How to Educate Entrepreneurs?

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Abstract

Entrepreneurship education has two purposes: To improve students' entrepreneurial skills and to provide impetus to those suited to entrepreneurship while discouraging the rest. While entrepreneurship education helps students to make a vocational decision its effects may conflict for those not suited to entrepreneurship. This study shows that vocational and the skill formation effects of entrepreneurship education can be identified empirically by drawing on the Theory of Planned Behavior. This is embedded in a structural equation model which we estimate and test using a robust 2SLS estimator. We find that the attitudinal factors posited by the Theory of Planned Behavior are positively correlated with students' entrepreneurial intentions. While conflicting effects of vocational and skill directed course content are observed in some individuals, overall these types of content are complements. This finding contradicts previous results in the literature. We reconcile the conflicting findings and discuss implications for the design of entrepreneurship courses.

JEL: L11, L13, O34

Keywords: Entrepreneurship education, entrepreneurial intention, Theory of Planned Behavior, structural equation models, two stage least squares.

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1 Introduction

Entrepreneurship education is a widespread component of school and university education (Martínez et al., 2010). It is supposed to increase the flow of entrepreneurs (Kuratko, 2005) who are seen as an important source of growth (Sheshinski et al., 2007). However, the real effects of entrepreneurship education on economic growth are most likely more complex than this suggests. For instance, while two recent papers which study entrepreneurship courses at universities find these reduced students' entrepreneurial intentions on average (Oosterbeek et al., 2010; von Graevenitz et al., 2010), this is not always true (Souitaris et al., 2007). von Graevenitz et al. (2010) also show that entrepreneurship education provides students with signals about their entrepreneurial ability, resulting in sorting. Some students learn that they are suited to entrepreneurship, others that they are not. This sorting function of entrepreneurship education matters because more entrepreneurs do not raise growth, contrary to what is sometimes argued (Shane, 2009). Rather, the pursuit of high quality entrepreneurial ventures can raise growth.

While sorting explains how entrepreneurship education may reduce average entrepreneurial intentions in a group of students, the ways in which entrepreneurship education affects students' entrepreneurial intentions remain unclear. This is true of the effects of education more generally: Oreopoulos and Salvanes (2011) argue that the non-pecuniary effects of education have been neglected in economics[1] while Gage (2009) notes that effects of course content are widely neglected by scholars of education. Although the literature on entrepreneurship education does address the effects of different kinds of content (Souitaris et al., 2007; Fitzsimmons and Douglas, 2010) it does not use consistent terminology or methodology and has produced conflicting results.

This study distinguishes two kinds of content provided in entrepreneurship courses: vocational content and content that forms entrepreneurial skills[2]. The effects of both types of content are identified empirically. It is shown that both contribute to the formation of entrepreneurial intentions and also that they are weak complements. This last finding is in contrast to the results of Fitzsimmons and Douglas (2010). We reconcile this apparent conflict as well as the conflicting evidence on average entrepreneurial intentions by drawing on the distinction between vocational and skill directed content as well as evidence on sorting of students resulting from entrepreneurship education.

We find that entrepreneurship education increases perceived entrepreneurship skills (e.g. business plan writing) and it helps in the discovery and appraisal of entrepreneurship as a vocation. These two effects may conflict for students who do not perceive entrepreneurship to be desirable: better skills make students more confident, raising intentions. A significant proportion of students will also recognize that they do not perceive entrepreneurship to be desirable creating a countervailing effect.

Should this conflict of effects be reflected in the design of entrepreneurship courses? For instance entry level courses could focus only on desirability[3], promoting sorting. In this paper we show that entrepreneurship skills should not be removed from entry level courses. However, entrepreneurship education focusing initially on the vocational decision to promote sorting will be more effective than

[1] For rare exceptions refer to Brown and Corcoran (1997) and Allgood et al. (2010) who provide evidence that course content affects both pecuniary and non-pecuniary outcomes of education. Additionally, Akerlof and Kranton (2002) and Bishop (2006) study participation decisions and the process of identity formation in education.

[2] A similar dichotomy of content may apply in many educational settings although it is likely that the vocational element of entrepreneurship education is particularly pronounced.

[3] This is suggested by as a general strategy by Souitaris et al. (2007)

education placing strong emphasis on skills from the outset. Also initial courses should be mandatory and follow on courses should be voluntary.

To show this we draw on the Theory of Planned Behavior (TPB) (Ajzen, 1991; Fishbein and Ajzen, 2010). It identifies three distinct attitudinal factors that affect a person's intentions: perceptions of the desirability of an action for that person, of the social norms regarding that action and of the degree of behavioral control the person has in undertaking the action. Each of these attitudes may change in response to content taught in entrepreneurship courses. Perceptions of behavioral control are affected by content focusing on the skills needed by an entrepreneur[4]. Perceptions of the desirability of entrepreneurship and social norms surrounding it will respond more to content dealing with the practice and experiences of actual entrepreneurs, often referred to as "war stories"[5].

To identify how the two aspects of entrepreneurship education affect intentions we apply a structural equation model to the theory. The literature on the TPB provides a well grounded set of items with which we are able to measure the attitudinal factors posited by the theory. Responses to these items were elicited in two surveys before and after a mandatory entrepreneurship course at the undergraduate level. By applying a structural equation model we can separately identify the effects of each latent attitudinal factor posited by the TPB on entrepreneurial intentions.

We estimate the structural model using an instrumental variables estimator as suggested by Bollen (1996). In contrast to the usual full information maximum likelihood estimators applied to structural equation models Bollen's estimation approach is more robust to misspecification of the structural model. Applying the estimator we find that it is possible to identify the effects of perceived behavioral control and effects of perceived desirability and social norms on entrepreneurship education. Further we show that these different kinds of content have different effects: teaching skills raises entrepreneurial intentions of almost all students while teaching focusing on the motivation and experience of entrepreneurs increases sorting of students. We find that few students report strongly conflicting influences of the two types of content. In fact a complementarity of the two types of course content is found when we extend the latent variable model to include interaction terms.

2 Theoretical Background

Many researchers see entrepreneurship as intentionally planned behavior (Shapero and Sokol, 1982; Bird, 1988). For this reason intentions-based models from social psychology are often employed in entrepreneurship research to predict entrepreneurial activity. These models also provide a promising framework for the evaluation of entrepreneurship education. In this section we discuss the Theory of Planned Behavior (Ajzen, 1985, 1991; Fishbein and Ajzen, 2010) and its application to studying effects of different kinds of content in entrepreneurship courses.

Entrepreneurship as Intentionally Planned Behavior Early entrepreneurship research tried to distinguish entrepreneurs from non-entrepreneurs by means of personality traits (Brockhaus, 1980). Among others these traits included the need for achievement, risk-taking propensity, locus of control, and need

[4] Anderson and Krathwohl (2001) classify these as factual, conceptual and procedural knowledge.

[5] This may fall partly into the domain of meta-cognitive knowledge as defined by Anderson and Krathwohl (2001). However, it seems more fitting to state that the course schools students' "interpersonal intelligences" (Gardner, 1983), i.e. their ability to understand others' desires, intentions and motivations.

for autonomy. This approach has been heavily criticized both for its methodological weaknesses (there are only few instruments for specifically measuring entrepreneurial affinity) and its low explanatory capacity, often also resulting in contradictory findings (Gartner, 1988; Robinson et al., 1991; Krueger et al., 2000). Therefore, personality traits alone are only weak predictors of entrepreneurial activity, the more so as they measure more general tendencies - they loose their efficacy when employed in specific areas like entrepreneurship (Krueger and Carsrud, 1993).

Research in social psychology shows that intentions are the single best predictor of every planned behavior, even when this behavior is rare, hard to observe or can only be observed with a significant time lag (Bagozzi and Yi, 1989; Ajzen, 1991). According to Bird (1988) (p. 442), "intentionality is a state of mind directing a person's attention (and therefore experience and action) toward a specific object (goal) or path in order to achieve something (means)".

Intentions predict actual behavior, while specific attitudes influence intentions. Individuals' attitudes arise from "exogenous influences" (Ajzen, 1987), such as personality traits, demographic and situational variables (Ajzen, 1991) or role models (Scherer et al., 1989). The attitude-intention model integrates the trait approach and also provides an explanation for its unsatisfying results: traits influence intentions (or behavior) only indirectly through the specific attitudes, either by strengthening or weakening the focal individual's attitudes. Both intentions and attitudes are based on individual perceptions, which may be influenced (Ajzen, 1991). That is why intentions vary among individuals (Krueger et al., 2000). So behavioral or intentions-based approaches describe how exogenous influences affect individual attitudes, and indirectly intentions, potentially altering actual behavior (Fishbein and Ajzen, 2010).

The Theory of Planned Behavior The social psychology literature on intentions is dominated by models derived from the TPB (Ajzen, 1985, 1991; Fishbein and Ajzen, 2010). According to the TPB, the intention to perform a behavior derives from three attitudinal factors: perceived desirability, perceived social norms and perceived behavioral control.

Perceived Desirability[6] derives from the individual's positive or negative evaluation of the outcome when exercising the behavior in question. It depends on information-based convictions, i.e. the probability of a positive or negative consequence of the execution of the behavior. Regarding entrepreneurship, this factor reflects the difference in the (after consideration of the available information) evaluations of being self-employed or organizationally employed.

Perceived Social Norms mirrors the perceived social pressure to perform the behavior in question or not. It depends on the normative convictions regarding the expectations of the focal individual's important persons and her motive to comply with them. Regarding entrepreneurship, this factor indicates the perceived pressure from other people to enter an entrepreneurial career or not.

Perceived Behavioral Control reflects the subjective perception of the ability to perform the behavior in question. It depends on the total set of accessible control beliefs, i.e., beliefs about the presence of factors that may facilitate or impede performance of the behavior. This factor overlaps with Bandura's "perceived self-efficacy" (Bandura, 1977).

The TPB has been used to predict entrepreneurial behavior (Kolvereid, 1996a; Krueger et al., 2000; Kolvereid and Isaksen, 2006). Recently the theory has been employed in evaluations of entrepreneurship education (Fayolle et al., 2006; Souitaris et al., 2007). Building on the TPB Souitaris et al. (2007)

[6] In the literature, this factor is also often called "Attitude towards behavior"

distinguish effects of entrepreneurship education on learning, inspiration and resource-utilisation. Using a pretest-post-test quasi-experiment they find support only for the effect of inspiration on norms and on intentions[7]. Their empirical results rely on the use of scales in OLS regressions. This reduced form approach does not allow them to test how well individual items contained in their scales reflect the underlying constructs. They also do no estimate a latent variable model to test the Theory of Planned behavior. A similar methodology is employed by Fitzsimmons and Douglas (2010) who distinguish between perceived feasibility and perceived desirability leaving social norms aside.

In contrast to this methodology Liñán (2008) estimates a structural equation model of the TPB using Partial Least Squares. His results indicate that all three attitudinal factors posited by the TPB affect entrepreneurial intentions. In contrast to all other studies he finds that perceived behavioral control is a stronger influence on intentions than perceived desirability. No direct effect of perceived social norms on intentions is hypothesized or tested. The author does not test the structural model estimated against possible alternative models, rather individual pathways within the model are tested.

