzing the impacts on entry into self-employment. Third, the paper contributes to the broader literature on active labor market policies, which tends to focus on programs targeting low-skilled youths or unemployed individuals. In contrast, our work looks at the effectiveness of a training program for higher education students, before they enter the labor-market. Lastly, we analyze the impacts of entrepreneurship training on a range of skills such as business skills, personality dimensions, or entrepreneurial traits. As such, the paper provides a link between the economic literature on the effectiveness of training programs on labor outcomes, and the broader psychology and entrepreneurship literature studying the specific skills or traits associated with successful entry into self-employment.

Results show that entrepreneurship education significantly increased the rate of self-employment among university graduates approximately one year after graduation. However, the effects are small in absolute terms, ranging from 1 to 4 percentage points. Given the low prevalence of self-employment in the population, these small absolute effects imply that program participants were on average 46–87% more likely to be self-employed compared with graduates from the control group. However, the employment rate among applicants remained unchanged, suggesting a substitution from wage employment and into self-employment. Findings on intermediary outcomes are consistent with the limited employment results: the program improved business skills, but had mixed impacts on personality and little effects on entrepreneurial traits. Nevertheless, participation in the entrepreneurship track heightened graduates' aspirations toward the future shortly after the Tunisian revolution.

The rest of the paper is organized as follows. Section 2 discusses the placement of the paper in the literature. Section 3 briefly sets the country context and describes the entrepreneurship track. Section 4 describes the randomized assignment and take-up of the entrepreneurship track. Section 5 presents the empirical strategy. Section 6 discusses the main effects of the program on labor market outcomes. Section 7 analyzes a range of skills as intermediary outcomes that can contribute to explain the observed employment impacts. Section 8 concludes.

2. RELATED LITERATURE

This paper relates with different strands of the literature. First, we relate directly to the empirical evidence on the effectiveness of entrepreneurship education programs in shaping individual skills and facilitating entry into self-employment. Several OECD countries provide entrepreneurship education in school. Despite the popularity of these programs, the evidence on their effectiveness remains thin (Valerio et al., 2014). Peterman and Kennedy (2003) and Souitaris, Zerbinati, and Al-Laham (2007) find some impacts of entrepreneurship education on entrepreneurial intentions among secondary school and high-school students, respectively. In contrast, Oosterbeek, van Praag, and Ijsselstein (2010) show that an entrepreneurship education program had no effect on university students' entrepreneurial skills and had a negative effect on the intention of becoming an entrepreneur. A limitation of these studies, however, is that they measure impacts on students' intentions while in school,

not on actual project creation or employment outcomes after students have graduated and joined the labor-market. [1] Given this limited evidence-base, the effectiveness of entrepreneurship education remains a topic of active debate. We provide unique evidence on the impacts of an entrepreneurship track introduced in Tunisian universities on the labor-market outcomes of participants one year after their graduation.

Second, we relate to a growing literature analyzing the effectiveness of entrepreneurship-support interventions, including programs providing a mix of capital and skills (for a review, see Cho & Honorati, 2014). Most studies on business training analyze whether the skills of existing entrepreneurs can be strengthened to improve their productivity (for a review, see McKenzie & Woodruff, 2014). Recent contributions show that business training can affect enterprise owners' practices, although effects on employment or productivity are more limited (Bruhn & Zia, 2013; Drexler, Fischer, & Schoar, 2014; Karlan & Valdivia, 2011; Klinger & Schündeln, 2011). In contrast, fewer studies focus on whether business training can equip individuals with the skills required to enter into self-employment. De Mel, McKenzie, and Woodruff (2014) show that business training targeted to women in urban Sri Lanka affected business practices but not productivity among existing business owners, and that the same training accelerated entry into self-employment in the short-run. Fairlie, Karlan, and Zinman (2015) find limited overall treatment effects of entrepreneurship training in the United States, although they find short-term effects on business ownership among individuals previously unemployed. We complement this limited literature analyzing the effectiveness of entrepreneurship training in facilitating entry into self-employment.

Third, we also complement the broader literature on active labor market policies by documenting the effectiveness of a training program for a high-skilled group of university students before they enter the labor-force. Active labor market policies mostly aim to foster employability and productivity among low-skilled youths or unemployed individuals (for reviews, see Kluve, Rother, & Sánchez-Puerta, 2010, or Almeida, Behrman, & Robalino, 2012). Most of the existing evidence on training programs in developing countries comes from Latin American programs and tends to focus on the effect of providing technical and vocational training to low-skilled, at-risk youth on their probability to enter wage employment (e.g., Attanasio, Kugler, & Meghir, 2011; Card, Ibarraran, Regalia, Rosas-Shady, & Soares, 2011). The active labor market program literature in developing countries is comprehensive and casts doubts on the cost-effectiveness of training (Almeida et al., 2012). The findings generally show that trainees of more comprehensive programs are more likely to find a job and tend to have better quality jobs than non-trainees, although differences in labor earnings are mixed. In contrast, this paper isolates the impact of a training program for high-skilled youths before they enter the labor-market, focusing on youths' transition from university to work and the decision to enter into self-employment. It is unclear a priori whether training programs should have larger or smaller impacts on the high-skilled relatively to the low-skilled. On the one hand, low-skilled youths have lower human capital than university students, and as such the marginal returns to additional training may be higher among them. On the other hand, high-skilled youths may face fewer constraints to enter self-employment in the first place, so that the impact of entrepreneurship training may be larger among them.

Finally and importantly, we relate also to the broader psychology and entrepreneurship literature studying the skills or personality traits needed for successful entry into self-

employment. A range of attributes, including business skills, personality, and entrepreneurial traits have been shown to be associated with productivity or employment outcomes, including occupational choice and entrepreneurship (Almlund, Duckworth, Heckman, & Kautz, 2011). A line of research analyzes whether entrepreneurs have significantly different personality or entrepreneurial traits (for reviews, see Brandstätter, 2011; Rauch & Frese, 2007; Zhao & Seibert, 2006; Zhao, Seibert, & Lumpkin, 2010; or Frese & Gielnik, 2014), for instance by comparing entrepreneurs to managers or wage workers (e.g., De Mel, McKenzie, & Woodruff, 2010; Cobb-Clark and Tan; 2010). Other studies have analyzed whether the personal attributes needed to enter self-employment are different than those needed to remain in self-employment (Caliendo, Fossen, & Kritikos, 2014; Ciavarella, Buchholtz, Riordan, Gatewood, & Stokes, 2004). Studies that compare entrepreneurs to other groups of individuals tend to find that entrepreneurs have some different personality or entrepreneurial traits. However, these observed differences often document associations rather than causality, and are not able to identify which skills or traits are more malleable. Another strand of the literature shows that behavioral skills and personality remain malleable, particularly among young adults (Almlund *et al.*, 2011; Roberts & Mroczek, 2008; Robins, Fraley, Roberts, & Trzesniewski, 2001). However, the economic literature assessing the effectiveness of entrepreneurship training or entrepreneurship education in improving labor-market outcomes does not usually document impacts along these domains. Only a few papers provide evidence of training impacts on behavioral skills, aspirations or attitudes, while also documenting impacts on labor-market or business creation outcomes (Groh, Krishnan, McKenzie, & Vishwanath, 2012; Macours, Premand, & Vakis, 2013; Solomon, Frese, Friedrich, & Glaub, 2013). In this paper, we also study the impacts on entrepreneurship training on a range of skills, including business skills, as well as personality and entrepreneurial traits. These are intermediary outcomes that can help understand changes in the main employment outcomes. By doing so, we are able to relate our findings with the broader psychology and business literature.

3. THE ENTREPRENEURSHIP EDUCATION TRACK: BUSINESS TRAINING AND COACHING

In Tunisia, both the graduation rate from university and the unemployment rate among tertiary-educated youth have been increasing steadily. Access to post-secondary education has soared over the past 20 years. Gross enrollment rates in tertiary education reached 34% in 2009, up from 12% in 1995.[2] At the same time, unemployment among youth holding a university degree increased from 34% in 2005 to 62% in 2012.[3] While tertiary-educated youth made up less than 16% of those employed in the Tunisian labor market in 2010, they accounted for over 34% of the unemployed. In this context, the graduates' employment challenge has become one of the main concerns for policymakers in Tunisia.

An innovative entrepreneurship track was introduced into the tertiary curriculum in the academic year 2009–10. Until that point, during the last semester of the applied undergraduate curriculum, students took an internship and wrote an academic thesis to graduate. In June 2009, the Ministry of Education and Higher Education passed a reform creating an entrepreneurship education track where students would receive business training and coaching to develop a business plan. In August 2009, the Ministries of Education and Higher Education and of Vocational Training and Labor jointly signed an order to allow students to graduate by submitting their business plan instead of the traditional thesis. The newly established entrepreneurship track primarily aimed to increase self-employment and foster an entrepreneurship culture among university graduates; more broadly, the program also aspired to improve participants' employment outcomes.

