

Entrepreneurial intention modeling using hierarchical multiple regression

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Abstract. The goal of this study is to identify the contribution of effectuation dimensions to the predictive power of the entrepreneurial intention model over and above that which can be accounted for by other predictors selected and confirmed in previous studies. As is often the case in social and behavioral studies, some variables are likely to be highly correlated with each other. Therefore, the relative amount of variance in the criterion variable explained by each of the predictors depends on several factors such as the order of variable entry and sample specifics. The results show the modest predictive power of two dimensions of effectuation prior to the introduction of the theory of planned behavior elements. The article highlights the main advantages of applying hierarchical regression in social sciences as well as in the specific context of entrepreneurial intention formation, and addresses some of the potential pitfalls that this type of analysis entails.

Key words: hierarchical multiple regression; entrepreneurial intentions; effectuation

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1. Introduction

Entrepreneurial intentions are a relatively young research area that has attracted many entrepreneurship scholars and seen a quick surge in a number of papers and studies. Defined as an interdisciplinary field, research into entrepreneurial intentions bridges the gap between behavior prediction models originated in the field of psychology and contemporary entrepreneurship research. The seminal work was focused on the description of personality characteristics of prospective entrepreneurs. Though a majority of entrepreneurs share some common characteristics such as proactive behavior, achievement

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motivation, internal locus of control and tolerance for ambiguity, in most cases, those personality characteristics have no predictive power and cannot be used to detect future entrepreneurs. To advance the understanding of self-employment as a career choice, entrepreneurship scholars have adopted the concept of behavioral intention and the theory of planned behavior [2] as a theoretical framework for predicting entrepreneurial behavior. Behavioral intention models are developed as part of social psychology research. This research implies that every individual influences their own behavior. In line with that, behavioral intention can be defined as a person's perceived likelihood that he or she will engage in a given behavior, or, in other words, intentions represent a person's motivation in the sense of her or his conscious plan or decision to exert effort to enact the behavior [7]. According to the theory of planned behavior, intentions are the most proximate predictors of behavior and are directly influenced by three categories of antecedents – personal attitudes, social norms, and perceived behavioral control. Based on the previous research, the theory of planned behavior accounted for 27% and 39% of the variance in behavior and intention, respectively [4].

From a methodological standpoint, research on entrepreneurial intentions is yet to apply more sophisticated data analysis methods. Until recently, correlation analysis and simple linear regression were predominantly used to test the relationship between various factors and entrepreneurial intentions [1, 5, 20]. The main focus has been on the improvement of scales' validity and reliability and consequently the reduction of the measurement error, as well as on the enhancement of the sample size and quality to achieve greater statistical power. However, a straightforward application of correlation analysis and simple (simultaneous) linear regression may not be the best choice when trying to boost predictive power of the model or to explain the most variability in the intention variable with the fewest possible predictors. It should be noted that correlation analysis itself does not indicate a true causal relationship, while simple linear regression demonstrates certain weaknesses when introducing new variables to the model. To account for these limitations, the authors employ hierarchical linear regression analysis as the primary data analysis procedure in the process of incorporating dimensions of effectuation in the entrepreneurial intention prediction model.

2. Previous research

Effectuation and entrepreneurial intention prediction models represent research fields that have rarely crossed their paths. Previous research in entrepreneurial intention was focused on personality traits, socio-demographic variables,

situational factors, and cultural idiosyncrasies of the geographical area in which an individual was born and raised.

The notion that entrepreneurship involves individuals with unique personality characteristics has been one of the major themes in the academic community for decades. The underlying assumption is that people tend to pursue careers and seek business environments that match their personalities [11]. Several personality traits (such as the need for achievement, locus of control, risk-taking propensity and tolerance for ambiguity) did show to be positively correlated with entrepreneurial behavior. Nevertheless, the significance and predictive power of those variables are a matter of an ongoing dispute among researchers.