These papers share the distinction between the skill (learning or perceived feasibility) component of entrepreneurship education and the vocational components (inspiration or perceived desirability). Only one paper (Liñán, 2008) also studies the effect of social norms on entrepreneurial intentions. Two empirical contradictions emerge from these studies: Souitaris et al. (2007) show that entrepreneurial intentions increased on average as a result of entrepreneurship education[8], something the other two studies could not measure as they did not apply a pre-post design. The finding contrasts with results of Oosterbeek et al. (2010) and von Graevenitz et al. (2010). Also, Fitzsimmons and Douglas (2010) allow for the interaction of vocational and skill directed course content in determining students' intentions. They find the two types of content to be substitutes. This result contrasts with our findings below.

3 A Structural Equation Model of Planned Behavior

The TPB posits three attitudinal factors which jointly determine intentions. In this section we develop a structural equation model which encompasses the TPB and discuss how this model is estimated below.

Deriving the Structural Equation Model The TPB provides this latent variable model:

$$\triangle\eta = \alpha_L + \gamma_C \triangle\xi_C + \gamma_N \triangle\xi_N + \gamma_D \triangle\xi_D + \zeta \quad . \tag{1}$$

The latent dependent variable $\triangle\eta$ is the change in entrepreneurial intention which is brought about by an entrepreneurship course. Intention is a function of three latent exogenous variables: *perceived behavioral control* (ξ_C), *perceived social norms* (ξ_N) and *perceived desirability* (ξ_D). Accordingly, the change in intention is a function of changes in the three attitudinal factors as set out in Equation (1). Here ζ is a random disturbance with $E(\zeta) = 0$ and $Cov(\zeta\zeta') = 0$. Equation (1) presents a standard latent variable model for a structural equation model (Bollen, 1996).

This latent variable model is complemented by a measurement model. The measurement model sets out how the latent variables are reflected in responses to a set of items elicited from students using a

[7] The vocational course contents have strongest effects on intentions in this study too.

[8] It is not clear that selection bias can be excluded as an explanation for their finding.

survey. The measurement model consists of the following measurement equations:

$$
\begin{aligned}
\triangle x_{1C} = &\quad \triangle\xi_C + \boldsymbol{\kappa}'_{1C}\boldsymbol{C}_{1C} + \delta_{1C} \\
\triangle x_{1N} = &\quad \triangle\xi_N + \boldsymbol{\kappa}'_{1N}\boldsymbol{C}_{1N} + \delta_{1N} \\
\triangle x_{1D} = &\quad \triangle\xi_D + \boldsymbol{\kappa}'_{1D}\boldsymbol{C}_{1D} + \delta_{1D} \\
\triangle x_{2C} = &\ \tau_{2C} + \lambda_{2C}\triangle\xi_C + \boldsymbol{\kappa}'_{2C}\boldsymbol{C}_{2C} + \delta_{2C} \\
\triangle x_{2N} = &\ \tau_{2N} + \lambda_{2N}\triangle\xi_N + \boldsymbol{\kappa}'_{2N}\boldsymbol{C}_{2N} + \delta_{2N} \\
\triangle x_{2D} = &\ \tau_{2D} + \lambda_{2D}\triangle\xi_D + \boldsymbol{\kappa}'_{2D}\boldsymbol{C}_{2D} + \delta_{2D} \\
&\ \vdots \\
\triangle y = &\quad \triangle\eta + \boldsymbol{\kappa}'_{L}\boldsymbol{W} + \epsilon \qquad .
\end{aligned}
\tag{2}
$$

For each of the three exogenous latent variables we have a number of indicator variables (x_{kK}) where $k \in [1, 6]$ and $K \in \{C, N, D\}$ which are determined by the corresponding latent variable. The first set of these measurement equations is used to scale the latent variables as proposed by Bollen (1996). Note that y is an effect indicator of entrepreneurial intention. The change in this indicator is determined jointly by the change in entrepreneurial intention and by a vector of control variables $(\boldsymbol{W})$. This contains the Big Five personality domains, students' gender and prior interest in entrepreneurship.

This measurement model implies that the latent exogenous variables are reflective constructs which determine the indicator variables (x_{kK}) (Bollen et al., 2008). We have introduced the possibility that responses to each item are also affected by a vector of control variables $(\boldsymbol{C}_{kK})$ that include measures of personality as well as peer effects.

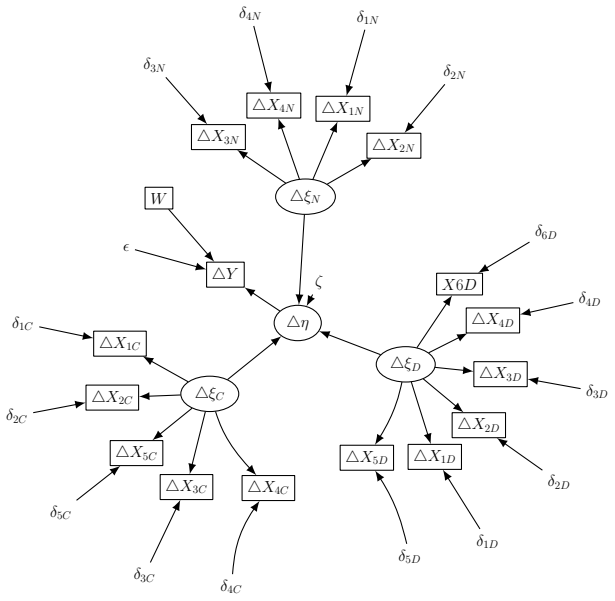

Figure 1: Path Diagram of the Idealized Structural Equation Model
Note: This figure shows the first differenced structural equation model presented in this section. Variables presented in circles are latent variables: η - entrepreneurial intention and ξ_D perceived desirability, ξ_N perceived social norms, ξ_C perceived behavioral control. Variables in squares are observed items, e.g. X_{10} or exogenous variables, e.g. W. All remaining variables are i.i.d. error terms, e.g. ϵ or δ_1. We exclude control variables for the measurement model in order not to clutter the graph.

The structural model discussed here can be represented in a path diagram. In Figure 1 we set out the

causal relationships (arrows) between effect variables, latent variables and items in levels. The structural model presented above is derived by differencing observations of each of these variables to take account of the changes brought about the entrepreneurship course we study. Figure 1 depicts causal relationships between latent variables (depicted in round circles) as well as relationships between these latent variables and the measurable items (depicted in squares) that reflect these latent variables. The figure also clarifies that each measurement of a latent variable by an item is affected by statistical errors (δ_i).

It is important to note that this path diagram and the measurement model present an idealized version of the TPB. It is quite likely that some of the items included in the survey reflect more than one of the latent variables. In the path diagram this would mean that arrows are missing which connect the latent variables to those additional items that also reflect them. We allow for this possibility when estimating the measurement model but abstract from it in Figure 1 above.

Estimating the Latent Variable Model By inverting the scaling equations from the measurement model and replacing the latent variables with their analogs we can rewrite the latent variable model as follows (Bollen, 1996; Kirby and Bollen, 2009; Bollen et al., 2008):

$$\triangle y = \alpha_L + \sum_{K \in \{C,N,D\}} \gamma_K \left(\triangle x_{1K} - \boldsymbol{\kappa}'_{1K} \triangle \boldsymbol{C}_{1K} \right) + \boldsymbol{\kappa}'_L \boldsymbol{W} + \zeta + \epsilon - \sum_{K \in \{C,N,D\}} \gamma_K \delta_{1K} \, . \qquad (3)$$

This equation cannot be estimated by OLS as the scaling items (x_{1K}) are correlated with the error terms if the scaling items are measured with error (Bollen, 1996). To estimate the model by 2SLS we have to find suitable instruments for the endogenous indicator variables. Bollen (1996) argues that we may use the remaining indicator variables from the measurement model as instruments if their error terms are not correlated with δ_{1K}. These variables are referred to as the "model implied instrumental variables".

Estimating the Measurement Model The structural equation model including the measurement model can be estimated by maximum likelihood methods such as those implemented in LISREL. However, this approach to estimation imposes strong regularity conditions and this implies that misspecification in one part of the model may affect all estimation results Bollen et al. (2007); Kirby and Bollen (2009). As Bollen (1996) notes the non-iterative 2SLS estimator is more robust and computationally less intensive than the full-information alternatives. We adopt this estimator because it also provides more flexibility in specifying individual equations within the measurement model. In particular, it allows us to individually select the instrument sets we employ for each equation that is estimated. Starting from the full set of model implied instrumental variables we dropped those instruments that were only weakly correlated with the endogenous scaling items. By doing this we were able to reduce the potential for bias resulting from weak instruments (Stock and Yogo, 2002; Baum et al., 2007).

Alternatively, it would also be possible to estimate the equations of the measurement model jointly as a system of equations using GMM. We do not implement this method of estimating the model as it would require that we employ the same set of instruments for each of the equations in the measurement model. This would reintroduce the potential for weak instruments bias.

Just as above we substitute out the latent variables in the measurement model equations with the help of the scaling equations. This induces endogeneity so that once more we apply the 2SLS estimator.

The instruments we use are the same as above:

$$\triangle x_{mL} = \alpha_L + \sum_{K \in \{C,N,D\}} \lambda_{jKL} \triangle x_{1K} + \boldsymbol{\kappa}'_{1L} \triangle \boldsymbol{C}_{1L} + \delta_{jL} + \sum_{K \in \{C,N,D\}} \lambda_{jKL} \delta_{1K} \ , \tag{4}$$

where $m \in \{j \in \{2,5\}, k \in \{2,4\}, l \in \{2,6\}\}$ and $L \in \{C, N, D\}$.

Notice that here we have augmented the measurement model to reflect the possibility that each item in our survey reflects not just one but all three of the latent variables posited by the Theory of Planned Behavior. If the theory is well specified we would expect the coefficients on the scaling items measuring the same latent variable as the dependent item to be significant and positive, i.e. $\lambda_{mKK} > 0$ where $m \in \{j, k, l\}$ and $K \in \{C, D, N\}$. If further coefficients are significant, then this indicates that the items reflect more than one latent variable. This is possible under the Theory of Planned Behavior (Fishbein and Ajzen, 2010). However, we would argue that the distinction between the latent variables will be lost if all of the remaining coefficients were to be significant. Shah and Goldstein (2006) refer to this as "double loading" in their review of structural equation modeling and indicate it is to be avoided. This is essentially an identification issue at the level of the measurement model. In the case of the Theory of Planned Behavior double loading is not excluded by the theory. Identification rules for the measurement model which do not necessarily exclude double loading are discussed by Bollen and Davis (2009). We discuss and apply these further below.

4 Data Description

This section describes the setting in which our surveys were administered. The section also provides descriptive statistics on the variables and measures we obtain from the survey. Finally we discuss construct reliability and provide evidence that sample selection did not affect the main variables of interest.

4.1 Setting for the Survey

The students we surveyed about their entrepreneurial intentions are drawn from the business administration bachelor degree offered by the Munich School of Management at the Ludwig-Maximilians-Universität Munich. In their 3^{rd} semester students on this degree take a mandatory course on "Business Planning". As the course takes place early in the degree and is mandatory, students' answers are not affected by previous courses or any selection bias in the set of business school students.

The course "Business Planning" is organized as follows: Every year, the 3rd semester students take the course in the winter term. The students attend lectures in which they are taught basic principles of entrepreneurship and the writing of business plans. Additionally, guest speakers such as entrepreneurs, marketing or finance experts provide practical input. Parallel to the lectures students work together in teams of four to six in order to develop a business plan (team-members of one focal student are called "peers" in the following). Each of the teams cooperates with a Munich-based entrepreneur who provides his or her business idea for the business planning task. This allows the students to leave the purely academic setting and to gain insight into the day to day activities of an entrepreneur. Finally, four teams at a time attend a weekly meeting led by Munich School of Management faculty. In these meetings the teams present their business planning progress and receive feedback.