The program was launched in all Tunisian universities delivering *licences appliquées* in 2009.[4] Communication campaigns took place on campus and in the media to inform students about the newly introduced alternative to the standard curriculum. Once in the entrepreneurship track, students were offered support for developing a business plan through business courses and personalized coaching. The entrepreneurship track provided students with: (i) business training organized by the public employment office; (ii) external private sector coaches, mainly entrepreneurs or professionals in an industry relevant to the student's business idea; and (iii) supervision from university professors in development and finalization of the business plan. For each student, the final product of the program was a comprehensive business plan that served as an undergraduate thesis.

Students received entrepreneurship education between February and June 2010, starting with intensive business training to develop, modify, or refine an initial business idea. Students took twenty days of full-time training at local employment offices (*Agence Nationale d'Emploi et de Travail Indépendent*, ANETI) between February and March 2010.[5] The training was called *Formation Création d'Entreprise et Formation des Entrepreneurs* (CEFE) and was part of the active labor market menu offered by ANETI. The training was conducted in small groups and included practical research on the ground, aimed at fostering participants' behavioral skills, business skills, and networking skills.

The first part of the training consisted of four modules: (a) for the person, aimed at developing an entrepreneurship culture and behavioral skills; (b) for the project, aimed at developing business ideas through brainstorming and followed by SWOT (strength, weaknesses, opportunities, and threat) analysis to isolate the best project idea for each participant; (c) for management, aimed at general management principles (including leadership, partnership choice, organization, time management, and planning tools); and (d) for marketing, aimed at identification of the relevant market and market research (competition, clients, technology standards, etc.) as input into cost analysis.

In a second phase, participants had the opportunity to present their ideas and get feedback from bankers and business experts. Students participated in three training modules: (a) information research, when participants focused on the challenges of implementing the projects; (b) business plan education, when participants estimated key project parameters, such as investments, revenues, and business expenses; and (c) building networks, when at least five outside experts or business professionals were invited to give talks.

After the completion of the courses, students were assigned a personalized coach for support in finalizing their business plan. Coaches were private sector entrepreneurs or specialized coaches from ANETI or the Ministry of Industry's network of start-up offices (*Agence de Promotion de l'Industrie*, API). Students were expected to participate in eight coaching sessions, either individually or in small groups. Coaching took place from April to June 2010. In parallel, students also received supervision from one of their university professors. In June 2010, the business plans were completed and defended by students at their university as part of the graduation requirements.

Upon graduation, participants in the entrepreneurship track were invited to submit their business plans to a business plan competition (*concours des meilleurs plan d'affaires "entreprendre et gagner"*). A jury selected fifty winners who were eligible to receive seed capital for establishing the business outlined in their business plans. The first five winners were eligible for seed capital of 15,000 Dinars each (approximately US $10,000), the next twenty winners, 7,000 Dinars; and the last 25 winners, 3,000 Dinars. Prizes were only paid if individuals had been able to secure all the complementary funding needed to set-up their project. Fewer than 15 winners fulfilled that requirements and actually cashed the prize.

4. DATA, RANDOMIZED ASSIGNMENT, AND COMPLIANCE

(a) Baseline data

In 2009–10, 18,682 students were enrolled in the third year of *licence appliquée* in Tunisian universities. Students were invited to submit an application form for the entrepreneurship track in November/December 2009. In total, 1,702 students (or 9.1% of all eligible students nationwide) applied to receive entrepreneurship education. Of those, 1,310 students applied individually and 392 applied in pairs, so that in total 1,506 projects were registered.

Table 1 shows the number of enrolled students and applicants by gender and university. The third column shows the distribution of the application rate. The last two columns present the distribution of all students enrolled in the third year of *licence appliquée* in 2009–10 and of applicants, by gender and by university respectively. Two-thirds of the applicants were women. While this is a high participation rate for women, it is not higher than the proportion of women in the overall population of enrolled students in Tunisia. Demand for the program varied across universities. Differences in application rates are likely explained by variations in the implementation of the information campaigns and intensity of advertisement about the program, [6] as well as regional variations in perceived employment opportunities. [7] The baseline data come from two sources. An application form was collected in November and December 2009. The application form contained information about students' socio-economic background and employment

experience, as well as their parents'. Additional information was collected through a phone survey in January and February 2010. It included proxies for risk and time preference. It also included measures of entrepreneurial traits similar to those selected by De Mel *et al.* (2010) based on the entrepreneurship psychology literature. These measures capture a range of traits that have been documented to characterize entrepreneurs: passion for work; tenacity; polychronicity; locus of control; achievement; power motivation; centrality of work; impulsiveness, and personal organization.

The baseline survey suggests that the intervention responded to a strong demand from students and that applicants had high expectations for their participation in the program: 88% of applicants expected that the intervention would facilitate their insertion in the labor market, and 89% expected to have higher earnings thanks to the intervention.

(b) Randomized assignment and compliance

Causal impacts of the program are identified based on randomized assignment to the entrepreneurship track among applicants. The program was oversubscribed, so that half of the applicants were randomly assigned to the entrepreneurship track and the other half were assigned to continue with the standard curriculum. Randomized assignment was conducted at the project level, stratified by gender and study subject. [8] 757 projects were assigned to the treatment (658 individual projects, and 99 projects in pair) and 742 projects were assigned to the control group (652 individual projects; 97 projects in pairs).

Table 2 presents the average baseline characteristics of the treatment group (assigned to the entrepreneurship track) and the control group (assigned to the standard curriculum), as well as differences between the two at baseline. (Table 5 in the appendix present results for several other characteristics). [9]

Overall, randomization achieved good balance. Still, in any randomization procedure, a small number of variables are expected to be statistically different across the treatment and control groups. In this case, the difference in past experience in self-employment is statistically significant. We will return to this point below, as past experience may determine future occupational choice, given the documented hysteresis associated with occupational choice among individuals over time. Overall, there are few systematic differences between

Table 1. *Characteristics of students in Licence Appliquée and entrepreneurship track*

		N "licence appliquée"	N applicants entrepreneurship track	Application rate (%)	Distribution among applicants (%)	Distribution among "licence appliquée" (%)
Gender	Female	12,539	1,129	9	68	67
	Male	6,143	573	9	32	33
University	Univ 7 Nov à Carthage	2,012	120	6	7	11
	Univ Tunis El-Manar	1,787	22	1	1	10
	Univ de Gabès	1,798	108	6	6	10
	Univ de Gafsa	1,060	304	29	18	6
	Univ de Jendouba	1,550	216	14	13	8
	Univ de Kairouan	1,237	109	9	6	7
	Univ de Manouba	1,659	11	1	1	9
	Univ de Monastir	1,935	316	16	19	10
	Univ de Sfax	2,005	284	14	17	11
	Univ de Sousse	2,351	141	6	8	13
	Univ de Tunis	1,010	61	6	4	5
	Univ Ez-Zitouna	93	10	11	1	0
Total		18,682	1,702	9	100	100

Source: Observatoire National de l'Emploi et des Qualifications.