Another stream of studies explores socio-demographic variables such as age, gender, education background, and the presence of a parental role model. According to [17], most men and women enter the world of entrepreneurship in the 25-34 year category, coupled with the prevalence of men in all age groups. Though there is a positive relationship between the entrepreneur's age and financial success of the venture, age as a variable has no predictive power in the context of pursuing an entrepreneurial career. In terms of male and female start-up entrepreneurship, gender can be a point of difference in a sense that men are more motivated by financial gain while women on average seek out personal fulfillment and a chance to balance private and professional life. These differences are reflected in personal attitudes and perceived behavioral control as the main antecedents of entrepreneurial intention. Education, especially entrepreneurship education, can have a positive impact on an individual's self-employment decision but more experimental research is necessary to confirm the direction of the causal relationship. Finally, exposure to an entrepreneurial lifestyle (in other words, having a parental role model) increases the likelihood that individuals will become self-employed.

Situational variables or triggering events, such as moving to a different city or country, losing a job and inheritance, can induce individuals to start contemplating a career of self-employment. Those factors are usually divided into "pull factors" (e.g., business opportunity recognition) and "push factors" (e.g., unemployment). Combined with the main antecedents of entrepreneurial intention, situational variables do show a certain predictive power toward choosing an entrepreneurial career [3].

In terms of cultural heritage of the area where an individual was born and raised, the relationship between cultural idiosyncrasies and entrepreneurial activity can be approached on the national level (e.g., influence of culture on aggregate measures of entrepreneurial activity – such as the number of start-ups), on the corporate level (the relationship between national culture and

corporate culture), and on the level of an individual (e.g., values, beliefs, motivation). In the context of Hofstede's dimensions of culture [10], a positive relationship has been shown between entrepreneurial activity and cultural environments characterized by high levels of individualism and masculinity and low levels of power distance and uncertainty avoidance. Furthermore, another study confirmed a strong influence of social norms on entrepreneurial intentions of individuals, and only a marginal role of personal attitudes in career choice decisions [19]. Similar conclusions were reached in a study of a sample of Malaysian students indicating that certain intention antecedents have a higher or a lower level of importance depending on the cultural context [16].

Effectuation is a new field within entrepreneurship theory and research introduced by Saras Sarasvathy [18] that focuses on entrepreneurial decision making in highly uncertain environments in which the future is unpredictable. Creation is at the core of effectual logic – effectuators begin with who they are, what they know and whom they know, and, through interaction with other people, start creating opportunities by surrounding themselves with self-selected partners whose commitment to the venture reduces uncertainty and defines the goals. Since starting a business is a process characterized by high uncertainty, the hypothesis behind merging these two theoretical fields is that effectual individuals are more likely to choose a career as an entrepreneur. For the purpose of this study, effectuation will be assessed through five main principles of effectuation (the Bird in Hand Principle, the Affordable Loss Principle, the Crazy Quilt Principle, the Lemonade Principle, and the Pilot in the Plane Principle) and one additional dimension – the tendency to control the future.

From a methodological standpoint, several paths of studies can be identified. Firstly, many authors have focused on the development and improvement of measurement scales to assess entrepreneurial intentions and the main antecedents. Issues such as increasing reliability and validity of the scales while keeping the number of items fairly small not to overwhelm the respondent are at the center of these studies [9, 12]. Secondly, new instruments have been developed to measure particular theoretical constructs related to entrepreneurship and to examine their role in entrepreneurial intention models [8]. Finally, nonstandard statistical methods (such as principal component analysis, neural networks, decision trees and support vector machines) have been applied in classifying and modeling entrepreneurial intentions [24, 25]. Nevertheless, correlation analysis and linear regression analysis are still predominant statistical methods applied in this field of research.

3. Methods

3.1. Sample and data collection

The sample frame was composed of second-year graduate students at the Faculty of Economics in Osijek majoring in one of the following areas: financial management, marketing, general management, business informatics and entrepreneurship. Business students, especially graduate students, are probably the most frequently represented respondents in studies on entrepreneurial intentions as they fit several criteria. First, business students, particularly those with a major in entrepreneurship, have a chance to gain the knowledge and skills necessary to start and run a business. Moreover, business students tend to identify themselves with their future career choice which makes them feel pulled toward it, rather than being pushed into it. Second, previous research has confirmed a positive influence of education on entrepreneurial intention formation [6]. Finally, graduate students are at the age when most people decide to pursue an entrepreneurial career [17] and the fact that soon they will complete their formal education may serve as a triggering effect to speed up the decision of becoming an entrepreneur.