At the end of the course student teams have to submit a complete business plan and present it to faculty and entrepreneurs. Grades are based on team performance in the written business plan and presentation as well as on individual achievement (each team-member is "responsible" for one chapter of the business plan). There is also an independently assessed award for the ten best business plans.

On average every year approximately 400 students attend "Business Planning", grouped into 80 teams with four to six students each, cooperating with 40 entrepreneurs.

4.2 Data Collection

The data analyzed below were collected in two surveys during the winter semesters 2008-09 (cohort 1) and 2009-10 (cohort 2). To measure changes in attitudes and intentions resulting from the Business Planning course a pre-test post-test design was adopted. Both cohorts filled out online-questionnaires directly before the first session (ex-ante questionnaire) of the course and directly after they submitted their final business plan, but before the grades were communicated (ex-post questionnaire). As the students made their statements anonymously, the matching of ex-ante and es-post questionnaires was achieved through a structured identification code. All students were told that the surveys were undertaken for research purposes only, that their participation in the survey was voluntary and that their information would not affect their grades. The questionnaires were reviewed by 3 academics and 5 non-participating students to ensure clarity of wording and validity of the constructs.[9]

409 students were enrolled in the course in cohort 1 and 405 students in cohort 2. A total of 622 students answered the ex ante questionnaire (280 students in cohort 1, 342 in cohort 2 respectively), and a total of 566 students filled in the ex post questionnaire (276 and 290 students respectively). We achieved a matching of questionnaires for 199 students of cohort 1 and 279 students of cohort 2.[10]

For the multivariate analysis below, we had to drop some observations. For students from cohort 1 we experienced some difficulties in reconstructing the teams that students worked in. As we employ several peer-effects variables, we have had to drop 43 observations from this cohort. Furthermore, due to missing values in single items, we drop a further eight observations from cohort 1 and 22 observations from cohort 2. This leaves us with a total of 405 valid observations, i.e. complete and matched questionnaires. When not indicated otherwise, the following analysis is based on these observations.

4.3 Measures and Descriptive Statistics

Here we discuss the variables obtained from the surveys. The items used and the variables constructed are derived from existing theoretical and empirical work on the TPB as applied to entrepreneurship. Details are provided in each subsection.

Next, this section also provides psychometric properties of the items measuring latent variables. Following Chandler and Lyon (2001) and Liñán and Chen (2009), the psychometric properties are tested in two steps: first we investigate validity of the scales and then we analyze their reliability.

[9] Translated questionnaires are available from the authors upon request.

[10] The matching was achieved through a structured identification code. The code consisted of the first letter of the first name of the student's mother, the last letter of the student's name, the first digit of the student's month of birth, and the first letter of the student's place of birth.

Validity analysis We carefully considered structural and content validity in the development of the instrument, and ensured that the used items are both relevant and representative of the construct being measured. Next we used confirmatory factor analysis to assess convergent validity. All items loaded on the expected factor only, however two anomalies appeared. The Perceived Behavioral Control item 4 in the ex-ante data and the Perceived Behavioral Control items 4 and 6 in the ex-post data did not load on any of the three attitudinal factors with a loading above 0.4. The differences in items 4 and 6 measuring Perceived Behavioral Control do not load on the difference in Perceived Behavioral Control. Therefore, we exclude these two items when building both the ex-ante and ex-post measure of Perceived Behavioral Control[11]. We assessed discriminant validity by looking at correlations. Correlations of each item to other constructs were always below the correlations with their own construct as required.

Table 1: Construct Reliability

Variable	**Statistic**	**Ex-ante**	**s.e.**	**Ex-post**	**s.e.**	**Difference**	**p-value**
Entrepreneurial intention	mean	4.19	0.089	3.91	0.092	0.281	0.000^{***}
Perceived desirability	mean	4.29	0.072	4.35	0.076	0.065	0.138
	α	0.89		0.92		0.81	
	ω_h	0.87		0.87		0.77	
Perceived social norms	mean	-4.68	1.46	-1.13	1.54	3.553	0.002^{**}
	α	0.93		0.94		0.85	
	ω_h	0.92		0.92		0.83	
Perceived behavioral control	mean	4.22	0.044	4.32	0.046	0.102	0.003^{**}
	α	0.79		0.79		0.50 (0.70)	
	ω_h	0.57		0.75		0.60 (0.69)	

Squared difference between ex ante and ex post values of items

		mean	**s.e.**	**p-value**	$\boldsymbol{\alpha}$	$\boldsymbol{\omega_h}$
Entrepreneurial intention	(1 item)	2.247	0.226	0.000^{***}		
Perceived desirability	(5 items)	2.591	0.197	0.000^{***}	0.82	0.78
Perceived social norms	(4 items)	214.5	14.55	0.000^{***}	0.72	0.68
Perceived behavioral control	(6 items)	1.834	0.112	0.000^{***}	0.67	0.64

$^{\dagger}p < 0.10,^{*} p < 0.05,^{**} p < 0.01,^{***} p < 0.001$

Construct Reliability Table 1 above provides a number of descriptive statistics and tests for the four latent variables in our structural equation model. Among others the table presents tests of construct reliability where a latent variable is based on three or more items. These tests show whether the items grouped together as reflective measures of each latent variable are correctly grouped together. We estimate two measures of construct reliability: Cronbach's α and McDonald's ω_H.

Cronbach's α is widely used in the literature to evaluate construct validity; values in excess of 0.7 are regarded as indicating high reliability of the construct (Nunnally, 1978). However Zinbarg et al. (2005) and Revelle and Zinbarg (2009) argue that Cronbach's α may reflect latent group factors that jointly determine subsets of the items included in a scale. In this case there need not even be a common latent factor. Therefore we also estimate McDonald's ω_H which provides an accurate measure of the

[11] In results not reported in the paper but available from the authors we also estimated the measurement model including these items. We found the items did not reflect any of the three attitudinal factors posited by the Theory of Planned Behavior.

proportion of variance in the items which is due to a unique common factor (Revelle and Zinbarg, 2009).

We discuss the remaining results set out in Table 1 in the following sections.

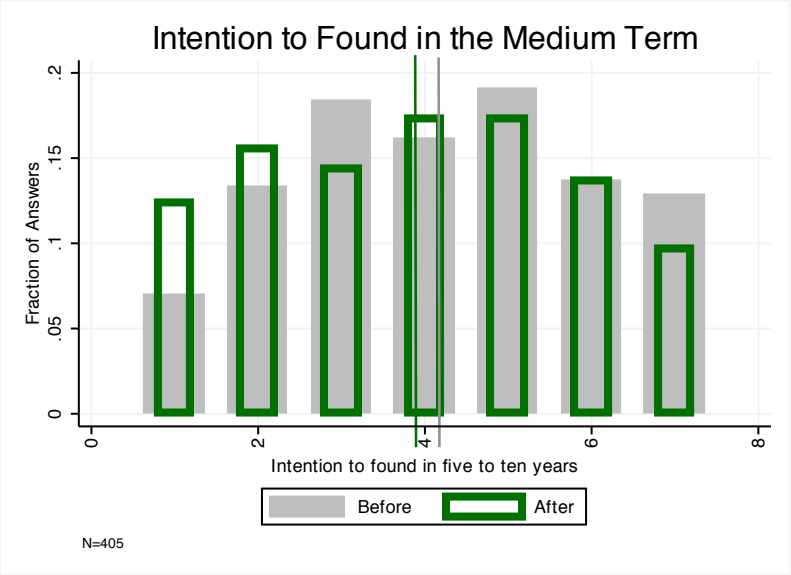

Figure 2: Measures of intention before and after the course.

Entrepreneurial Intention This variable is the dependent variable in the latent variable model. It reflects the student's latent intention to pursue an entrepreneurial venture. We measure this using a single item proposed by Shapero and Sokol (1982). Students were presented with the statement "I intend to start my own business in the next ten years" and asked to indicate their agreement to it on a seven-point Likert-scale with answers ranging from "completely disagree" to "completely agree".

Table 2: Comparing the Variance of Ex ante and Ex post Intentions

		Standard Deviation of Intentions by Sample			
		Full	Estimation	Estimation Restricted	Most Restricted
N		866	810	650	610
Response time	ex ante	1.775	1.789	1.350	1.389
	ex post	1.853	1.860	1.673	1.725
				p-value	
Test statistic	F-test	0.186	0.216	0.000	0.000
	Levene's robust test	0.377	0.451	0.000	0.000
	Brown and Forsythe's median test	0.374	0.440	0.000	0.000

Figure 2 provides information on the mean of students' responses to the item (horizontal lines) and the distribution of their responses ex ante and ex post. Clearly mean entrepreneurial intention decreased. In Table 1 above we show that this decrease is statistically significant at the 1% percent level. Table 2 also shows that the standard deviation of students' entrepreneurial intentions increases as a result of the course and that this effect is statistically significant if we exclude students who already have very strong intentions ex ante. This indicates that students are being sorted into two groups by the course.

We consider a number of different samples when undertaking the differences in variances tests reported in Table 2. First we include everyone who responded to the question on intentions. Then we consider only those students that are included in our estimation sample. Then we exclude those students who do not change their intentions at all. In the final sample we also exclude students who have very extreme ex ante intentions as their intentions cannot become more dispersed by definition. In the latter two samples the increase in the standard deviation is highly significant.

Perceived Desirability, Perceived Behavioral Control and Perceived Social Norms Next we discuss measurement of the three latent constructs that jointly determine entrepreneurial intentions according to the Theory of Planned Behavior.

Perceived Desirability Perceived desirability is measured using a five-item measure on a seven-point Likert-scale first developed by Gundry and Welsch (2001) and subsequently adopted by Kolvereid and Isaksen (2006). Students indicated their agreement to the following statements (1 "completely disagree" - 7 "completely agree").

1. I would rather own my own business than earn a higher salary as an employee.
2. I would rather own my own business than pursue a promising career as an employee.
3. I am willing to make significant personal sacrifices in order to stay in my own business.
4. I would work somewhere else only in order to make another attempt to start my own business.
5. I am willing to work more with the same salary in my own business, than as an employee.

To test whether the items jointly measure an underlying construct Table 1 provides two test statistics, Cronbach's α and McDonald's ω_H. Both statistics indicate that the ex ante and ex post items, their differences and the squared differences of these measure an underlying construct as their values are very similar and well above 0.7. Table 1 also shows that the mean value of the construct is not affected by the course while its squared differences are significantly different from zero. This suggests that the course induces more polarized views of perceived desirability of entrepreneurship in the students taking it.

Perceived Social Norms To measure perceived social norms three-items (7-point Likert-scales) are adopted from Kolvereid (1996b). These were subsequently used by Tkachev and Kolvereid (1999), Kolvereid and Isaksen (2006), and Souitaris et al. (2007). The items assess whether family members, friends or other important persons thought that the respondent ought to become an entrepreneur or not. We include an additional item about the opinions of fellow students, as this perception becomes important in entrepreneurship courses in which students receive repeated feedback from their peers.