Table 2. *Baseline balance for effective sample*

	N	Mean control	Mean treatment	Difference ($T - C$)	St. Err. for difference
Variables from application form					
Male	1,580	0.33	0.32	−0.01	0.01
Applied in pair	1,580	0.23	0.23	−0.00	0.01
Had a project idea when applying	1,580	0.84	0.86	0.02	0.01
Age	1,578	23.00	23.07	0.07	0.06
Single	1,580	0.99	0.98	−0.01	0.01
Average grade in 2nd year of university (0–20)	1,560	11.43	11.52	0.09	0.06
Lowest grade in 2nd year of university (0–20)	1,443	6.16	6.22	0.05	0.14
Highest grade in 2nd year of university (0–20)	1,539	17.05	17.09	0.03	0.10
Took entrepreneurship course	1,580	0.74	0.76	0.02	0.01
Grade at entrepreneurship course	1,184	13.61	13.53	−0.09	0.13
Knowledge of Arabic (1–5)	1,580	3.71	3.67	−0.04	0.05
Knowledge of French (1–5)	1,580	3.52	3.50	−0.03	0.04
Knowledge of English (1–5)	1,580	3.09	3.08	−0.01	0.06
Ever worked	1,580	0.70	0.72	0.02	0.02
Age at first job	1,112	17.48	17.15	−0.32[*]	0.16
Duration of first job (months)	1,105	5.93	6.35	0.42	0.76
First job: seasonal worker	1,580	0.36	0.35	−0.00	0.03
First job: wage worker	1,580	0.19	0.19	−0.01	0.02
First job: family helper	1,580	0.06	0.05	−0.01	0.01
First job: self-employed	1,580	0.08	0.11	0.03[***]	0.01
Has experience related to project	1,580	0.62	0.63	0.02	0.02
Knows an entrepreneur	1,580	0.59	0.63	0.04	0.02
Has helped an entrepreneur	1,580	0.27	0.30	0.03	0.02
Is willing to take risk	1,580	0.96	0.93	−0.02[*]	0.01
Prefers 1000 TND for sure to a salary between 500 TND and 1500 TND based on performance	1,580	0.26	0.25	−0.01	0.02
Household size	1,579	6.49	6.51	0.02	0.10
HH earnings between 0 and 300 TND	1,580	0.25	0.25	0.00	0.02
HH earnings between 301 and 500 TND	1,580	0.30	0.30	0.00	0.02
HH earnings between 501 and 800 TND	1,580	0.21	0.20	−0.02	0.02
HH earnings above 801 TND	1,580	0.24	0.25	0.01	0.02
Family can provide financial support	1,580	0.64	0.63	−0.02	0.02
Variables from phone survey					
Years since baccalaureate	1,432	3.38	3.37	−0.01	0.04
Grade at baccalaureate (0–20)	1,432	10.64	10.60	−0.04	0.05
Prefers 1000 TND for sure in 6 months to 800 TND now	1,432	0.51	0.55	0.05[**]	0.02
Willingness to take risk (1–10)	1,432	7.41	7.46	0.05	0.07
Certainty equivalent for a lottery with a 50% chance of winning 2000 TND and a 50% chance of winning 0 TND	1,427	1,003.99	1,084.85	80.85[**]	33.57
Impulsiveness (normalized score)	1,432	0.00	−0.10	−0.10[**]	0.04
Passion for work (normalized score)	1,432	0.00	0.02	0.02	0.06
Tenacity (normalized score)	1,432	0.00	0.11	0.11[*]	0.06
Polychronicity (normalized score)	1,432	0.00	−0.01	−0.01	0.04
Locus of control (normalized score)	1,432	0.00	0.08	0.08	0.06
Achievement (normalized score)	1,432	0.00	0.19	0.19[***]	0.05
Power motivation (normalized score)	1,432	0.00	0.01	0.01	0.07
Centrality of work (normalized score)	1,432	0.00	−0.04	−0.04	0.06
Personal organization (normalized score)	1,432	0.00	0.10	0.10[*]	0.06
Optimism (normalized score)	1,432	0.00	0.05	0.05	0.05

Results reported: number of observations in survey; mean of treatment and control groups at baseline; difference between the two; and standard errors for difference between treatment and control group.

Results for effective sample for estimation (excluding attritors at follow-up).

Effective sample is 1,580 for variables in the baseline application form, and 1,432 for the baseline phone survey (due to the combined attrition in the baseline phone survey and the follow-up survey).

[*] Significant at 10%.

[**] Significant at 5%.

[***] Significant at 1%.

participants and non-participants and the differences are quantitatively small. The empirical analysis will control for the characteristics in Table 2 that are statistically different between the two groups at baseline.

Administrative records from the implementing agency reveal imperfect compliance with assignment to the treatment group, which is mostly driven by drop-out of the entrepreneurship track. Of the 856 students who applied and were

randomly assigned to the entrepreneurship track, 67% completed the business training, and 59% completed both business training and coaching. Overall, 41% dropped out of entrepreneurship education prior to completing both training and coaching. Table 6 in the appendix presents marginal effects from the estimation of a logit model to describe the profile of students who complied with their assignment to the entrepreneurship track and completed it.

Administrative data reveal high compliance for students assigned to the control group. The twenty days of CEFE training were provided by employment offices so that some control students may also have been able to take the training after graduating, although personalized coaching would not have been available to them. Administrative and survey data show that take-up of the CEFE training was low in the control group, with only twenty-nine students (or 3.4% of the control group) completing the CEFE training after graduation.

(c) Follow-up data and post-revolution context

After the baseline data were collected and the randomization performed, students participated in the entrepreneurship track between February and June 2010. Graduation took place in June 2010. In October 2010, qualitative data were collected to gather students', coaches', and professors' perceptions on the implementation of the intervention.

The follow-up data were collected through face-to-face interviews between April and June 2011, nine to twelve months after the end of the academic year. The instrument included similar questions than the baseline, with the same measures of preferences and entrepreneurial traits. Additional modules were introduced, including a detailed labor module, a module on business skills related to the content of the training, a module on networks and a module on access to credit. It also contained additional measures of personality and aspirations. The measures of personality capture the commonly used Big Five dimensions (Almlund et al., 2011; John, Naumann, & Soto, 2008): extraversion; agreeableness; conscientiousness; emotional stability; and openness to experience. Specifically, the TIPI scale developed by Gosling, Rentfrow, and Swann (2003) was used to obtain brief measures of the "Big Five" personality dimensions. Aspirations were measured through positive items as in the CESD depression scale, capturing positive attitudes toward the future (Radloff, 1977).

Despite the high mobility of the population of graduates, thorough tracking procedures led to high response rates at follow-up [10]: 92.8% of the 1,702 applicants were tracked. [11] This low level of attrition is noteworthy since many studies on entrepreneurship education suffer from high attrition. Attrition was balanced and uncorrelated with treatment status. [12]

The follow-up survey was conducted 3–6 months after the Tunisian revolution, which occurred in January 2011. In the follow-up survey, individuals were asked to report their perceptions on how the revolution affected their employment opportunities. Graduates revealed positive outlooks, including a stronger desire to look for employment, and less interest in migrating abroad than before the revolution. They also stated that the revolution increased their prospects for wage and self-employment. In addition, there was no difference in the relative intensity at which the revolution affected graduates' perception of opportunities in wage and self-employment. In other words, students did not believe that the revolution disproportionately affected their chances to obtain wage jobs or enter self-employment. As such, the post-revolution context

in which the results are obtained does not affect the internal validity of the findings.

5. EMPIRICAL IDENTIFICATION STRATEGY

(a) Specifications

Identification of program impacts relies on the randomized assignment of applicants to the entrepreneurship track. We first present intent-to-treat (ITT) estimates, measuring the impact of offering business training and coaching independently of actual take-up. We estimate the following individual-level intent-to-treat regression:

$$Y_i = \beta T_i + \gamma X_i + \pi_{is} + \varepsilon_i \qquad (1)$$

where Y_i is the outcome of interest for individual i at follow-up, T_i is a binary variable for being randomly assigned to the treatment group, X_i is a set of control variables, π_{is} are fixed effects for each randomization strata (by gender and subject) and ε_i is a mean-zero error term. [13]

We present results for three alternative specifications. In specification I, X_i includes a set of control variables from the baseline application form. [14] In specification II, X_i contains a constant and an expanded set of controls including those from the baseline application form as well as additional variables from the baseline phone survey measuring entrepreneurial traits. [15] This expanded set of controls reduces the effective sample size to 1,432 due to combined attrition in the baseline phone survey and the follow-up survey. In specification I and II, standard errors are clustered at the level of the randomization strata (by gender and study subject). Specification III includes the same set of variables as in specification I but standard errors clustered by the governorate where students live at baseline. [16]

In addition to ITT estimates, we also present and briefly discuss "treatment on the treated" (TOT) estimates for each of the three specifications. The last section documented that not all students assigned to the treatment group remained in the program (and a few control students took up the business training component of the entrepreneurship track). TOT estimates are obtained by 2SLS by instrumenting actual completion of the entrepreneurship track with the randomized assignment to treatment. We define program completion or compliance for students in the treatment group as completing the business training and receiving coaching. [17]

TOT estimates are local average treatment effects that measure the impact of the entrepreneurship track for the students who complied with their assignment to the treatment or control group. Very few students in the control group took the business training (CEFE provided by the public employment agency) after graduation. In this sense, TOT estimates essentially produce the average impact of the program for students who did not drop-out from the entrepreneurship track.

Importantly, almost all the results are robust across ITT and TOT estimates, with TOT estimates of a larger magnitude as would be expected. Given the consistency of the results across both estimates, we focus on discussing ITT estimates since they are our preferred set of estimates and more directly policy-relevant.

(b) Hypothesis and outcomes

The main question is whether entrepreneurship education (including business training and coaching) promoted self-employment among tertiary graduates. To answer this

question, we use three alternative outcome indicators. The first captures whether the respondent owned a project at any point over the twelve months prior to the survey. The second indicator captures self-employment based on a seven day recall consistent with official ILO definitions used in Tunisia. [18] The third and more conservative indicator is based on a seven day recall, excluding self-employed individuals in seasonal activities. [19] None of the self-employment indicators includes family helpers.