Data was collected using self-report written questionnaires that were distributed to students in the classroom during December 2012 and January 2013. Generally, 345 students participated in the study and a total of 333 questionnaires were found to be suitable for further analysis. As is often the case with similar studies, the authors used convenience sampling as the respondents were selected based on their accessibility and proximity (the proportion of the students included in the sample was 59.7%). On average, these participants were 24.6 years old (standard deviation of 1.70 years) and 30.9% of them were female. A small group of respondents (13.8%) had some kind of previous entrepreneurial experience (predominantly in a family business), while 28.5% of them had at least one self-employed parent.

3.2. Measures

3.2.1. Dependent variable

Entrepreneurial intent was set as a dependent variable and measured with a five-item measurement construct adapted from [12]. Each item of the construct was scored on a five-point Likert scale (from “Strongly disagree” to “Strongly agree”). An example item is “My professional goal is to become an entrepreneur.” Reasons for applying a five-point Likert scale are twofold. First,

a previous study recommends the usage of several modalities when assessing the entrepreneurial intention to capture the strength of the intent [22]. Second, a five-point Likert type scale is especially suitable for collecting data on populations that have educational systems with grades from 1 to 5, as individuals are used to thinking and evaluating things in terms of that range [13]. The reliability of entrepreneurial intent construct was 0.952 (Cronbach's Alpha).

3.2.2. Independent variables

The authors used multi-item constructs to assess three main antecedents (personal attitudes, subjective norms and perceived behavioral control) of entrepreneurial intentions according to the theory of planned behavior, and the main dimensions of effectuation according to the seminal work of Sarasvathy [18]. All constructs followed the five-point Likert-type question format and the final score for each of the measurement constructs (except for the subjective norms) is the average of the scores on the items included in the construct. For the purpose of this study, subjective norms were measured from the perspective of three reference groups (family, friends and colleagues) and the strength of each normative belief was weighted by the individual's motivation to comply with the specific reference group.

All five principles of effectuation and one additional dimension were measured using measurement constructs developed particularly for this study. The questions were case-based in a way that each question included a short scenario in which the main character contemplates a decision whether or not to start a new venture. The respondents had to identify themselves with the main character and choose a set of actions (presented as statements) some of which are effectual and some are not effectual. The statements are designed as five-point Likert-type questions and the final score for each construct is the average of the scores on the items included in the construct.

Psychometric testing of the proposed constructs included reliability measures analysis (Cronbach's Alpha coefficient, Alpha-if-deleted indicator, inter-item correlation, and item-total correlation) and validity measures analysis. In terms of reliability, measurement constructs related to effectuation have relatively lower Cronbach's Alpha values which is quite common (and acceptable) with the newly developed constructs. According to [14], all proposed constructs have adequate reliability (see Table 1). Exploratory factor analysis was employed to establish the construct validity of the observed constructs (see Table 2).

3.2.3. Control variables

The analysis included four binary control variables that potentially influence the intention: 1) focus of education (major in entrepreneurship vs. major in a non-entrepreneurship field), 2) employment status (employed vs. unemployed), 3) entrepreneurship experience (type of previous working experience, if any), and 4) parents as role models in entrepreneurship.

4. Methodology and results

The predictive power of effectuation dimensions was tested using hierarchical regression analysis. According to [21], hierarchical multiple regression should be applied in studies based on strong theoretical frameworks when a researcher wants to test the explanatory power of suggested regression models. This method is one of three main variants of the basic multiple regression procedure, along with standard (simultaneous) multiple regression and stepwise regression. Differences among these three methods are primarily related to what happens to overlapping variability due to correlated independent variables and who determines the order of entry of independent variables into the equation. Standard multiple regression is used to evaluate the relationship between a set of independent variables and a dependent variable by entering all the independent variables at once. Each independent variable is evaluated in terms of what it adds to the prediction of the dependent variable that is different from the predictability afforded by all other independent variables [21]. Stepwise regression is primarily used in the exploratory phase of research or for purposes of pure prediction, not theory testing. Hierarchical (or sequential) regression, however, allows the researcher to enter independent variables cumulatively according to some specified hierarchy that is dictated in advance by the theory and logic of the research. Therefore, a greater responsibility is placed on the researcher to make a strong theoretical foundation of research hypotheses. In addition to that, hierarchical regression does not have the same drawbacks present in stepwise regression, regarding degrees of freedom, identification of the best predictor set of a pre-specified size, and replicability [22]. For an extensive description of how these methods of multiple regression are computed, please see [15].