We asked students to indicate their agreement to the respective statements (1 "completely disagree" - 7 "completely agree"). The four items were transformed to yield a symmetric scale from -3 to 3, which was then multiplied by a weight indicating to which extent the respondent cares about the expectation of the respective group (four items on 7-point Likert scales).

1. My closest family think that I should start my own business.
2. My closest friends think that I should start my own business.
3. My fellow students think that I should start my own business.
4. Other people who are important to me think that I should start my own business.

5. For me, the expectations of my closest family are (not important at all - very important).
6. For me, the expectations of my closest friends are (not important at all - very important).
7. For me, the expectations of my fellow students are (not important at all - very important).
8. For me, the expectations of other people, who are important for me, are (not important at all - very important).

Cronbach's α and McDonald's ω_H (cf. Table 1) indicate that the ex ante and ex post items, their differences and the squared differences of these measure an underlying construct as the statistics are very similar and well above 0.7. The table also shows that the difference in means for this measure is significantly positive. This indicates that the course led students to evaluate social norms more positively. Furthermore, the squared differences of the measure are significantly different from zero which indicates that there is also a polarization in this dimension of students' perceptions.

Perceived Behavioral Control A measure of perceived behavioral control was obtained from a scale of six items on 7-point Likert-scales suggested by Kolvereid (1996a). This measure has subsequently been used by Tkachev and Kolvereid (1999) and Souitaris et al. (2007). Again, we asked students to indicate in how far they agreed to the following statements (1 "completely disagree" - 7 "completely agree").

1. For me, being self-employed would be very easy.
2. If I wanted to, I could easily pursue a career being self-employed.
3. Being self-employed, I would have complete control over the situation.
4. The number of events outside my control which could prevent me from being self-employed is very high.
5. If I become self-employed, the chances of success would be very high.
6. If I pursue a career being self-employed, the chances of failure would be very high.

Note: Items 4 and 6 are reverse-coded.

To test whether these items jointly measure an underlying construct Table 1 provides Cronbach's α and McDonald's ω_H. In this case McDonald's ω_H indicates that the construct is not as reliable as one would like ex ante. More specifically McDonald's ω_H indicates that the high value of Cronbach's α reflects strong group factors relative to the general factor we are interested in measuring (Zinbarg et al., 2005). We have found that this is due to items 4 and 6, and is perhaps due to reverse-coding. In case of the difference between ex ante and ex post items we also report the statistics when we exclude items 4 and 6 in brackets. Once this is done the construct can be seen to be just at the level of reliability which the literature regards as adequate (0.7).

Table 1 also shows that the mean value of this construct increases. This indicates that the course improves the average students' impression of being able to undertake entrepreneurial tasks. At the same time the squared differences between the ex ante and ex post items are significantly different from zero indicating that perceptions of behavioral control have also become more polarized due to the course. In Section 5.3 we investigate whether this polarization outweighs the rightward shift in the mean of this construct in its effects on students' intentions.

Summary of Results on Latent Variables Overall the descriptive analysis of the latent variables in this section shows that students' perceptions of desirability, social norms and behavioral control are

more polarized after the entrepreneurship course. Also, we find that the means of perceived behavioral control and perceived social norms are significantly shifted to the right.

Table 3: Determinants of Perceived Desirability, Perceived Social Norms and Perceived Behavioral Control

Variable	**Mean**	**SD**	**Median**	**Min**	**Max**
Ex-ante intention to become an entrepreneur	4.190	1.789	4	1	7
Ex-ante perceived desirability - item 1	3.807	1.801	4	1	7
Ex-ante perceived desirability - item 2	4.422	1.741	4	1	7
Ex-ante perceived desirability - item 3	4.025	1.66	4	1	7
Ex-ante perceived desirability - item 4	4.24	1.745	4	1	7
Ex-ante perceived desirability - item 5	4.948	1.71	5	1	7
Ex-ante perceived social norms - weighted item 1	-1.686	9.82	0	-21	21
Ex-ante perceived social norms - weighted item 2	-0.61	9.106	0	-21	21
Ex-ante perceived social norms - weighted item 3	-1.378	5.383	0	-15	21
Ex-ante perceived social norms - weighted item 4	-1.007	7.762	0	-21	21
Ex-ante perceived behavioral control - item 1	4.22	1.238	4	1	7
Ex-ante perceived behavioral control - item 2	3.706	1.316	4	1	7
Ex-ante perceived behavioral control - item 3	4.378	1.343	5	1	7
Ex-ante perceived behavioral control - item 4	3.904	1.385	4	1	7
Ex-ante perceived behavioral control - item 5	4.435	1.143	4	1	7
Ex-ante perceived behavioral control - item 6	4.672	1.236	5	1	7
Entrepreneur	0.067	0.25	0	0	1
Self-employed parents	0.484	0.5	0	0	1
Prior interest	3.548	1.18	4	1	5
Prior knowledge	2.684	0.994	3	1	5
Time invested by entrepreneur (days)‡	0.691	1.202	0.417	0.042	10.417
Extraversion	4.942	1.148	5	1	7
Agreeableness	4.5	0.776	4.5	1	7
Conscientiousness	5.426	1.134	5.5	1	7
Emotional stability	4.742	1.155	5	1	7
Openness to experience	5.462	1	5.5	1	7
Peers assessment of desirability	4.275	0.881	4.267	1	6.8
Peers parents self-employed (share)	0.505	0.331	0.5	0	1
Peers are entrepreneurs (share)	0.065	0.148	0	0	1
German	0.835	0.372	1	0	1
Gender (F= 1)	0.538	0.499	1	0	1
Age	21.699	2.211	21	19	34

‡ marks variables adjusted for outliers as discussed below.

Description of Exogenous Variables Now we discuss control variables included in the two surveys. Descriptive statistics for these variables are provided in Table 3 below.

Big 5 *personality domains* To obtain measures for the Big 5 personality domains extraversion, agreeableness, conscientiousness, emotional stability, and openness to experiences we employed the Ten-Item Personality Inventory (7-point Likert scales) developed by Gosling et al. (2003).

Prior exposure to entrepreneurship To obtain a measure of prior exposure to entrepreneurship we included four items asking for four possible types of entrepreneurial experience following Krueger (1993). We asked the following four questions (coded 1 for yes, 0 for no):

Did your parents ever start a business? Did they ever work for a small or new company? Did you ever start a company on your own? Finally we asked for an estimate of the number of acquaintances that have started a business. In one case a student provided a very high estimate which we found had an effect on the significance of this variable in several regressions. We reduced the variable to the 99^{th} percentile in this case. This change did not affect the significance or interpretation of any of the main variables of interest. Table 3 reflects this change.

Prior knowledge and interest We asked students to indicate their interest in and knowledge about entrepreneurship prior to the course.

Time invested by entrepreneur To measure the entrepreneur's commitment, we asked students for an estimate how many hours the founder spent in the joint development of the business plan in total over the whole course duration. We subsequently transformed this variable into a measure for the number of days to ease interpretation in the tables below. In one case a student provided an extreme overestimate of the number of hours. This had an effect on the significance of the variable in several regressions. Therefore we reduced the value to the maximal value given by the peers in the student's team. This change did not affect the significance or interpretation of any of the main variables of interest.

Peer variables The peer variables in Table 3 are constructed by taking the peers' mean value for the respective variable without the contribution of the respective focal student. The variable "Peer gender heterogeneity" is one exception: This heterogeneity was calculated using Blau's index (Blau, 1977). Blau's index is calculated as $1 - \sum p \cdot i^2$, where p is the proportion of peers in a category and i is the number of different categories represented in the peer group (in this case is $i = 2$, which means that gender heterogeneity is simply the percentage of the smaller gender representation. Note: We included all ex-ante observations in the calculation of the peer variables, i.e. these values are based on 512 observations and are not affected by a potential non-response bias (see also Table 5).

4.4 Sample Selection and Non Response Bias

Here we provide tests for sample selection and non-response bias. We can show that the sample is randomly selected in three dimensions. 784 of the 814 enrolled students provided data on gender and the number of ECTS points collected prior to taking part in the "Business Planning" course. Additionally, we know which cohort the students come from. To test for sample selection we estimate a probit model. In this model the dependent variable is equal to one if an individual returned completed ex-ante and ex-post questionnaires (405 students) and zero otherwise. We test whether the cohort, the number of ECTS points collected and gender can explain full participation in the two surveys.

Results are presented in Table 4. The student's level of ECTS points increases the likelihood of response in both survey rounds, while the effect of gender is not statistically significant at the 1% level. This may reflect greater pressures acting on students with less progress in their studies making them less willing to invest time to answer in both survey rounds. The level of ECTS points collected does not sig-

nificantly affect results further below. As we could not determine team membership in all cases we drop some observations in cohort 1. Therefore the dummy for the 2009 cohort is also highly significant.[12]

Table 4: Determinants of Valid Ex ante and Ex post Responses

	D(= 1) if matched and valid questionnaire	
	Coefficients	Marginal effects
ECTS points	0.022^{***}	0.009^{***}
collected	(0.003)	(0.001)
Gender (F=1)	-0.016	-0.006
	(0.096)	(0.038)
Cohort (2009=1)	1.205^{***}	0.452^{***}
	(0.104)	(0.0345)
Constant	-1.484^{***}	
	(0.182)	
Log-likelihood	-463.090	
N	784	

† p<0.10, * p<0.05, ** p<0.01, $^{***}p¡0.001$

Next, we investigate the response behavior to both surveys. In addition to the 405 matched ex-ante and ex-post questionnaires we received 189 valid ex-ante-only questionnaires. Table 5 provides demographic variables as well as the ex-ante values of the variables of the TPB for these two groups. The table shows that students who are performing relatively badly during their studies, older students and students with a nationality other than German more often failed to complete the ex-post test.

Table 5: Demographic characteristics and sample composition

		subgroup		**test statistic**	
Variables		pre-survey only $(N = 189)$	both surveys $(N = 405)$	**|t|**	**p-value**
Age	(years)	22.1	21.7	2.001	0.004
Gender (F=1)	(%)	59.2	53.8	1.330	0.184
German	(%)	71.7	83.5	3.567	0.000
ECTS		41.2	45.3	2.872	0.004
Parent(s) self-employed	(%)	51.3	48.4	0.777	0.437
Acquaintance(s) self-employed	(count)	1.9	3.3	0.529	0.299
Entrepreneur	(%)	0.09	0.07	1.541	0.124
Ex-ante intention		4.24	4.19	0.375	0.708
Ex-ante desirability		4.35	4.29	0.610	0.542
Ex-ante social norms		-4.61	-4.68	0.081	0.936
Ex-ante behavioral control		4.20	4.22	0.138	0.890

The most important finding from Table 5 is that the mean of the dependent variables for those responding only to the first or to both questionnaires is statistically indistinguishable. This shows that the demographic departures from a representative sample that we see in the table above do not introduce a measurable non-response bias in the dependent variables.

[12] If we drop the ECTS variable we can include the missing observations in the regression and the cohort dummy is no longer significant.

5 Results from the Structural Equation Model

This section provides results from estimation of the measurement and latent variable models. Both are estimated using model implied instrumental variables as proposed by Bollen (1996). First, we present results from estimation of the measurement model. With these we analyze whether the latent variables posited by the TPB can be identified. Next, we analyze the latent variable model to test whether the latent variables affect entrepreneurial intentions as predicted by the TPB. Finally, we extend the latent variable model to test whether skill directed and vocational course contents are complements or substitutes.