As a second hypothesis, we test whether the entrepreneurship track increased overall employment among beneficiaries. On the one hand, skills acquired through entrepreneurship education may be transferable across occupations. The entrepreneurship track can potentially equip students with skills valued by employers and as such increase graduates' probability of finding wage jobs. On the other hand, the assignment to the entrepreneurship track may induce a substitution away from wage employment. For instance, the program may negatively affect the probability that participants find wage jobs in the private sector, either because it equips students with sub-optimal skills for wage employment or because the standard curriculum may be more valuable to finding wage jobs since it includes writing an academic thesis and undertaking an internship. To shed light on these potential mechanisms, we estimate the impact of the entrepreneurship track on overall employment as well as its two main components, self-employment (as above) and wage employment. We also measure the impact of the interventions on other variables of employment status (unemployed, studying, inactive). [20] Finally, we estimate the impact of the intervention on some employment characteristics, including hours worked, earnings, self-reported reservation wage for public and private sector wage employment, whether the individual has a contract or is covered by social security.

Third, we analyze potential mechanisms through which the intervention can affect employment outcomes. These different channels relate to the content and objectives of the intervention described in Section 3. The entrepreneurship track aimed to provide participants with business skills, technical knowledge and experience directly useful to produce a business plan. In parallel, a component of the business training aimed to shape students' behavioral skills and entrepreneurship culture. However, the program was not grounded in psychological theory to outline a clear set of behavioral skills or domains of personality it aimed to affect. In this context, we test whether the intervention affected (i) business skills, (ii) personality dimensions, (iii) entrepreneurial traits, and (iv) aspirations toward the future. Changes in these intermediary outcomes can contribute to explain the observed employment impacts. We also test (and report in the appendix) alternative mechanisms that may affect graduates' employment outcomes including through changes in preferences, networks and access to credit.

6. MAIN RESULTS: LABOR MARKET OUTCOMES

This section discusses program impacts on labor market outcomes. The main findings are reported in Table 3 including self-employment (Panel A), employment status (Panel B), and employment characteristics (Panel C). Column one reports the number of observations; the second and third columns report the sample means for the dependent variable in the control and treatment groups. The next 4 columns present results from specification I followed by specifications II and III. ITT estimates are in columns (1), (3) and (5), TOT estimates in columns (2), (4) and (6).

(a) Self-employment

Estimates show that entrepreneurship education led to a small increase in self-employment among participants approximately one year after graduation. The positive impact of the entrepreneurship track on graduates' self-employment holds across a range of indicators, such as whether the individual reported owning a project over the twelve months prior to the survey, whether he/she was self-employed in any activity last week, or whether he/she was self-employed in permanent activities last week. Focusing on self-employment in any activity in the last seven days (the official definition of self-employment in Tunisia), the ITT estimate shows a 3 percentage point increase in the probability of being self-employed. For those students who actually completed the entrepreneurship track (education and coaching), the TOT estimate reveals a 5 percentage point increase in the likelihood of being self-employed in any activity in the last week.

While increases in self-employment are robust across specifications and indicators, the estimated effects are small in absolute terms, ranging for 1 to 4 percentage points for ITT estimates. Since the rate of self-employment is low in the control group, these small absolute impacts lead to relatively large effect sizes. Indeed, the average self-employment rate in the control group is 4.4%. [21] Therefore, a 3 percentage point increase in self-employment in any activity over the last week is equivalent to a 68% increase over the self-employment rate in the control group. Average effect sizes for intent-to-treat estimates range from 46 to 87% depending on the specification and self-employment indicator.

As mentioned in Section 4, a significant difference in past experience in self-employment was observed between the treatment and control group at baseline. As Table 3 shows, estimated program impacts are robust across specifications, including when controlling for baseline differences (specification I and III), as well as when controlling for a broad range of preferences and entrepreneurial traits that are typically associated with the propensity to become self-employed (specification II). It may still be possible that part of effects are driven by unobserved individual-specific preferences for self-employment that we do not fully capture by including all the baseline control variables (including past experience in self-employment).

(b) Employment status

Table 3 (Panel B) shows that only 28% of graduates in the control group were employed one year after graduation, contrasting with 48% being unemployed. [22] This highlights the slow school-to-work transition among young university graduates.

While the program led to a small increase in self-employment, we find no evidence that the program significantly affected overall employment as captured by the likelihood of being employed in the last seven days. In fact, estimates suggest a reduction in the probability that program beneficiaries hold salaried employment. Even though the effect is not significant, the decrease in wage employment is of the same magnitude as the significant increase in self-employment. Similar to findings in Fairlie et al. (2015) in the US, these results suggest that the program changed the composition of employment by inducing a partial substitution from wage employment to self-employment for participants in the entrepreneurship track.

It is worth noting, however, that this shift from wage employment into self-employment may free up job opportuni-

Table 3. *Main results, program impacts on employment outcomes*

	N	C	T	Specification I				Specification II				Specification III			
				(1)		(2)		(3)		(4)		(5)		(6)	
				ITT	St. Err	TOT	St. Err	ITT	St. Err	TOT	St. Err	ITT	St. Err	TOT	St. Err
A. Self-employment															
Self-employed in last 12 months	1,580	0.05	0.09	0.04***	0.01	0.07***	0.02	0.04***	0.01	0.07***	0.02	0.04***	0.01	0.07***	0.02
Self-employed (any activity in last 7 days)	1,580	0.04	0.08	0.03**	0.01	0.05**	0.02	0.03**	0.01	0.05**	0.02	0.03**	0.01	0.05**	0.02
Self-employed (in last 7 days, excluding seasonal activities)	1,580	0.03	0.04	0.01*	0.01	0.02*	0.01	0.01*	0.01	0.02*	0.01	0.01	0.01	0.02	0.02
B. Employment status															
Employed in last 7 days	1,580	0.28	0.29	−0.00	0.02	−0.00	0.04	−0.00	0.02	−0.00	0.04	−0.00	0.03	−0.00	0.05
Salaried worker in last 7 days	1,580	0.21	0.18	−0.03	0.02	−0.05	0.03	−0.03	0.02	−0.05*	0.03	−0.03*	0.02	−0.05*	0.03
Unemployed in last 7 days	1,580	0.48	0.49	0.01	0.03	0.01	0.05	0.02	0.03	0.03	0.05	0.00	0.03	0.00	0.05
Studying in last 7 days	1,580	0.19	0.18	−0.00	0.02	−0.01	0.03	−0.01	0.02	−0.02	0.03	0.00	0.02	0.00	0.03
Inactive in last 7 days	1,580	0.03	0.03	0.01	0.01	0.01	0.01	−0.00	0.01	−0.00	0.01	0.01	0.01	0.01	0.02
C. Characteristics of employment															
Hours worked in last 7 days	1,570	8.55	9.35	0.66	0.98	1.12	1.64	0.48	0.99	0.76	1.54	0.69	0.93	1.17	1.48
Total labor earnings (log, monthly)	1,502	1.22	1.14	−0.06	0.13	−0.11	0.20	−0.08	0.13	−0.13	0.20	−0.06	0.12	−0.11	0.20
Total labor earnings (monthly)	1,502	74.79	88.97	17.51	33.86	29.80	56.38	17.50	33.23	27.97	51.90	10.70	14.06	18.30	22.68
Has contract	1,580	0.12	0.10	−0.02	0.02	−0.03	0.03	−0.02	0.02	−0.03	0.03	−0.02	0.02	−0.03	0.03
Covered by Social Security	1,580	0.05	0.06	0.01	0.01	0.01	0.02	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.02
Works in large firm	1,485	0.07	0.07	0.00	0.01	0.00	0.02	−0.00	0.01	−0.01	0.02	0.00	0.01	0.00	0.02
Reservation wage for private sector job (monthly)	1,579	473.50	491.20	17.13*	8.73	28.85**	14.68	12.03	9.56	19.09	14.91	18.76*	9.96	31.69*	16.18
Reservation wage for private sector job (log, monthly)	1,579	6.10	6.13	0.03*	0.02	0.06**	0.03	0.02	0.02	0.03	0.03	0.03*	0.02	0.06**	0.03
Reservation wage for public sector job (monthly)	1,577	487.86	491.45	4.15	7.30	6.99	12.00	−1.25	8.44	−1.99	12.96	5.18	8.66	8.75	13.85
Reservation wage for public sector job (log, monthly)	1,577	6.14	6.15	0.01	0.02	0.02	0.03	−0.00	0.02	−0.00	0.03	0.01	0.02	0.02	0.03

Note: Number of observations, average for control group, average for treatment group, intent-to-treat (ITT) estimates, standard errors for ITT estimates, treatment-on-the-treated (TOT) estimates for completing entrepreneurship training and attending coaching sessions, standard errors for TOT estimates. Standard errors clustered by strata in specification I and II, by governorate in specification III. Estimates are obtained separately for each outcome and each specification. In all specifications controls include strata fixed-effects (by gender and subject), as well as a set of control variables from the baseline application form, including age at first job, previous experience in self-employment, prior experience with projects, prior experience in helping an entrepreneur and mother's employment status. Controls in specification II also include a range of baseline skills of the respondents (patience, willingness to take risk, impulsiveness, tenacity and sense of achievement). Sample size for Specification I and II: $N = 1,580$. Sample Size for Specification III: $N = 1,432$ (due to attrition in baseline phone survey).
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

ties for students that do not participate in the entrepreneurship track. This may lead to higher overall employment. Unfortunately, the design of this study does not allow us to quantify potential general equilibrium effects.