By its nature, hierarchical regression assumes building successive linear regression models by adding more predictors. With each addition, r^2 and partial coefficients of each variable are calculated, which basically means that with the addition of the i -th independent variable, multiple regression analysis at that stage is simultaneous in i variables.

The general purpose of multiple regression is to model the relationship between two or more explanatory variables and a response variable by fitting a linear equation to the observed data. The regression equation takes the following form:

$$y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \dots + \beta_p x_{ip} + \varepsilon_i \quad \text{for } i = 1, 2, \dots, n. \quad (1)$$

Unknown parameters are denoted by β , independent variables are denoted by x and a dependent variable by y . The outcome of multiple linear regression represents the best prediction of a dependent variable from several continuous (or dichotomous) independent variables.

In this study, statistical analysis included a total of nine predictor variables and four control variables. Correlation analysis confirmed a statistically significant relationship between entrepreneurial intention and all three antecedents according to the theory of planned behavior, as well as a statistically significant relationship between entrepreneurial intention and two dimensions of effectuation (see Table 1).

	1	2	3	4	5	6	7	8	9	10
(1) Personal attitude	1	.514**	.252**	.118*	-.003	.164**	.157**	.214**	.271**	.741**
(2) Perceived behavioral control		1	.179**	.039	-.158**	.025	.157**	.204**	.182**	.671**
(3) Subjective norms			1	.164**	.080	.207**	.184**	.159**	.160**	.161**
(4) Bird in Hand Principle				1	.149**	.167**	.046	.165**	.042	-.023
(5) Affordable Loss Principle					1	.296**	.195**	.106	.052	-.099
(6) Crazy Quilt Principle						1	.408**	.279**	.323**	.019
(7) Lemonade Principle							1	.272**	.255**	.079
(8) Pilot in the Plane Principle								1	.422**	.185**
(9) Tendency to control the future									1	.219**
(10) Entrepreneurial intention										1
Number of items	5	6	3	4	6	4	4	4	4	5
Cronbach's Alpha	.908	.782	.879	.719	.771	.605	.702	.640	.624	.952
Kaiser-Meyer-Olkin Measure	.868			.792						
Bartlett's Test of Sphericity	$\chi^2 = 1797.243$, df = 300, p < 0.001			$\chi^2 = 1887.929$, df = 325, p < 0.001						
% of variance explained	40.513	16.160	12.822	10.342	17.426	5.067	8.327	4.337	6.606	

** Correlation is significant at the 0.01 level.

* Correlation is significant at the 0.05 level.

Table 1: Correlation matrix for entrepreneurial intentions and nine predictor variables

In the context of the theory of planned behavior, factor analysis of variables confirmed the existence of three separate factors (three main antecedents) that explain 69.49% of variance. Furthermore, factor analysis of main effectuation dimensions (26 items) resulted in six factors that cumulatively explain 52.41% of variance. All predictor variables are not highly correlated ($r < 0.514$) supporting the assumption of no multicollinearity. In the next step, the relationship among variables is tested using hierarchical regression analysis and the results are presented in Table 2.

The no autocorrelation assumption is not violated (Durbin - Watson test = 1.769) and multicollinearity is not an issue according to VIF (<1.755) and the tolerance indicator (>0.57). F-statistic is statistically significant ($p < 0.001$) in all three models. Standardized regression coefficients and adjusted coefficients of determination are presented in Table 2. When interpreting the results of hierarchical regression, it is recommended to use an adjusted coefficient of determination, as it accounts for the size of the sample and the number of independent variables.