The measurement model is estimated using the specification set out in equation (4). The results show that items introduced into the questionnaires to measure a specific attitudinal factor of planned behavior usually reflect only that factor. In some cases more than one factor is reflected. However, we are able to identify each attitudinal factor and can determine its effects on entrepreneurial intentions. Overall, the results show that the Theory of Planned Behavior provides a reliable basis for the analysis of entrepreneurship education.

The latent variable model is estimated using the specification set out in Equation (3). The results show that all three attitudinal factors posited by the TPB have a significant positive effect on students' entrepreneurial intentions.

All results reported below have been estimated using a robust estimator of the standard errors. We cluster errors at the level of the groups in which the students undertook small group work in order to control for any common influences within these groups or from the assistants teaching in these groups. There are 36 groups in the data we analyze.

5.1 Testing the Measurement Model

In this section we report results from estimation of the measurement model. We estimate equations for changes in each non-scaling item included in the measurement model. One aim is to test whether the item which is the dependent variable reflects only the latent attitudinal factor suggested by the literature or whether it reflects one or both of the other latent attitudinal factors that are part of the Theory of Planned Behavior as well. Therefore, the model we estimate is general enough to encompass departures from the idealized model as it is presented graphically in Figure 1.

Ogden (2003) and Ajzen and Fishbein (2004) discuss common criticisms of the Theory of Planned Behavior and its empirical applications. The first criticism is that the theory is not testable because authors do not clarify circumstances under which they would consider the Theory of Planned Behavior to have failed. The second criticism is that items constructed to measure latent attitudinal factors and intentions within the Theory of Planned Behavior are so similarly worded as to be indistinguishable. This would make it a foregone conclusion that intentions and attitudinal factors are correlated.

We address both of these criticisms here. The discussion of the structural equation model in Section 3 above shows that three extreme outcomes from estimation of the measurement model are conceivable: i) all items used to measure the attitudinal factors may correlate with each one of these factors or ii) none may do so and finally iii) items are only correlated to factors they are not intended to measure. Each of these results would provide grounds to reject the applicability of the theory to our data. The results we present below do not fall into any one of these categories.

The second criticism is addressed here too. We find that all of the 10 items we employ are signif-

icantly positively correlated to the latent attitudinal factor they measure. Some of these items are also correlated with additional factors but the correlations with these are weaker in all cases but one. Thus we find some evidence of links between the latent factors posited by the TPB. However, this evidence fails to reject identification of the latent factors in our data.

All results presented in this section derive from estimation of the model equations by two stage least squares using GMM. Each equation is estimated twice. First we report results in which we use only the remaining non-scaling items as instruments as suggested by Kirby and Bollen (2009). If the measurement model is correctly specified and the items measuring each attitudinal factor are affected by independent error terms $\delta_{iC}, \delta_{iN}, \delta_{iD}$ (viz. 2), then these instruments should be sufficient to identify each equation that is part of the measurement model. Were some of these instruments to be rejected this would indicate a misspecification of the measurement model as we estimate it. In two cases within the set of items measuring perceived desirability one of the model implied instruments was rejected indicating some additional correlation of items. We discuss this further below. In all remaining cases the main instruments suggested by the model were not rejected.

In addition to the regression suggested by Kirby and Bollen (2009), we provide estimates for each equation in which we augment the set of instruments. By adding additional instruments we test the robustness of the measurement model further. The additional instruments are the ex ante values of the items used to measure the latent attitudinal factors. These values are exogenous as we measure them before the course takes place and they do not measure how students expect the course to affect their attitudes or perceptions. Results from these regressions suggest that the augmented set of instruments is less likely to introduce biases into the estimates we obtain. Using these instruments we find more evidence of interaction between the three attitudinal factors posited by the TPB than we do using only the model implied instruments. As noted above the significant positive correlation of the item and the latent attitudinal factor is given in all cases. In one case a second attitudinal factor is also significantly reflected by an item once we introduce the extended set of instruments.

Overall we do not regard the measurement model as suggested by the TPB to have been rejected by our results. There is an indication of a close connection between the perception of desirability of entrepreneurship and the perceptions of social norms but this does not undermine the model as we discuss in more detail below.

The measurement model set out in section 3 above could be estimated as a system of simultaneous equations which would improve efficiency. We prefer to estimate the model equation by equation in order to be able to employ robust estimators of the standard error of coefficients as well as tests of the instrument sets we employ. Furthermore this allows us to vary the set of instruments such that we can eliminate any instruments rejected by the data.

We present three tables below, each containing results for one attitudinal factor. The specifications presented are arrived at by testing down from a common specification. We iteratively eliminated the least significant control variables from these specifications.

Perceived Desirability Table 6 below provides results from the regressions explaining differences in students' responses to items 2-5 measuring perceived desirability. In each equation the latent attitudinal factors are measured using the first item in the scale for that factor. As noted in Section 3 these measures

Table 6: Determinants of Perceived Desirability

	Difference in answer to item ex-ante and ex-post							
Variables	Item 2		Item 3		Item 4		Item 5	
	m	f	m	f	m	f	m	f
$\triangle$ Desirability$_1$	1.037^{***}	1.016^{***}	1.020^{***}	0.773^{***}	0.900^{***}	0.819^{***}	0.712^{***}	0.754^{***}
	(0.083)	(0.052)	(0.126)	(0.041)	(0.054)	(0.047)	(0.099)	(0.056)
$\triangle$ Norms$_1$	-0.015	-0.007	-0.016	0.017^{**}	0.058^{***}	0.060^{***}	0.016	0.013
	(0.012)	(0.009)	(0.013)	(0.006)	(0.011)	(0.008)	(0.015)	(0.008)
$\triangle$ Control$_1$	0.034	0.046	0.132	0.118^{*}	-0.193^{*}	$-0.146^{\dagger}$	0.141	0.093
	(0.105)	(0.053)	(0.100)	(0.058)	(0.089)	(0.080)	(0.105)	(0.061)
Peers' parents are	-0.175	$-0.254^{\dagger}$						
self employed	(0.165)	(0.133)						
Extraversion			$-0.074^{\dagger}$	-0.036				
			(0.043)	(0.034)				
Conscientiousness	0.097^{**}	0.110^{***}			0.119*	0.152^{**}	0.187^{**}	0.177^{***}
	(0.037)	(0.032)			(0.053)	(0.048)	(0.066)	(0.043)
Desirability item 1	0.831^{***}	0.798^{***}	0.685^{***}	0.572^{***}	0.500^{***}	0.485^{***}	0.565^{***}	0.625^{***}
	(0.058)	(0.054)	(0.070)	(0.038)	(0.049)	(0.044)	(0.082)	(0.066)
Desirability item 2	-0.881^{***}	-0.881^{***}					-0.197^{**}	-0.252^{***}
	(0.053)	(0.045)					(0.069)	(0.058)
Desirability item 3	$0.059^{\dagger}$	0.064^{*}	-0.667^{***}	-0.637^{***}	0.050	0.036	$0.107^{\dagger}$	0.119^{**}
	(0.033)	(0.027)	(0.051)	(0.033)	(0.050)	(0.045)	(0.063)	(0.046)
Desirability item 4					-0.662^{***}	-0.682^{***}		
					(0.062)	(0.058)		
Desirability item 5							-0.706^{***}	-0.730^{***}
							(0.060)	(0.047)
Norms item 1					0.043^{***}	0.049^{***}		
					(0.008)	(0.007)		
Norms item 3	-0.033^{*}	$-0.021^{\dagger}$						
	(0.015)	(0.011)						
Norms item 4							0.028^{*}	0.030^{***}
							(0.011)	(0.007)
Control item 2					-0.140^{*}	-0.169^{**}		
					(0.071)	(0.065)		
Desirability item 3	$-0.042^{\dagger}$	-0.049^{**}	-0.051^{*}	-0.041^{**}	-0.067^{**}	-0.076^{***}		
(sdfsm)	(0.022)	(0.018)	(0.021)	(0.016)	(0.021)	(0.019)		
Desirability item 4					0.063^{**}	0.077^{***}		
(sdfsm)					(0.020)	(0.015)		
Desirability item 5	0.027^{*}	0.024^{*}						
(sdfsm)	(0.013)	(0.010)						
Norms item 2	0.003^{***}	0.003^{***}	0.003^{***}	0.002^{***}			0.003^{***}	0.003^{***}
(sdfsm)	(0.001)	(0.001)	(0.001)	(0.001)			(0.001)	(0.001)
Norms item 3	-0.003	$-0.002^{\dagger}$						
(sdfsm)	(0.002)	(0.001)						
Norms item 4	-0.002^{**}	-0.002^{***}	-0.002	-0.001			-0.004^{***}	-0.004^{***}
(sdfsm)	(0.001)	(0.001)	(0.001)	(0.001)			(0.001)	(0.001)
Control item 2	-0.047	$-0.031^{\dagger}$						
(sdfsm)	(0.029)	(0.019)						
Control item 4			0.051^{*}	0.032^{*}				
(sdfsm)			(0.022)	(0.015)				
Control item 5			-0.067^{**}	-0.078^{***}				
(sdfsm)			(0.022)	(0.016)				
Constant	-0.357	-0.333	0.335	0.527^{**}	0.543	0.568	0.459	0.680^{*}
	(0.405)	(0.278)	(0.241)	(0.201)	(0.445)	(0.392)	(0.514)	(0.338)

Table 6: Determinants of Perceived Desirability

	Difference in answer to item ex-ante and ex-post							
Variables	Item 2		Item 3		Item 4		Item 5	
	m	f	m	f	m	f	m	f
Adjusted R^2	0.530	0.540	0.248	0.437	0.449	0.492	0.412	0.399
Underidentification	24.917	27.287	18.613	28.278	18.582	26.298	63.015	27.623
p-value	0.001	0.018	0.005	0.020	0.010	0.016	0.000	0.010
Weak instr. 5%	16.10	18.94	15.18	19.13	16.10	18.73	15.18	18.73
Weak instr. 10%	9.37	10.41	9.01	10.47	9.37	10.33	9.01	10.33
Weak instr.	10.766	17.030	9.313	27.743	6.311	16.211	13.290	30.230
Overident. rest.	6	13	5	14	6	12	5	12
Hansen-J Test	6.670	11.531	7.259	18.730	11.744	18.637	7.798	20.078
p-value	.350	.566	.202	.176	.068	.098	.168	.066
N=405	$^{\dagger}p < 0.10$,	$^{*}p < 0.05$,	$^{**}p < 0.01$,	$^{***}p < 0.001$				

are endogenous in the measurement model equations. We instrument the measures with two different sets of instruments: first with a set of model implied instruments (m) and second we augment these instruments with the ex ante measures of the items (f). Table 6 provides a separate regression for each item and set of instruments.

We provide measures of the quality of the instruments employed at the bottom of Table 6. These measures show that we can reject underidentification of the endogenous variables at the 1% or 5% levels using the Kleibergen and Paap (2006) rk statistic[13]. The Hansen-J Test fails to reject the null hypothesis that the instruments are uncorrelated with the error terms at the 5% or 10% levels. Finally, we find that the bias that might be caused by weakness of instruments is below 10% whenever we use the augmented set of instruments and in the equations for items 3 and 5 it is below 5%. Note that in the equations for item 5 we exclude the difference in item 3 from the set of instruments. This restriction is suggested by the Hansen-J test. Once we eliminate the difference in item 5 as an instrument in the regression for item 3 the underidentification statistic, the weak instruments statistic and the Hansen-J Test statistic all increase. This shows that there is a common factor for items 3 and 5 leading to a violation of the assumption that the errors δ_{3D} and δ_{5D} are independent.