Overall, while the program increased graduates' self-employment in a context where the availability of wage jobs is limited, the results show that the entrepreneurship track did not promote graduates' chances of finding a salaried job nor did it have an impact on the probability of being employed in any activity one year after graduation. This is partly explained by the fact that the entrepreneurship track is only effective in increasing self-employment for a limited (although significant) number of students. At the same time, the evidence does not support the hypothesis that the entrepreneurship track would also better align students' skills with employers' needs and improve their prospect of finding wage jobs. On the contrary, the results suggest trade-offs between policies that aim to promote self-employment and policies that aim to facilitate the transition from school to wage jobs.

(c) Employment characteristics

Table 3 (Panel C) presents the impacts of the entrepreneurship track on employment characteristics such as hours worked, earnings, having a contract, being covered by social security, working in a large firm, and reservation wages. The variables capturing the characteristics of employment (including earnings) contain zeros for those individuals not working. Two other outcomes include whether the worker is employed in a job with social security coverage and whether he/she has a written contract. These variables are binary; i.e., they take a value of one if an individual is employed with social security coverage or has a written contract and zero if he/she is not working at all or works without coverage or without a written contract. This distinction allows us to shed some light on the program's potential effect on entry into higher-end, formal sector jobs.

The results show no significant impact of the entrepreneurship track on earnings or hours worked, even if the estimates tend to be positive for both variables.[23] The entrepreneurship track did not promote entry into higher quality jobs among participants either. In particular, there were no significant program impacts on employment in the formal sector or in the size of the firm where graduates worked. These results are consistent with the findings that overall employment remained unchanged.

The results also suggest that the program increased students' reservation wage for private sector jobs, i.e., the minimum wage at which an individuals would accept a job offer. Higher reservation wage for private sector jobs is consistent with the program leading to greater valuation of self-employment or entrepreneurial activities in general. This result can contribute to explain the partial substitution from wage to self-employment documented above. In contrast, the program did not affect the reservation wage for public sector jobs. This suggests that self-employment is a substitute for private sector jobs, but not for public sector jobs.[24]

7. SKILLS AS INTERMEDIARY OUTCOMES

The previous section showed that the program led to a small increase in self-employment among participants without affecting their overall employment rates. Here we tease out the channels and intermediary outcomes through which the program affected employment outcomes. This is done by assessing program impacts on (i) business skills, (ii) personality dimensions and entrepreneurial traits, as well as (iii) aspirations toward the future.

(a) Business skills

Table 4 displays estimated program impacts on a range of skills. It uses the same specifications as in Table 3. Panel A shows strong impacts on participants' self-reported business skills. Results show that beneficiaries are more likely to report having practical experience in undertaking projects or in producing a business plan. They also report better knowledge about topics taught in the entrepreneurship track.[25] Students in the treatment group have knowledge of about 52% of the content of business plans, 25 percentage points higher than the control group. When the business skills score is standardized, it is clear that the impact on business skills is of large magnitude (0.7 standard deviation for the ITT estimates). These impacts are closely related to the core content of the business courses, which were relatively effective in imparting business knowledge to participants. Still, not all students assigned to the entrepreneurship track fully acquired the technical knowledge. This is fully consistent with the dropout patterns shown above.

(b) Personality dimensions and entrepreneurial traits

As discussed in Section 3, the entrepreneurship track contained a module designed "for the person", aimed at developing entrepreneurship culture and behavioral skills. During qualitative interviews undertaken prior to the follow-up survey, some facilitators stressed that one of their main objectives was to change students' personality and "turn them into entrepreneurs". Despite this general intention, the program was not grounded in a psychological theory, outlining a clear set of personality dimensions or entrepreneurial traits that it desired to affect.[26] Still, we test whether the program impacted a range of personality dimensions and entrepreneurial traits that are often associated with entrepreneurship in the literature.

Panels B and C of Table 4 document impacts on personality dimensions and entrepreneurial traits. Measuring personality dimensions and entrepreneurial traits in large-scale surveys is challenging. We are unable to use extensive measures, but rely instead on brief measures taken from the literature. The indicators in panel B capture the five dimensions of the most commonly used theory of personality (Almlund et al., 2011; John et al., 2008): extraversion; agreeableness; conscientiousness; emotional stability, and openness to experience. These are measured based on the TIPI scale developed by Gosling et al. (2003). The scale is known to have somewhat diminished psychometric properties, but was designed to study personality dimensions in situations when the use of more extensive measures is not feasible.[27] The nine indicators in panel C capture a range of more specific entrepreneurial traits: impulsiveness; passion for work; tenacity; polychronicity; locus of control; achievement; power motivation; centrality of work, and personal organization. These entrepreneurial traits are measured as in De Mel et al. (2010), who discuss how they stem from the psychology literature.[28] All measures are internally standardized so that they have a mean of 0 and a standard deviation of 1 in the control group. Therefore, all coefficients can be interpreted in terms of standard deviations from the average "level" in the control group.

The results show that the intervention led to measurable and significant changes in several "Big Five" dimensions. These

Table 4. *Intermediary impacts on business skills, personality dimensions, entrepreneurial traits and aspirations toward the future*

	N	C	T	Specification I				Specification II				Specification III			
				(1)		(2)		(3)		(4)		(5)		(6)	
				ITT	St. Err	TOT	St. Err	ITT	St. Err	TOT	St. Err	ITT	St. Err	TOT	St. Err
A. Business skills															
Has practical experience in projects	1,577	0.37	0.48	0.10***	0.02	0.17***	0.04	0.11***	0.02	0.17***	0.03	0.10***	0.02	0.17***	0.03
Knows how to produce a business plan	1,579	0.45	0.77	0.31***	0.03	0.53***	0.05	0.32***	0.03	0.52***	0.05	0.31***	0.03	0.52***	0.05
Business Plan Knowledge (composite score)	1,579	0.27	0.52	0.25***	0.03	0.42***	0.04	0.26***	0.03	0.41***	0.04	0.24***	0.02	0.41***	0.03
Business Plan Knowledge (normalized score)	1,579	0.00	0.71	0.70***	0.08	1.17***	0.11	0.72***	0.08	1.15***	0.10	0.68***	0.06	1.15***	0.08
B. Personality dimensions															
Big 5: Extraversion (normalized score)	1,580	0.00	0.11	0.10**	0.05	0.18**	0.07	0.05	0.05	0.08	0.08	0.11**	0.05	0.18**	0.08
Big 5: Agreeable (normalized score)	1,578	0.00	−0.23	−0.24***	0.05	−0.40***	0.08	−0.23***	0.05	−0.37***	0.08	−0.25***	0.04	−0.42***	0.06
Big 5: Conscientiousness (normalized score)	1,577	0.00	−0.14	−0.14**	0.05	−0.24***	0.08	−0.13**	0.06	−0.21**	0.09	−0.14***	0.04	−0.24***	0.06
Big 5: Emotionally Stable (normalized score)	1,579	0.00	−0.11	−0.11**	0.04	−0.18***	0.07	−0.07*	0.04	−0.12**	0.06	−0.12**	0.05	−0.20**	0.08
Big 5: Openness (normalized score)	1,577	0.00	−0.02	−0.03	0.04	−0.05	0.06	−0.03	0.04	−0.05	0.06	−0.04	0.04	−0.06	0.06
C. Entrepreneurial traits															
Impulsiveness (normalized score)	1,573	0.00	−0.12	−0.12**	0.05	−0.21**	0.09	−0.11	0.07	−0.18*	0.11	−0.13**	0.06	−0.22**	0.09
Passion for work (normalized score)	1,579	0.00	0.03	0.03	0.05	0.06	0.09	−0.01	0.06	−0.02	0.09	0.04	0.05	0.06	0.09
Tenacity (normalized score)	1,576	0.00	0.03	0.04	0.05	0.07	0.08	0.01	0.05	0.02	0.08	0.05	0.04	0.09	0.07
Polychronicity (normalized score)	1,577	0.00	−0.05	−0.05	0.05	−0.08	0.08	−0.03	0.05	−0.05	0.08	−0.04	0.06	−0.07	0.10
Locus of control (normalized score)	1,579	0.00	0.02	0.02	0.06	0.03	0.10	0.01	0.06	0.02	0.10	0.03	0.05	0.04	0.08
Achievement (normalized score)	1,576	0.00	0.02	0.04	0.06	0.06	0.10	−0.02	0.05	−0.03	0.08	0.04	0.04	0.07	0.06
Power Motivation (normalized score)	1,574	0.00	−0.05	−0.04	0.05	−0.07	0.09	−0.10*	0.05	−0.15*	0.08	−0.04	0.04	−0.06	0.07
Centrality of work (normalized score)	1,578	0.00	0.09	0.10*	0.05	0.16*	0.09	0.04	0.05	0.07	0.08	0.11**	0.04	0.19***	0.07
Personal organization (normalized score)	1,580	0.00	0.08	0.08	0.07	0.14	0.11	0.05	0.07	0.07	0.11	0.09	0.06	0.15	0.10
D. Aspirations toward the future															
Optimism (normalized score)	1,578	0.00	0.12	0.13***	0.04	0.21***	0.07	0.12**	0.05	0.18***	0.07	0.13***	0.04	0.22***	0.06
Days feels moving forward	1,578	3.79	4.09	0.28**	0.11	0.47***	0.17	0.23*	0.13	0.37*	0.19	0.25*	0.14	0.43*	0.25
Days thinking about how to move forward	1,578	5.62	5.87	0.23**	0.11	0.39**	0.19	0.25**	0.12	0.39**	0.19	0.21*	0.12	0.36*	0.21
Has more faith in future now than last year	1,574	0.52	0.57	0.04*	0.02	0.08*	0.04	0.05*	0.02	0.07*	0.04	0.05	0.03	0.08	0.05