	Model 1	Model 2	Model 3
<i>Control variables</i>			
Focus of education	.325***	.303***	.090**
Employment status	.095	.072	-.001
Entrepreneurship experience	.097	.085	-.004
Entrepreneurship role models	.063	.062	.037
<i>Effectuation variables</i>			
P1: Bird in Hand Principle		-.008	-.087**
P2: Affordable Loss Principle		-.032	.018
P3: Crazy Quilt Principle		-.055	-.059
P4: Lemonade Principle		-.013	-.064
P5: Pilot in the Plane Principle		.119*	.025
Tendency to control the future		.143*	.022
<i>Theory of planned behavior variables</i>			
Personal attitude			.542***
Perceived behavioral control			.377***
Subjective norms			-.017
r ²	.147	.189	.690
Adjusted r ²	.136	.163	.677
Δ r ²	.147	.042	.501
F-test	13.506***	2.637*	163.917***
Δ F-test	13.506***	7.513***	52.088***

*** p < 0.001, ** p < 0.01, * p < 0.05

Table 2: Hierarchical regression analysis

As is usually the case with this type of model development, control variables are included in model 1. Only one variable (education focus or major) is a statistically significant predictor of entrepreneurial intention and it explains approximately 13.6% of variability in the response variable ($F=13.506$, $p<0.001$). In addition to control variables, model 2 incorporates six effectuation dimensions only two of which are statistically significant. Generally, the model explains 16.3% of the variance which represents only a modest improvement relative to model 1 ($F=7.513$, $p<0.001$). Finally, three main antecedents of entrepreneurial intention are added to model 3. The predictive power of these constructs has been confirmed in numerous previous studies, which is the main reason for adding these variables in the last model. The predictive power of the model is significantly higher (67.7%) than in model 2 ($F=52.088$, $p<0.001$). In model 3, personal attitude ($\beta=0.542$, $p<0.001$), perceived behavioral control ($\beta=0.377$, $p<0.001$) and focus of education ($\beta=0.090$, $p<0.01$) are statistically significant predictors, which confirms the results of the previous research. Two things should be noted here. First, effectuation dimensions lost their predictive power (except for the Bird in Hand principle, $\beta=-0.087$, $p<0.01$) as elements of the theory of planned behavior were introduced to the model. Second, education focus (entrepreneurship or non-entrepreneurship major) lost its power as a predictor in model 3. To sum up, graduate students who have strong positive attitudes toward an entrepreneurial career in addition to the knowledge and skills necessary to start a new venture, have the strongest intention to become entrepreneurs.

5. Discussion and conclusion

A thorough and thoughtful analysis of previous studies on the theory of planned behavior and the theory of effectuation provided theoretical evidence to support the inclusion of effectuation dimensions in the theory of planned behavior. However, the goal of merging these two fields was not to maximize the prediction power of the model, but to separately test the relationship between effectuation variables and entrepreneurial intention before and after the addition of personal attitude, perceived behavioral control and subjective norms as the main antecedents of intent. The results of hierarchical regression showed that two dimensions of effectuation have a quite modest predictive power relative to entrepreneurial intention (model 2). However, once elements of the theory of planned behavior were included in the model (model 3), effectuation dimensions lost their predictive power. The potential explanation for such results can be found in the assumption that part of the information present in the effectuation dimensions is already incorporated in personal attitude and perceived behavioral control. In light of that, recommendations for further research are directed

toward the application of more sophisticated statistical methods, such as structural equation modeling, to test for moderation and mediation effects. Additionally, this study has several limitations that arise from having a convenience sample of second-year graduate students from one university as well as the fact that we collected self-reported data at only one point in time. Therefore, the findings are not generalizable beyond the selected sample and it is difficult to determine true causality between some variables such as education and entrepreneurial intention. These limitations can be overcome by altering the sampling strategy and applying experimental research design.

From a methodological standpoint, simple linear regression was until recently a method of choice for studies focusing on entrepreneurial intentions. Nevertheless, we argue that the application of hierarchical regression sheds more light on the matter and provides a clearer picture of where future studies should be directed. First, it provides a researcher with the opportunity to examine the incremental validity of the newly introduced variables in a sequential process grounded on strong theoretical foundations. Second, hierarchical regression is an appropriate analytical strategy when variance on a dependent variable is explained by predictor variables that are correlated with each other [15], which is often the case in social science research. However, the use of hierarchical regression is not as simple as it seems. To reach valid and relevant results, researchers should follow these guidelines: (a) apply hierarchical regression primarily when testing theory-based hypotheses (as opposed to determining the “optimal” set of predictors), (b) provide a clear and thorough rationale for selecting a specific order of entry of predictor variables, and (c) address the problem of multicollinearity that may affect calculations regarding individual predictors. When applied in an appropriate way, hierarchical regression provides useful insights into differences found through comparison of progressive steps of entering prospective predictors.

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