Each regression contains controls for students' ex ante responses to all items as well as the squared difference of these responses from the scale mean. These variables control for students' ex ante attitudes. We eliminated all insignificant controls iteratively.

Table 6 shows that all four items measuring perceived desirability reflect this latent attitudinal factor. Items 3 and 4 also reflect both of the other latent attitudinal factors perceived social norms and perceived behavioral control. In both these cases the coefficients of perceived desirability are significantly larger than those of the other two latent attitudinal factors. Items 2 and 5 reflect only perceived desirability of entrepreneurship. This shows that variation in perceived desirability can be separately identified with the set of items we employ.

However, the results presented here suggest that perceived desirability is partly affected by perceptions of social norms and behavioral control. As noted by Ajzen and Fishbein (2004) such effects from one attitudinal factor on another are not excluded by the TPB.

Finally, it is interesting to note that changes in the perceived desirability of entrepreneurship are hardly affected by exogenous outside influences such as own family background, gender or nationality.

[13] We estimate all models in STATA 11.2 using `IVREG2` (Baum et al., 2007). Standard errors are cluster and heteroskedasticity robust. We cluster at the team level - cf. Section 4.1.

Only one factor exerts strong influence: the student's own conscientiousness. As Heckman et al. (2008) note, Big 5 conscientiousness is the personality trait that predicts outcomes such as grades, leadership performance or longevity better than any other Big 5 personality predictor. Thus it is interesting that it also has significant effects on the perceived desirability of entrepreneurship.

Table 7: Determinants of Perceived Social Norms

	Difference between ex-ante and ex-post responses					
Variables	Item 2		Item 3		Item 4	
	m	f	m	f	m	f
$\triangle$ Desirability$_1$	0.050	0.490^{***}	0.387	0.515^{***}	-0.331	0.443^{***}
	(0.372)	(0.143)	(0.323)	(0.133)	(0.311)	(0.115)
$\triangle$ Norms$_1$	1.020^{***}	0.920^{***}	0.525^{***}	0.480^{***}	0.745^{***}	0.702^{***}
	(0.065)	(0.030)	(0.060)	(0.026)	(0.059)	(0.041)
$\triangle$ Control$_1$	0.241	0.055	-0.091	-0.102	0.229	0.095
	(0.411)	(0.218)	(0.400)	(0.189)	(0.402)	(0.234)
Entrepreneur					2.448^{*}	2.579^{**}
					(1.154)	(0.908)
Time invested by	-0.461	-0.692^{**}	-0.700^{**}	-0.634^{***}	-0.576^{*}	-0.479^{*}
entrepreneur	(0.324)	(0.218)	(0.225)	(0.162)	(0.282)	(0.201)
Prior interest	0.051	0.194			$0.383^{\dagger}$	0.430^{*}
	(0.260)	(0.154)			(0.211)	(0.187)
Peers' parents are	-2.184^{**}	-2.172^{***}				
self employed	(0.739)	(0.640)				
Peers' courses			$-0.060^{\dagger}$	-0.055^{*}		
			(0.032)	(0.026)		
German					0.935	1.146^{*}
					(0.677)	(0.505)
Norms item 1	0.862^{***}	0.792^{***}	0.425^{***}	0.403^{***}	0.662^{***}	0.632^{***}
	(0.065)	(0.044)	(0.045)	(0.027)	(0.058)	(0.044)
Norms item 2	-0.832^{***}	-0.800^{***}				
	(0.067)	(0.050)				
Norms item 3			-0.685^{***}	-0.671^{***}		
			(0.058)	(0.044)		
Norms item 4					-0.859^{***}	-0.817^{***}
					(0.056)	(0.051)
Control item 4			-0.472^{**}	-0.569^{***}	$-0.413^{\dagger}$	-0.627^{***}
			(0.183)	(0.152)	(0.219)	(0.188)
Norms item 3	-0.008^{*}	-0.008^{**}				
(sdfsm)	(0.003)	(0.003)				
Norms item 4			-0.005^{*}	$-0.004^{\dagger}$		
(sdfsm)			(0.002)	(0.002)		
Constant	$1.709^{\dagger}$	$1.208^{\dagger}$	3.639^{*}	3.320^{*}	-1.514	-1.166
	(1.039)	(0.646)	(1.657)	(1.520)	(1.539)	(1.383)
Adjusted R^2	0.564	0.628	0.396	0.426	0.432	0.481
Underidentification	21.449	32.747	21.654	31.293	21.236	31.154
p-value	0.003	0.008	0.003	0.005	0.003	0.005
Weak instr. 5%	16.10	18.47	16.10	18.94	16.10	18.94
Weak instr. 10%	9.37	10.25	9.37	10.41	9.37	10.41
Weak instr.	7.892	36.769	8.681	29.829	9.368	30.144
Overident. rest.	6	15	6	13	6	13
Hansen-J Test	3.715	16.448	12.039	14.675	8.280	15.601
p-value	.715	.353	.061	.328	.218	.271
N=405	$^{\dagger}p < 0.10$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$					

Perceived Social Norms Table 7 provides results from regressions explaining differences in students' responses to items 2-4 measuring perceived social norms. As before the main explanatory variables are differences in the three scaling items: Desirability_1, Norms_1 and Control_1. These variables are endogenous and instrumented as above. Table 7 provides results based just on the model implied instruments (m) and results based on an augmented set of instruments (f).

Tests set out at the bottom of Table 7 indicate that we cannot reject the instruments on the basis of the underidentification or the Hansen-J Test. The weak instruments test indicates that the instrumental variables regression introduces only small biases, in all cases these are below 5%. We include the same set of ex ante controls as previously and eliminate all insignificant controls iteratively beginning with the least significant. Note that the model implied instruments are not rejected in any of the regressions.

Table 7 shows that all three items reflect the latent attitudinal factor perceived desirability. All items also reflect perceived desirability once we rely on the augmented set of instruments. In case of item 3 the coefficient reflecting the effect of perceived social norms is as large as the coefficient for perceived desirability. In the other cases the coefficients on the scaling item for social norms are larger and significantly different from those on perceived desirability.

This indicates that social norms are difficult to separate from the perception of desirability in the case of entrepreneurship education. However, we saw previously that perceived desirability can be separately identified from social norms. Furthermore two items measuring perceived social norms reflect these more strongly than perceived desirability. Therefore, we conclude that perceived social norms are separately identifiable from perceived desirability.

Changes in perceived social norms surrounding entrepreneurship are affected by a heterogeneous set of exogenous influences that vary across the three items. These include prior interest in entrepreneurship and whether the student or their peers' parents are active as entrepreneurs. More importantly it emerges that the students' believe less strongly that their environment thinks they should become entrepreneurs the more time the entrepreneur they are matched with during the course invests in interacting with the students. Note that this variable has no effect on perceived desirability or on perceived behavioral control where one might have expected an effect. It seems that interaction with the entrepreneur instills greater awareness of the risks of entrepreneurship in the students.[14]

Perceived Behavioral Control Table 8 below provides results from the regressions explaining differences in students' responses to items 2,3 and 5 measuring perceived behavioral control. As discussed in Section 4 above we removed items 4 and 6 from the scale. Confirmatory factor analysis shows that these items do not reflect the latent construct perceived behavioral control. In the regressions for the measurement model we confirm this result. We do not report these results to save space.

As previously the main explanatory variables are differences in the three scaling items: Desirability_1, Norms_1 and Control_1. The variables are endogenous and we use the same initial set of instruments as above. Tests set out the bottom of Table 8 indicate that we cannot reject the instruments on the basis of the underidentification or the Hansen-J Test. Also the weak instruments test indicates that the expected bias due to the instruments is around 5% in two cases and below 10% in one case. Overall these results are only slightly worse than for the other attitudinal factors.

[14] We have not found any evidence that entrepreneurs with weaker projects spend more time with students. This might have been an alternative explanation.

Table 8: Determinants of Perceived Behavioral Control

	Difference between ex-ante and ex-post responses					
Variables	Item 2		Item 3		Item 5	
	m	f	m	f	m	f
$\triangle$ Desirability$_1$	-0.076	-0.012	0.179^{**}	0.130^{**}	0.031	$0.049^{\dagger}$
	(0.074)	(0.030)	(0.059)	(0.048)	(0.053)	(0.027)
$\triangle$ Norms$_1$	0.007	$0.009^{\dagger}$	-0.018^{*}	-0.009^{*}	0.005	-0.001
	(0.008)	(0.005)	(0.008)	(0.004)	(0.009)	(0.005)
$\triangle$ Control$_1$	1.074^{***}	0.898^{***}	0.639^{***}	0.528^{***}	0.614^{***}	0.578^{***}
	(0.153)	(0.077)	(0.086)	(0.056)	(0.076)	(0.053)
Entrepreneur					-0.362^{**}	-0.406^{**}
					(0.122)	(0.108)
Prior knowledge	-0.012	0.025			-0.160^{**}	-0.150^{***}
	(0.068)	(0.034)			(0.050)	(0.033)
Peers' assessment	-0.050	$-0.065^{\dagger}$	-0.136^{*}	-0.106^{*}		
of desirability	(0.045)	(0.035)	(0.054)	(0.042)		
Peers are	-0.731^{**}	-0.511^{*}				
entrepreneurs	(0.267)	(0.227)				
Peers' parents self	0.199	0.224^{*}				
employed	(0.168)	(0.105)				
Emotional stability	0.021	0.048	0.088^{*}	0.108^{**}		
	(0.053)	(0.038)	(0.044)	(0.038)		
Extraversion					$-0.060^{\dagger}$	-0.071^{*}
					(0.033)	(0.029)
Conscientiousness					0.097^{**}	0.119^{***}
					(0.033)	(0.024)
Control item 1	0.881^{***}	0.777^{***}	0.402^{***}	0.345^{***}	0.455^{***}	0.419^{***}
	(0.092)	(0.071)	(0.067)	(0.040)	(0.066)	(0.043)
Control item 2	-0.800^{***}	-0.798^{***}			0.076	$0.072^{\dagger}$
	(0.054)	(0.048)			(0.050)	(0.041)
Control item 3			-0.723^{***}	-0.718^{***}		
			(0.046)	(0.043)		
Control item 5			$0.085^{\dagger}$	0.102^{*}	-0.792^{***}	-0.758^{***}
			(0.046)	(0.040)	(0.054)	(0.049)
Control item 6	0.012	0.050			0.053	$0.081^{\dagger}$
	(0.087)	(0.067)			(0.064)	(0.047)
Control item 4					$0.038^{\dagger}$	0.060^{**}
(sdfsm)					(0.023)	(0.019)
Constant	-0.574	-0.491	1.337^{***}	1.270^{***}	0.908^{*}	0.733^{*}
	(0.458)	(0.334)	(0.386)	(0.290)	(0.357)	(0.261)
Adjusted R^2	0.498	0.567	0.433	0.480	0.392	0.412
Underidentification	16.572	25.687	23.670	28.113	23.301	27.098
p-value	0.020	0.012	0.001	0.021	0.001	0.028
Weak instruments 5%	16.10	18.47	16.10	19.13	15.18	19.29
Weak instruments 10%	9.37	10.25	9.37	10.47	9.01	10.52
Weak Instruments	5.376	17.900	14.174	19.343	14.026	22.061
Overidentifying rest.	6	11	6	14	5	15
Hansen-J Test	10.215	14.586	12.567	19.109	6.541	17.631
p-value	.116	.202	.050	.161	.257	.224

N=405 $^{\dagger}p < 0.10$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table 8 shows that all three items reflect the latent attitudinal factor perceived behavioral control. Items 3 and 5 also reflect the latent factor perceived desirability. The coefficients on the measure of perceived behavioral control are several times greater than the coefficients for perceived desirability in both cases and their difference is statistically significant. Item 2 marginally reflects perceived social

norms but the coefficient is very small relative to that on perceived behavioral control. Overall these results show that we can identify perceived behavioral control with the help of the items presented here.