Note: Same specifications as Table 3, see note therein.
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

observed changes are consistent with the fact that personality has been shown to be particularly malleable among young adults (Roberts & Mroczek, 2008). The results suggest that participants in the entrepreneurship track became more extrovert, as well as less agreeablene, conscientious, and emotionally stable. The observed changes in personality dimensions are of relatively small magnitude (0.1–0.2 standard deviations for ITT estimates). In particular, these changes are of smaller magnitude than the changes in business skills discussed above. When interpreting these findings in the context of the broader psychology and entrepreneurship literature, the observed changes in personality are qualitatively mixed. In fact, not all changes would appear to make individuals more inclined to be entrepreneurs. Indeed, meta-reviews in the psychology and business literature have suggested that entrepreneurs tend to score higher on conscientiousness, openness to experience, extraversion, and emotional stability, and lower in agreeableness (for instance, see Brandstätter, 2011; Zhao & Seibert, 2006; Zhao et al., 2010). As such, the observed increase in extraversion and decrease in agreeableness are changes likely to be conducive to entry into entrepreneurship. However, the decrease in emotional stability and conscientiousness are not. These mixed results are consistent with the limited employment impacts documented above.

We interpret the observed changes in personality as broadly consistent with the treatment group's experience in the entrepreneurship track, and in particular how that experience differed from the control group's experience with the traditional curriculum. The significant increase in extraversion means that former participants to the entrepreneurship track tend to have a stronger outward orientation and be more sociable. It is in line with some of the elements of the entrepreneurship track seeking to make students more outspoken, inviting them to reach out to a range of business professionals and more generally to expose them to experiences outside the university circles. The decrease in agreeableness means that former participants to the entrepreneurship track have a lower tendency to act in a cooperative, unselfish manner. This is also broadly consistent with aspects of the entrepreneurship track such as defending business ideas in front of professionals, applying negotiation skills, or getting immersed in a competitive business environment.

In contrast, the observed decreases in conscientiousness and emotional stability are not changes that are likely to be conducive to entrepreneurship. When analyzing changes in entrepreneurship traits following an entrepreneurship education program, Oosterbeek et al. (2010) find faster increases in entrepreneurial skills among the control group than among entrepreneurship education students. A similar effect may be at play in our context. While it cannot be formally confirmed since personality is not observed at baseline, the experience of the control group of writing an academic thesis may be relatively more effective in shaping conscientiousness or emotional stability than entrepreneurship education.

To summarize, the observed changes in personality are of smaller magnitude than the results on business skills. They are also more mixed in the sense that not all the observed changes are likely to be more conducive to entrepreneurship. We interpret these results to be consistent with the overall limited employment impacts documented above.

Panel C of Table 4 documents limited program impacts on a range of entrepreneurial traits beyond the "Big Five" personality dimensions. Results show significantly lower impulsivity, and higher centrality of work among past participants to the entrepreneurship track. Both of these changes are qualitatively more conducive to entrepreneurship (as per the discussion in De Mel et al. (2010)). However, the magnitude of changes in these entrepreneurial traits is limited (0.1 standard deviation for ITT estimates), and the results are not fully robust across specifications. All other entrepreneurial traits, including power motivation and tenacity, remain unchanged.

The identification of program impacts on personality dimensions but not on entrepreneurial traits deserves a discussion. The entrepreneurial traits included in the study do not necessarily map into the broader personality dimensions: the observed changes in personality are not expected to be the sum of some observed impacts on entrepreneurial traits. This is a broader issue in the entrepreneurship literature, where many potentially relevant entrepreneurial traits are cited (e.g., Rauch & Frese, 2007). It is not always evident how various entrepreneurial traits map to each other, how to prioritize them, and how they contribute to personality dimensions. In addition, it is a subject of debate whether analysis should focus on personality or on more specific entrepreneurial traits. Some argue that analyzing higher order dimensions is preferable. Zhao and Seibert (2006) note that it is an empirical question whether lower order traits provide useful information beyond the personality dimensions. In contrast, Rauch and Frese (2007) or Frese and Gielnik (2014) have shown that a range of specific entrepreneurial traits correlate with entrepreneurship outcomes, and favor analyzing changes in specific traits. Caliendo et al. (2014) find that both personality dimensions and specific entrepreneurial traits are associated with entry into self-employment.

Overall, our results are qualitatively similar to Oosterbeek et al. (2010), who also do not find impacts of entrepreneurship education on entrepreneurial traits. The fact that entrepreneurial traits are unaffected may suggest that the program was not precise enough in targeting specific changes in behavioral skills that are most relevant for entrepreneurship. Entrepreneurship education programs may need to be better grounded in psychological theory to outline more clearly the specific personality dimensions or entrepreneurial traits they seek to target, and how they intend to do so.

(c) Aspirations toward the future

Although the results on employment outcomes and skills are mixed, Table 4 (Panel D) shows some consistent positive impacts on graduates' aspirations toward the future. Participants report being much more optimistic, more likely to feel like they are moving forward in life, or thinking about how to move forward in life. Students assigned to the entrepreneurship track also reveal having relatively more faith in the future compared to graduates from the control group. These results are robust and are consistent across a range of different indicators measured independently, including an "optimism" sub-scale composed of six different questions (as in De Mel et al., 2010). Overall, these results offer strong evidence that program participants perceived a heightened sense of opportunities for the future. These results contrast with some previous evaluations of entrepreneurship education that have not found similar effects (for instance Oosterbeek et al., 2010).

(d) Other potential mechanisms

Finally, Table 7 in the appendix contains a range of ancillary results documenting impacts on other intermediary outcomes. There are several interesting findings. First, no impacts are observed on preference parameters such as risk or time-preference. In contrast to skills, preference parameters are stable and are not affected by the intervention. Second,

while the entrepreneurship track contributed to expand networks, participants' business networks are not very active. Third, there is no direct evidence that the intervention alleviated credit constraints.

8. CONCLUSION

This paper relies on randomized assignment to measure impacts of the introduction of a track providing entrepreneurship education in Tunisian universities. This new track offered business training and personalized coaching for students to develop a business plan for a project of their choice. Students in this track had the option to graduate with a business plan instead of a traditional thesis. We evaluate the impact of randomized assignment to the entrepreneurship track on employment outcomes. We also assess changes in intermediary outcomes such as business skills, personality dimensions, entrepreneurial traits, as well as aspirations toward the future.

We find that assignment of university students to the entrepreneurship track led to a small increase in self-employment among graduates approximately one year after graduation. The effects are small in absolute terms, ranging from 1 to 4 percentage points in the probability of being self-employed. Given the low prevalence of self-employment in the control group, these small absolute effects imply that beneficiaries of the program were on average 46–87% more likely to be self-employed compared with graduates from the control group. However, the intervention did not increase the overall employment rate among beneficiaries. These results suggest a substitution from wage employment to self-employment, similar to findings in Fairlie *et al.* (2015) in the U.S. They are also consistent with findings that private sector reservation wages are higher among participants in the entrepreneurship track.