We include the same set of ex ante control variables as previously and eliminated all insignificant control variables iteratively beginning with the least significant. Changes in perceived behavioral control are affected by prior exposure to entrepreneurship through acquaintances, friends and by own experience or interest in the topic. Additionally, peer effects and several personality traits have a significant effect on the perception of behavioral control.

Assessment of the Measurement Model Returning to the criticisms of previous tests of the Theory of Planned Behavior (Ogden, 2003; Ajzen and Fishbein, 2004) discussed above we find that the items used to measure the three attitudinal factors correlate most strongly with the attitudinal factor they are associated with in the previous literature for ten out of ten items at the five percent significance level. However, items also correlate with attitudinal factors they are not primarily associated with in three out of ten cases if we restrict ourselves to the results based on only the model implied instruments. Regressions based on the augmented set of instruments suggest that students' perceptions of social norms are closely linked to their perceptions of desirability. Here we can identify the coefficients of both attitudinal factors but we are not be able to identify all the variances and covariances in the structural model (Bollen and Davis, 2009). The measurement model emerging from these results is graphically presented in Figure 3 in the Appendix.

These results support the distinction between the vocational effects of entrepreneurship education that are mediated by perceptions of desirability and social norms and the skill directed effects mediated by perceptions of behavioral control.

5.2 The Latent Variable Model

Here we provide results from estimation of the latent variable model (Equation 3). The dependent variable is the change between students' ex-ante and ex-post entrepreneurial intentions. The main explanatory variables of interest are the latent attitudinal factors perceived desirability, perceived behavioral control and perceived social norms. These variables are endogenous so we use instrumental variables.

Table 9 provides results from estimation of the latent variable model using OLS and instrumental variables estimators. We estimate the instrumental variables regressions by GMM and use model implied instruments (m) as well as an augmented set of instruments (f) as in the previous section. As noted by Bollen (1996) we are free to choose which items define the scaling equations in the structural equation model. Table 9 contains results for two combinations of scaling items. On the left hand side we use the first item from each set of items and on the right hand side we use the second item from each set. We do this to test the robustness of our results to the choice of scaling items.

The results presented in Table 9 show that the OLS estimates of the effects of the attitudinal factors on entrepreneurial intentions are generally biased. The bias is often statistically significant if we compare OLS to the instrumental variables models with the fullest set of instruments (f). These results from the instrumental variables regressions may also be affected by biases, however the weak instruments test shows that these biases are well below 5%. Furthermore the underidentification test and Hansen's J Test both indicate that we can reject underidentification and that we cannot reject the instruments. Therefore, we rely on the instrumental variables regressions with the full set of instruments (f) in what follows.

Table 9: Results for the Latent Variable Model

	Difference between ex-ante and ex-post entrepreneurial intentions					
Variables	OLS (1,1,1)	IV (1,1,1)		OLS (2,2,2)	IV (2,2,2)	
		m	f		m	f
△ Desirability$_1$	0.387^{***}	0.451^{***}	0.498^{***}			
	(0.053)	(0.085)	(0.054)			
△ Norms$_1$	0.031^{***}	0.044^{***}	0.039^{***}			
	(0.008)	(0.010)	(0.008)			
△ Control$_1$	0.214^{***}	0.217^{**}	0.172^{***}			
	(0.051)	(0.076)	(0.052)			
△ Desirability$_2$				0.354^{***}	0.600^{***}	0.482^{***}
				(0.055)	(0.087)	(0.053)
△ Norms$_2$				0.047^{***}	0.045^{***}	0.053^{***}
				(0.010)	(0.011)	(0.009)
△ Control$_2$				0.143^{*}	0.115	0.190^{**}
				(0.056)	(0.089)	(0.074)
Emotional stability	0.097^{*}	0.105^{**}	0.095^{**}	0.072	0.114^{**}	0.085^{*}
	(0.039)	(0.035)	(0.033)	(0.049)	(0.043)	(0.039)
Openness to experience	-0.026	-0.020	-0.032	-0.059	-0.121^{*}	-0.127^{**}
	(0.062)	(0.050)	(0.040)	(0.062)	(0.052)	(0.040)
Agreeableness	0.099	0.135^{*}	0.132^{*}	0.075	0.081	0.070
	(0.073)	(0.065)	(0.054)	(0.077)	(0.066)	(0.058)
Extraversion	-0.075	-0.135^{**}	-0.114^{**}	-0.030	-0.074	-0.053
	(0.058)	(0.051)	(0.040)	(0.065)	(0.059)	(0.053)
Gender (F= 1)	-0.363^{**}	-0.476^{***}	-0.455^{***}	-0.304^{*}	-0.284^{**}	-0.321^{***}
	(0.130)	(0.101)	(0.097)	(0.116)	(0.090)	(0.082)
Prior interest	0.122^{**}	0.133^{***}	0.129^{***}	$0.113^{\dagger}$	0.131^{*}	0.139^{**}
	(0.041)	(0.039)	(0.039)	(0.057)	(0.052)	(0.049)
Ex ante intention	-0.551^{***}	-0.618^{***}	-0.606^{***}	-0.554^{***}	-0.590^{***}	-0.576^{***}
	(0.040)	(0.033)	(0.028)	(0.048)	(0.040)	(0.034)
Desirability item 1	0.265^{***}	0.295^{***}	0.322^{***}			
	(0.046)	(0.057)	(0.043)			
Desirability item 2				0.255^{***}	0.378^{***}	0.304^{***}
				(0.058)	(0.071)	(0.053)
Norms item 1	$0.024^{\dagger}$	0.035^{**}	0.031^{*}	-0.006	-0.005	-0.009
	(0.013)	(0.013)	(0.011)	(0.014)	(0.011)	(0.011)
Norms item 2	$0.025^{\dagger}$	0.029^{*}	0.030^{**}	0.051^{**}	0.047^{**}	0.053^{***}
	(0.014)	(0.013)	(0.011)	(0.015)	(0.015)	(0.013)
Norms item 3	-0.027	-0.023	-0.029^{*}			
	(0.017)	(0.015)	(0.013)			
Desirability item 1	0.026	0.033^{*}	0.038^{**}			
(sdfsm)	(0.016)	(0.015)	(0.013)			
Desirability item 2				0.018	0.032	$0.032^{\dagger}$
(sdfsm)				(0.021)	(0.020)	(0.018)
Norms item 1	-0.001^{*}	$-0.001^{\dagger}$	-0.001^{**}	$-0.001^{\dagger}$	$-0.001^{\dagger}$	-0.001^{*}
(sdfsm)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Control item 4	0.063^{**}	0.062^{***}	0.071^{***}	0.071^{**}	0.076^{***}	0.067^{***}
(sdfsm)	(0.023)	(0.017)	(0.015)	(0.023)	(0.022)	(0.012)
Constant	0.166	0.379	0.245	0.299	0.104	0.475
	(0.532)	(0.483)	(0.399)	(0.567)	(0.542)	(0.446)
Adjusted R^2	.520	.502	.500	.483	.431	.456
Underidentification		23.046	25.927		22.723	25.593
p-value		.003	.017		.004	.019
Weak instruments 5%		16.80	18.73		16.89	18.73
Weak instruments 10%		9.64	10.33		9.64	10.33
Weak Instruments		10.300	29.323		11.976	21.888
Overidentifying rest.	–	7	12	–	7	12
Hansen-J Test		11.020	13.616		7.498	12.754
p-value		.138	.326		.379	.387

N=405 $^{\dagger}p < 0.10$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Note that the instrumental variables regression which relies solely on the model implied instruments is broadly comparable in outcome to that with the full set of instruments. However, the weak instruments test indicates that results may be slightly more biased than results from the regressions with the full set of instruments. Furthermore results from the two different sets of scaling items are most similar when we use the full set of instruments and are statistically indistinguishable for perceived desirability and perceived behavioral control.

Table 9 shows that all three attitudinal factors have a significant positive effect on entrepreneurial intention. Perceived desirability has the strongest effect on students' intentions, followed by perceived social norms and perceived behavioral control.[15] We control for a number of additional influences on students' entrepreneurial intentions. The most important is gender. Women have significantly lower entrepreneurial intentions than men. Also, emotional stability has a stable positive effect on entrepreneurial intentions that is of a comparable size across all regressions and that is not affected by the choice of scaling items. A one standard deviation increase in this measure has an effect that is about half as strong as a one standard deviation increase in perceived behavioral control. Finally, prior interest emerges as having a stable and positively significant effect on students' entrepreneurial intentions as one would expect.

5.3 Content Complementarity

Above we show that the latent attitudinal factors posited by the Theory of Planned Behavior can be identified in the data and that positive increases in these factors increase students' entrepreneurial intentions. Figure 2 and Table 2 also showed that students' entrepreneurial intentions become polarized by the course - ex post intentions have greater variance than ex ante intentions.

Here we extend the latent variable model slightly to investigate how interactions of the latent attitudinal factors affect students' entrepreneurial intentions. The extended model includes interaction terms for two of the three combinations of the latent variables. Results including the interaction between perceived desirability and perceived social norms are not presented as this interaction was never significant[16].

Table 10 below shows that the interaction of perceived desirability and perceived behavioral control is positive and significant once we apply instrumental variables. The result is robust to the choice of scaling items and the estimated coefficient is comparable across the regressions reported in Table 10 [17]. The size of the effect is quite small however, adding approximately 1% to the direct effect of perceived behavioral control on entrepreneurial intentions. A test in which we included quadratic terms of the attitudinal factors showed that the result is not due to misspecification of the regression function.

This finding reveals that course content directed at entrepreneurship skills (e.g. business plan writing) and content directed at the vocational decisions of students (e.g. "war stories") complement each other in helping students to form their intention towards entrepreneurship. The strength of the effect is likely to depend on how courses are structured and more work will be necessary to determine how variation in course design affects the complementarity of different course components.

As noted above the course we analyze here contains lectures of successful entrepreneurs as well as a course element in which students work on business plans with entrepreneurs on ongoing ventures. Or-

[15] Note that as a standard deviation change in perceived social norms is six times larger than that in perceived behavioral control, changes in perceived behavioral control have the weakest effect on entrepreneurial intentions.

[16] Results are available from the authors on request

[17] The interaction of perceived social norms and perceived behavioral control is not robust to such controls. Therefore, we do not discuss it any further.

Table 10: Results for the Extended Latent Variable Model

	Difference between ex-ante and ex-post entrepreneurial intentions					
Variables	OLS (1,1,1)	IV (1,1,1)		OLS (2,2,2)	IV (2,2,2)	
		m	f		m	f
$\triangle$ Desirability$_1$	0.378^{***}	0.504^{***}	0.511^{***}			
	(0.055)	(0.068)	(0.046)			
$\triangle$ Norms$_1$	0.032^{***}	0.038^{***}	0.038^{***}			
	(0.008)	(0.008)	(0.007)			
$\triangle$ Control$_1$	0.215^{***}	0.230^{**}	0.182^{***}			
	(0.050)	(0.072)	(0.046)			
$\triangle$ Desirability$_1\times$	0.014	0.043^{*}	0.033^{*}			
$\triangle$ Control$_1$	(0.011)	(0.019)	(0.015)			
$\triangle$ Norms$_1\times$	-0.006	-0.009	$-0.009^{\dagger}$			
$\triangle$ Control$_1$	(0.004)	(0.006)	(0.005)			
$\triangle$ Desirability$_2$				0.351^{***}	0.545^{***}	0.459^{***}
				(0.056)	(0.074)	(0.049)
$\triangle$ Norms$_2$				0.048^{***}	0.045^{***}	0.048^{***}
				(0.009)	(0.010)	(0.008)
$\triangle$ Control$_2$				0.157^{**}	$0.130^{\dagger}$	0.230^{***}
				(0.054)	(0.073)	(0.050)
$\triangle$ Desirability$_2\times$				0.036^{*}	0.038^{*}	0.040^{***}
$\triangle$ Control$_2$				(0.016)	(0.017)	(0.012)
$\triangle$ Norms$_1\times$				-0.008	-0.015^{*}	-0.013^{*}
$\triangle$ Control$_2$				(0.005)	(0.006)	(0.006)
Emotional stability	0.097^{*}	0.127^{***}	0.123^{***}	0.075	0.122^{**}	0.092^{*}
	(0.038)	(0.032)	(0.031)	(0.045)	(0.039)	(0.036)
Openness to experience	-0.017	-0.010	-0.005	-0.039	-0.063	-0.066
	(0.060)	(0.042)	(0.037)	(0.060)	(0.043)	(0.041)
Agreeableness	0.086	0.121^{*}	$0.105^{\dagger}$	0.057	0.057	0.080
	(0.074)	(0.061)	(0.055)	(0.074)	(0.063)	(0.054)
Extraversion	-0.071	-0.105^{*}	-0.089^{*}	-0.017	-0.078	-0.050
	(0.057)	(0.052)	(0.039)	(0.066)	(0.059)	(0.054)
Gender (F= 1)	-0.365^{**}	-0.505^{***}	-0.465^{***}	-0.337^{**}	-0.292^{**}	-0.302^{***}
	(0.133)	(0.102)	(0.099)	(0.113)	(0.090)	(0.082)
Prior interest	0.119^{**}	0.115^{**}	0.099^{*}	0.117^{*}	0.155^{**}	0.137^{**}
	(0.041)	(0.039)	(0.039)	(0.054)	(0.049)	(0.042)
Ex ante intention	-0.540^{***}	-0.566^{***}	-0.554^{***}	-0.541^{***}	-0.563^{***}	-0.559^{***}
	(0.040)	(0.032)	(0.030)	(0.046)	(0.038)	(0.034)
Desirability item 1	0.262^{***}	0.322^{***}	0.318^{***}			
	(0.046)	(0.045)	(0.036)			
Desirability item 2				0.258^{***}	0.347^{***}	0.304^{***}
				(0.057)	(0.057)	(0.049)
Norms item 1	$0.024^{\dagger}$	$0.021^{\dagger}$	0.023^{*}	-0.008	-0.010	-0.013
	(0.013)	(0.012)	(0.012)	(0.014)	(0.011)	(0.010)
Norms item 2	0.024	0.037^{***}	0.033^{***}	0.058^{**}	0.054^{***}	0.058^{***}
	(0.015)	(0.011)	(0.010)	(0.016)	(0.015)	(0.014)
Norms item 3	-0.026	-0.032^{*}	-0.033^{**}	-0.019	-0.003	-0.007
	(0.017)	(0.014)	(0.012)	(0.016)	(0.014)	(0.012)
Desirability item 1	0.027	0.032^{*}	0.031^{**}			
(sdfsm)	(0.017)	(0.014)	(0.011)			
Desirability item 2				0.018	0.032	0.022
(sdfsm)				(0.022)	(0.019)	(0.017)
Norms item 1	$-0.001^{\dagger}$	-0.000	-0.000	$-0.001^{\dagger}$	-0.000	-0.000
(sdfsm)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Control item 4	0.060^{*}	0.042^{**}	0.055^{***}	0.067^{**}	0.067^{***}	0.058^{***}
(sdfsm)	(0.024)	(0.016)	(0.015)	(0.023)	(0.020)	(0.012)
Control item 5	-0.026	-0.054^{**}	-0.059^{**}	-0.023	-0.042^{*}	-0.026
(sdfsm)	(0.027)	(0.020)	(0.020)	(0.031)	(0.020)	(0.018)
Constant	0.149	-0.120	-0.128	0.141	-0.125	0.016
	(0.538)	(0.454)	(0.400)	(0.568)	(0.479)	(0.440)

Table 10: Results for the Extended Latent Variable Model

	Difference between ex-ante and ex-post entrepreneurial intentions					
Variables	OLS (1,1,1)	IV (1,1,1)		OLS (2,2,2)	IV (2,2,2)	
		m	f		m	f
Adjusted R^2	.521	.489	.497	.488	.445	.464
Underidentification		24.173	24.172		23.659	26.470
p-value		.012	.086		.014	.048
Overidentifying rest.	–	10	18	–	10	16
Hansen-J Test		14.181	18.526		11.274	15.816
p-value		.165	.236		.337	.394

N=405 $^{\dagger}p < 0.10$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

ganizing this course element is costly. The results we provide indicate that it is also valuable - the direct effect of perceived desirability on the formation of entrepreneurial intentions is strong and additionally, there is a significant effect on students' ability to benefit from the skill directed course content.

If students' perceptions of the desirability of entrepreneurship become more polarized as indicated by the results set out in Table 1 this counteracts the observed positive shift due to perceived behavioral control that is also visible in that table. Our data show that the effect of perceived behavioral control only overcomes assessments of desirability (Overly skilled) in marginal cases in which students' perceptions of the desirability of entrepreneurship have fallen very slightly after the course. There are 43 such students in this sample. In contrast, cases in which students' enthusiasm for entrepreneurship is not aligned with their own assessments of their skills (Overly enthusiastic) can occur in students who experience strong reductions in the perception of behavioral control. However, there are only 33 students of this type in the sample and most of them display moderate over-enthusiasm.

Overall we find that both vocational elements of the course and skill directed elements contribute to alterations in students' entrepreneurial intentions. These intentions may increase or fall as a result of the course. There is only a small proportion of students for whom different course components have countervailing effects. In most cases these result in moderate changes of entrepreneurial intentions. This evidence further supports the complementarity of different course components found above.

6 Conclusion

This study distinguishes between course content that affects skills and course content that changes students' attitudes to entrepreneurship as a vocation. This distinction is implicit in previous work on entrepreneurship education (Souitaris et al., 2007; Liñán, 2008; Fitzsimmons and Douglas, 2010). In this literature the effects of skill directed course content are measured by items reflecting perceived behavioral control. Additionally, we measure course content affecting students' vocational aspirations by items reflecting perceived social norms and perceived desirability.

Previous research sometimes shows that entrepreneurship education raises the entrepreneurial intentions of the average student (Souitaris et al., 2007), sometimes the opposite is true (Oosterbeek et al., 2010; von Graevenitz et al., 2010). Additionally, one previous study (Fitzsimmons and Douglas, 2010) shows that vocational course elements are a substitute to course elements that are skill directed. In contrast, this study shows these types of content to be weak complements.

In our view these contradictory findings can be explained if entrepreneurship education has different effects on perceptions of skill than it has on students' vocational aspirations. If an entrepreneurship

course is well designed it will raise almost all students' perceptions of their own entrepreneurship skills. This is regularly found to be the case in the literature. This effect will make even those students more inclined towards entrepreneurship that are not likely to choose entrepreneurship as a vocation. In contrast, the effect of entrepreneurship education on vocational aspirations is primarily to make students' perceptions of the desirability and social norms affecting entrepreneurs more concrete, contributing to more polarized entrepreneurial intentions. This means that the change in the entrepreneurial intention of the average student does not reveal much about the effects of entrepreneurship education. It is to be expected that sometimes this average may increase while at other times it falls. The average is more likely to rise in groups of students that are partly or wholly self selected into entrepreneurship courses as is the case in the sample used by Souitaris et al. (2007).

If entrepreneurship education contributes to sorting would-be entrepreneurs from the remaining students while raising all students' perceptions of their entrepreneurship skills, then these two effects will counteract for students who aspire less to entrepreneurship as a vocation after a course. Depending on what proportion of students is affected by these countervailing effects researchers will find that vocational content and skill directed content of entrepreneurship courses may be complements or substitutes.

Souitaris et al. (2007) argue that entrepreneurship educators should focus on changing "hearts and minds". Our own results suggest a more nuanced approach - entrepreneurship educators must be aware of the sorting function of entrepreneurship education. Rather than attempting to convince all and sundry to see entrepreneurship as their vocation such education should help students choose what they are best suited for. As we have also found that teaching entrepreneurship skills may reduce some students' ability to make that choice clearly, we would argue that skill directed course content should not be emphasized in compulsory entrepreneurship courses taken by students not exposed to the subject previously. In contrast, once students have self selected into a course that seeks to strengthen their previous experience of entrepreneurship it is more likely that the skill component and the vocational components will be complements. Thus entrepreneurship skills should receive greater weight in such later courses.

While we have sought to minimize the possibility that our results are affected by measurement error, selection bias or attrition bias it is clear that results would be even more convincing if a quasi-experimental approach to the identification of the effects of different types of educational content were adopted. We leave this for future work. Additionally, it would seem important to study the effects of entrepreneurship education in a series of successive courses to further test our conclusions.

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7 Appendix

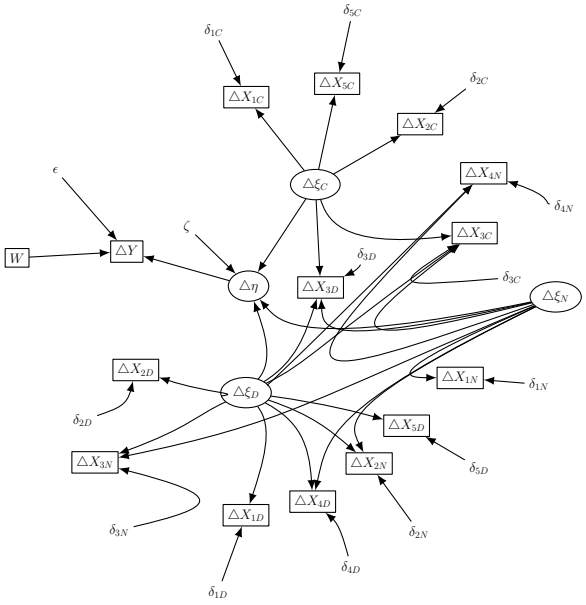

Figure 3: Path Diagram of the Estimated Structural Equation Model
Note: This figure sets out the causal relationships in the structural equation model estimated in this paper. Variables presented in circles are latent variables: η - entrepreneurial intention and ξ_D perceived desirability, ξ_N perceived social norms, ξ_C perceived behavioral control. Variables in squares are observed items, e.g. X_{10} or exogenous variables, e.g. W. All remaining variables are i.i.d. error terms, e.g. ϵ or δ_1.