We also shed light on the changes in skills that underlie the employment results. The program improved business skills, but had mixed impacts on personality and little effects on entrepreneurial traits. Overall, these contribute to explain the limited employment impacts found. Nevertheless, the program did lead to positive impacts on graduates' aspirations toward the future. Given this, additional research on potential long-term effects of the entrepreneurship track could explore the possibility that some employment impacts may take longer to materialize.

While the evaluation design does not allow us to formally disentangle the effects of the entrepreneurship track (business training and personalized coaching) from the start-up capital offered to winners of the business plan competition, we interpret the results as being mainly driven by participation in the entrepreneurship track (training and coaching) and to the business skills developed. Indeed, few winners cashed the monetary prize and most participants still report lack of access to credit as the main remaining constraint to entry into self-employment.

The findings in this paper have thus several important policy implications. First, our results suggest limited effectiveness of entrepreneurship education and training offered to university students with relatively little screening or targeting. Second, the results highlight potential trade-offs in designing programs aiming to foster self-employment and those geared toward facilitating access to wage employment. Finally, the mixed results on personality and entrepreneurial traits are consistent with the overall limited employment impacts. Entrepreneurship education programs may benefit from a clearer definition of which specific skills or entrepreneurial traits they seek to improve, along with a more comprehensive articulation of how changes in skills are expected to lead to employment outcomes.

NOTES

1. Most existing studies on entrepreneurship education also face methodological issues since they are based on quasi-experimental data and have limited external validity given they tend to use data from just a few schools.

2. Source: EduStats.

3. Source: Tunisia Labor Force Surveys.

4. This included the following universities: Ez-Zitouna, Jendouba, Gabès, Gafsa, Tunis, Kairouan, Mannouba, Monastir, Carthage, Sfax, Sousse, Tunis, and Tunis El-Manar.

5. The training lasted on average 6 hours a day, for a total of approximately 120 hours.

6. University professors played an instrumental role in informing students about the program. 84% of all applicants heard about the program through professors, 39% from posters, and 17% from other students, friends, and relatives.

7. Application to the entrepreneurship track was particularly high in regions with the highest unemployment.

8. The fourteen groups of subjects were: Economics and Finance; Accounting; Business Administration; Marketing; Humanities; Languages; Sciences; Technical; Telecommunication; Civil Engineering; IT; Sports and Tourism; Food/Agriculture, and Other.

9. Table 2 is presented for the effective sample used for estimations and composed of the 1,580 students that could be tracked at follow-up. Results are almost identical when using the full baseline sample of 1,702 students. Table 5 in the appendix presents differences in treatment and control groups for several other characteristics.

10. Detailed contact information was collected in the baseline surveys. Most students register at employment offices upon graduation, and contact information (phone numbers and address) from the employment office database was also collected and merged with the data.

11. The attrition rate is lower than in other similar surveys. For instance, the attrition rate for the 2005 Tunisia graduate tracer survey was 11%. Oosterbeek et al. (2010) have an attrition rate of 56% in their study of entrepreneurship education for university students in the Netherlands.

12. Attrition in the full baseline sample was 7.2% at follow-up. At baseline, 10.1% of applicants could not be reached for the complementary phone survey conducted in January and February 2010. Combined attrition in either this baseline phone survey or the follow-up survey

collected in 2011 is 15.9%. Attrition in both surveys was 1.4%. All of these attrition indicators were balanced across treatment and comparison groups.

13. We include a binary variable for each randomization strata to increase power (Bruhn & McKenzie, 2009).

14. The controls include unbalanced variables from the baseline application form, such as age at first job, previous experience in self-employment, prior experience with projects, prior experience in helping an entrepreneur, and mother's employment status.

15. In particular, these include patience, willingness to take risk, impulsiveness, tenacity, and sense of achievement.

16. As mentioned in Section 4, while the baseline survey included a mix of administrative data and phone interviews, the follow-up survey was conducted face to face. The empirical strategy also relies on randomized assignment and identifies program impacts through first-difference in outcomes at follow-up (measured face to face). Specification I and III includes control variables from the baseline administrative forms. Specification II includes some controls from the complementary baseline survey done by phone. Results from these various specifications are robust. In addition, results are also robust by taking first-difference only without any baseline control variables (this specification is not presented given the preferred specification includes baseline controls as mentioned above). Taken together, the identification strategy based on randomized assignment along with the robustness of the results suggests that having various sources of baseline data is not a cause of concern.

17. Results are very similar when compliance is defined as completing the business training only (not presented here).

18. The indicators on project ownership and employment status do not fully match, and as such it is useful to consider the robustness of results across these two indicators.

19. Project owners that report seasonal employment have activities in sectors such as agriculture, construction, craft productions, or other services where businesses may not operate year-round.

20. All these indicators are based on a 7-day recall period, consistent with official ILO definitions used in Tunisia.

21. This is in line with the low rate of self-employment among university-educated in Tunisia in general. Among 25–34-year old with a university degree, 4.6% were classified as independent workers and 5.6% as employers according to the Labor Force Survey of 2010.

22. These results are comparable with data from a tracer survey of university graduates from the class of 2004, which found that 46% of graduates were still unemployed 18 months after graduation (MFPE & World Bank, 2009).

23. Conditional on being wage-employed the results suggest that program beneficiaries hold slightly better quality jobs, as they were more likely to have full-time contracts, and less likely to be supported by a wage-subsidy (*stages d'Initiation à la Vie Professionnelle* "SIVP"), but more likely to hold term contracts (*contrats à durée déterminée* "CDD") (results not presented here).

24. Consistent with a higher reservation wage for private sector jobs, individuals in the treatment group are more likely to state having rejected a job offer because the salary is too low (result not presented here).

25. Respondents were asked questions about the components of a business plan (such as a supply assessment or a marketing plan), based on which a composite knowledge score was created.

26. In contrast, some business skills training programs target much more well-defined and specific entrepreneurial trait. For instance, Glaub *et al.* (2014) focus on 'personal initiative'.

27. The TIPI scale was designed to measure broad dimensions of personality. In large-scale surveys, it is typically not possible to use extensive measures of the "Big Five" personality dimensions – including extensive instruments that also provide measurement of specific facets within each big five dimension. The TIPI scale is based on polar factors within each dimension. Given the way the scale was constructed, correlation between items within a dimension is not sufficiently informative to establish its statistical properties (Gosling *et al.*, 2003; Woods & Hampson, 2005). Gosling *et al.* (2003) argue that test–retest analysis is the most appropriate approach to establish validity of the scale. They show that, while the scale has somewhat diminished psychometric properties compared to longer scales, it displays substantial convergence, substantial test–retest reliability, and expected patterns of external correlations. Credé, Harms, Niehorster, and Gaye-Valentine (2012) discuss the psychometric limitations of short measures in more details. Cultural variations in personality dimensions also remain an active field of research. The TIPI scale was used in the study in light of the large-scale coverage of the survey, as well as its scope.

28. As for the TIPI scale of personality dimensions, entrepreneurial traits are observed through brief measures based on a few items. Similar limitations as those highlighted in the previous note apply. The measures of entrepreneurial traits were based on De Mel *et al.* (2010) since it was considered the most closely related to our study at the time of designing the baseline instrument.

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APPENDIX A

Table 5. *Baseline balance for effective sample (excluding attritors at follow-up) (continuation of Table 2)*

Variables from application form	N	Mean control	Mean treatment	Difference ($T - C$)	St. Err. for difference
Subject: Food/Agriculture	1,580	0.02	0.02	0.00	0.00
Subject: Humanities	1,580	0.16	0.17	0.01	0.01
Subject: Sciences	1,580	0.09	0.09	−0.00	0.01
Subject: Accounting	1,580	0.09	0.09	−0.01	0.01
Subject: Economics and Finance	1,580	0.08	0.08	−0.00	0.00
Subject: Civil Engineering	1,580	0.02	0.02	0.00	0.01
Subject: IT	1,580	0.10	0.10	−0.00	0.00
Subject: Telecommunication	1,580	0.06	0.05	−0.00	0.00
Subject: Languages	1,580	0.09	0.09	0.00	0.00
Subject: Business Administration	1,580	0.03	0.03	0.00	0.00
Subject: Marketing	1,580	0.04	0.04	0.01	0.01
Subject: Sports and Tourism	1,580	0.03	0.03	−0.00	0.00
Subject: Technical	1,580	0.15	0.15	0.00	0.00
Subject: Others	1,580	0.03	0.03	−0.00	0.00
University Ez-Zitouna	1,580	0.00	0.01	0.00	0.00
University of Tunis	1,580	0.03	0.04	0.00	0.01
University of Sousse	1,580	0.08	0.08	−0.00	0.02
University of Monastir	1,580	0.19	0.18	−0.01	0.02
University of Kairouan	1,580	0.07	0.07	0.00	0.01
University of Sfax	1,580	0.16	0.16	−0.00	0.02
University of Gafsa	1,580	0.18	0.19	0.02	0.01
University of Gabes	1,580	0.07	0.06	−0.01	0.01
University of Manouba	1,580	0.01	0.00	−0.01	0.01
University of Tunis El-Manar	1,580	0.01	0.01	−0.00	0.01
University of Carthage	1,580	0.07	0.07	0.00	0.01
University of Jendouba	1,580	0.13	0.13	0.00	0.02
Father has primary education	1,580	0.41	0.45	0.03[*]	0.02
Father has secondary education	1,580	0.43	0.39	−0.03	0.02
Father has tertiary education	1,580	0.16	0.16	−0.00	0.02
Mother has primary education	1,580	0.66	0.67	0.01	0.03
Mother has secondary education	1,580	0.28	0.27	−0.01	0.03
Mother has tertiary education	1,580	0.06	0.06	−0.00	0.01
Father is salaried worker	1,580	0.36	0.34	−0.02	0.02
Father is self-employed	1,580	0.27	0.27	0.00	0.02
Father is retired	1,580	0.25	0.26	0.01	0.01
Father is unemployed	1,580	0.02	0.02	0.00	0.01
Mother is salaried worker	1,580	0.09	0.09	−0.00	0.02
Mother is self-employed	1,580	0.07	0.08	0.02	0.01
Mother is retired	1,580	0.02	0.03	0.02	0.01
Mother is unemployed	1,580	0.03	0.04	0.01	0.01
Baccalaureate: Humanities	1,432	0.24	0.23	−0.01	0.01
Baccalaureate: Economics	1,432	0.19	0.18	−0.01	0.02
Baccalaureate: Sciences	1,432	0.23	0.25	0.02	0.02
Baccalaureate: Math	1,432	0.19	0.20	0.01	0.02
Baccalaureate: Technical	1,432	0.15	0.13	−0.02	0.02

Results reported: number of observations in survey; mean of treatment and control groups at baseline; difference between the two; and standard errors for difference between treatment and control group. Results for effective sample for estimation (excluding attritors at follow-up). Effective sample is 1,580 for variables in the baseline application form, and 1,432 for the baseline phone survey (due to the combined attrition in the baseline phone survey and the follow-up survey).
[*]Significant at 10%.
[**]Significant at 5%.
[***]Significant at 1%.

Table 6. *Compliance with assignment to entrepreneurship track (marginal effects)*

	Training completion		Training and coaching completion	
	(1)	(2)	(3)	(4)
Unemployment rate in governorate	0.01*	0.00	0.01*	−0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Diploma: Economics, Finance, Business	−0.16*	−0.20*	−0.18*	−0.18*
	(0.04)	(0.05)	(0.04)	(0.05)
Male	−0.09**	−0.08**	−0.11*	−0.10**
	(0.04)	(0.04)	(0.04)	(0.04)
Applied in pair	0.12*	0.12*	0.06	0.06
	(0.04)	(0.04)	(0.04)	(0.04)
Had a project idea	0.09***	0.12**	0.05	0.09***
	(0.05)	(0.05)	(0.05)	(0.05)
Family can provide financial support	0.13*	0.06	0.17*	0.01
	(0.04)	(0.04)	(0.04)	(0.05)
Is willing to take risk	0.01	0.03	0.01	0.03
	(0.07)	(0.07)	(0.07)	(0.08)
Preference for stable salary	−0.01	−0.00	−0.01	0.02
	(0.04)	(0.04)	(0.04)	(0.05)
Household income 301–500 TND (ref = <300 TND)	0.06	0.07	0.03	0.04
	(0.04)	(0.04)	(0.05)	(0.05)
Household income 501–800 TND	0.07	0.09***	0.05	0.06
	(0.05)	(0.05)	(0.05)	(0.06)
Household income > 800 TND	−0.02	0.02	−0.06	−0.02
	(0.05)	(0.05)	(0.05)	(0.05)
University of Sousse (ref = Tunis)		0.02		0.20*
		(0.07)		(0.06)
University of Monastir		−0.01		0.20*
		(0.06)		(0.05)
University of Kairouan		0.11***		0.25*
		(0.06)		(0.05)
University of Sfax		−0.22*		−0.19*
		(0.07)		(0.07)
University of Gafsa		0.12***		0.29*
		(0.07)		(0.06)
University of Gabes		−0.09		−0.07
		(0.09)		(0.09)
University of Jendouba		0.15**		0.15**
		(0.06)		(0.07)
Number of observations	856	856	856	856
R^2	0.063	0.093	0.0611	0.1184

* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

Table 7. *Ancillary results (intermediary impacts on preferences, networks and access to credit)*

	N	C	T	Specification I				Specification II				Specification III			
				(1)		(2)		(3)		(4)		(5)		(6)	
				ITT	St. Err	TOT	St. Err	ITT	St. Err	TOT	St. Err	ITT	St. Err	TOT	St. Err
A. Preferences															
Willingness to take risk (0–10)	1,575	6.06	6.10	−0.02	0.14	−0.03	0.24	−0.04	0.14	−0.06	0.21	−0.02	0.10	−0.03	0.16
Certainty equivalent for lottery with 50% chance of winning 0 and 50% chance of winning 2000DT	1,556	674.44	694.33	16.21	19.53	27.43	31.83	−2.89	17.97	−4.62	27.78	14.32	18.95	24.34	31.71
Risk taker	1,556	0.18	0.18	−0.01	0.02	−0.01	0.03	−0.02	0.02	−0.03	0.03	−0.01	0.02	−0.02	0.03
Patience	1,577	0.27	0.29	0.02	0.02	0.03	0.04	0.00	0.02	0.00	0.03	0.02	0.02	0.03	0.03
B. Networks															
Registered at Employment Office	1,702	0.78	0.82	0.04	0.02	0.07*	0.04	0.04	0.02	0.06*	0.03	0.03*	0.02	0.06*	0.03
Knows an employment agent	1,580	0.14	0.28	0.13***	0.02	0.22***	0.03	0.15***	0.02	0.23***	0.03	0.13***	0.02	0.22***	0.03
Number of times spoke to employment agent in last month	329	2.26	1.83	−0.31	0.39	−0.42	0.47	−0.14	0.30	−0.18	0.36	−0.32	0.49	−0.43	0.60
Knows an entrepreneur	1,580	0.44	0.49	0.05*	0.02	0.08*	0.04	0.04	0.03	0.06	0.04	0.05**	0.02	0.08***	0.03
Number of times spoke to entrepreneur in last month	726	5.05	5.11	−0.01	0.65	−0.01	0.98	0.08	0.66	0.12	0.97	0.04	0.77	0.07	1.17
Knows a banker	1,580	0.25	0.31	0.06***	0.02	0.09***	0.03	0.06**	0.02	0.09***	0.03	0.06**	0.03	0.10***	0.04
Number of times spoke to a banker in last month	440	2.44	3.67	1.16**	0.53	2.00**	0.88	0.77	0.56	1.25	0.83	1.29*	0.74	2.27*	1.29
C. Access to credit															
Knows how to apply for credit	1,580	0.20	0.22	0.02	0.02	0.03	0.03	0.02	0.02	0.04	0.03	0.02	0.02	0.03	0.03
Expect to be able to obtain credit	1,568	0.30	0.39	0.08**	0.04	0.14**	0.06	0.09**	0.04	0.14**	0.06	0.09***	0.02	0.15***	0.03
Has applied for credit	1,580	0.04	0.08	0.04**	0.02	0.06**	0.02	0.05***	0.02	0.07***	0.02	0.04*	0.02	0.06*	0.03
Has obtained credit	1,580	0.003	0.004	0.001	0.001	0.002	0.002	0.001	0.001	0.002	0.002	0.001	0.002	0.002	0.003

Note: Number of observations, average for control group, average for treatment group, intent-to-treat (ITT) estimates, standard error for ITT estimates, treatment-on-the-treated (TOT) estimates for completing entrepreneurship training and attending coaching sessions, standard errors for TOT estimates. Standard errors clustered by strata in specification I and II, by governorate in specification III. Estimates are obtained separately for each outcome and each specification. In all specifications controls include strata fixed-effects (by gender and subject), as well as a set of control variables from the baseline application form, including age at first job, previous experience in self-employment, prior experience with projects, prior experience in helping an entrepreneur and mother's employment status. Controls in specification II also include a range of baseline skills of the respondents (patience, willingness to take risk, impulsiveness, tenacity and sense of achievement). Sample size for Specification I and II: $N = 1,580$. Sample Size for Specification III: $N = 1,432$ (due to attrition in baseline phone survey).
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.