**The Heterogeneous Process of Entrepreneurial Learning by Doing**

**Abstract**

While it is generally agreed that the performance of new ventures is strongly influenced by entrepreneurial capability, whether entrepreneurial capability can be enhanced through learning-by-doing (LBD) has been supported by conflicting evidence. This paper employs experiential learning theory to frame an empirical study of processes by which entrepreneurial experience is transformed into generalizable entrepreneurial knowledge that enhances entrepreneurial capability. The results show that entrepreneurial LBD is heterogeneity across individuals and is most sensitive to experience among entrepreneurs with high educational ability and diverse occupational experience. These results, which help reconcile the conflicting results found by previous studies, have implications for both theory and practice.

**1. Introduction**

Ventures established by serial entrepreneurs usually perform better than those founded by first-time entrepreneurs. This discrepancy in performance may be the result of the selection effect (i.e., people with high entrepreneurial capability become serial entrepreneurs) and/or the learning-by-doing effect (LBD) (i.e., serial entrepreneurs improve their entrepreneurial ability through their entrepreneurial experience). Having empirically examined this discrepancy by applying divergent methods to various samples, studies have agreed on the existence of the selection effect but found conflicting results on the LBD effect. For example, while Eesley and Roberts (2007) and Stam et al. (2008) presented evidence of a strong LBD effect on entrepreneurial activities, Gompers et al. (2006, 2008), Lafontain and Shaw (2016) identified a positive but limited LBD effect, and Parker (2013) found a temporary LBD effect. Nevertheless, others such as Chen (2014) and Rocha et al. (2015) found no LBD effect at all. Hence, these conflicting results raise questions about the existence of the entrepreneurial LBD effect.

To address this lack of consensus in the literature, a stream of research has tested the conditions under which entrepreneurs are subject to the LBD effect. These papers have tested several moderating factors of the relationship between entrepreneurial experience and venture performance and found industry similarity (Lafontaine and Shaw, 2016; Toft-Kehler, Wennberg, and Kim, 2014), temporal similarity (Parker, 2013; Rocha, Carneiro, and Varum, 2015; Toft-Kehler, Wennberg, and Kim, 2014), and geographic similarity (Toft-Kehler, Wennberg, and Kim, 2014), all of which are external variables rather than individual characteristics. However, the individual characteristics of serial entrepreneurs that have a strong entrepreneurial LBD effect have not yet been identified. The answer to this question is critical to entrepreneurs, investors, and policy makers, all of whom depend on aggregated entrepreneurial experience to predict future venture performance (Toft-Kehler, Wennberg, and Kim, 2014). Serial entrepreneurs, although a group of selected individuals with heterogeneous characteristics and background, include not only billionaires such as Elon Must and Richard Branson but also a large number of self- or unemployed individuals of meager subsistence; they are also composed of university professors with expertise in particular areas of technology and MBA graduates rich in general management experience. In addition, as heterogeneous entrepreneurs vary in their entrepreneurial LBD processes, the effects lead to heterogeneous learning. Applying experiential learning theory, this study divides the learning process into stages to investigate individual characteristics that moderate the entrepreneurial LBD effect.

This paper argues that the ability stemming from individuals’ education and their experience from occupational diversity are moderators of the entrepreneurial LBD process. Educational ability, which this paper defines as the ability to achieve educational success, is directly linked to individuals’ general learning ability and occupational diversity as the variety of jobs they have during their professional careers, is linked to one’s industry knowledge. To test the moderating effects of these two individual characteristics, we drew a sample of serial entrepreneurs from NLS97, a longitudinal dataset that represents the U.S. population. Because of the large heterogeneity of individuals in this sample, the study is able to test the moderating effect of educational ability and occupational diversity. To reduce the potential endogeneity caused by the selection effect, this study examines both treatment and control groups of serial entrepreneurs and matches the two groups on five critical variables that influence individual entrepreneurship decisions. The analyses support the hypothesis that educational ability and occupational diversity are two moderators of the relationship between aggregated entrepreneurial experience and venture performance, and individuals with higher educational abilities and richer in occupational diversity are more effective at entrepreneurial LBD.

**2. Theoretical Framework**

Studies have referred to the learning-by-doing (LBD) effect to explain learning phenomena that relate to the amount of engagement in various activities at both the micro and macro levels (Thompson, 2010). The LBD effect taking place within an entrepreneurial context is experiential in nature and manifested as a positive relationship between an individual’s aggregated entrepreneurial experience and new venture performance (Politis, 2005). By applying experiential learning theory, we theoretically analyze the entrepreneurial LBD process by dividing the learning process into four stages. Then we identify the unique characteristics of LBD in the entrepreneurial context and analyze the reasons behind higher educational ability and diversified occupational experience and their roles in establishing effective entrepreneurial LBD.

2.1 Experiential learning theory

Based on experiential learning theory, entrepreneurial LBD proceeds in four steps: accumulated experience, reflected observation, abstract conceptualization, and active experimentation (Kolb, 1984). The LBD process begins when entrepreneurs initially become involved in entrepreneurial activities and accumulate immediate concrete experience (Politis, 2005), the major source of information for later knowledge transformation activities. After this initial period, entrepreneurs observe and reflect on their experience from diverse perspectives and generate valid information that they use to create knowledge (Kolb, 1984; Politis, 2005). Then they integrate the information and acquired knowledge into logically sound and generalizable new entrepreneurial knowledge that they apply when they become involved in a similar situation (Kolb, 1984). In the last step, entrepreneurs actively test their newly acquired knowledge in entrepreneurial practice and evaluate deviations from their desired goals to continue enhancing their knowledge (Kolb, 1984). The effectiveness of both the reflection stage and the conceptualization stage, which are the major heterogeneity of learning results come from, are dependent on an individual’s cognitive mechanism and knowledge structure (Cohen and Levinthal, 1990). Therefore, individuals whose cognitive mechanisms and knowledge structures differ may have the same experience but generate different knowledge, which leads to the heterogeneous entrepreneurial LBD effect. This paper predicts that educational ability and occupational diversity, which are representative characteristics of individuals’ cognitive mechanisms and knowledge structures, are two moderators of the relationship between aggregated entrepreneurial experience and venture performance.

2.2 The Moderating Effect of Educational Ability

Different from making pizza dough or driving a car, which individuals can easily try many times at a low cost, a large proportion of entrepreneurial activities and decisions such as choosing major investors and alliance partners occur only once, as does the full learning cycle. In such cases, entrepreneurs have few opportunities to evaluate and modify the results of their learning by actively testing them in the real world. Therefore, reflection and conceptualization processes are key ingredients in the entrepreneurial processes. That is, the functioning of reflection and conceptualization directly determines the results of learning.

The reflection stage begins with the acquisition of external information. During this process, individuals select useful information and establish linkages between new information and existing knowledge in their memory (Cohen and Levinthal, 1990), which is a cognitive process that contributes to one’s educational ability. The higher the educational ability, the more linkages an individual can identify. These linkages serve as bridges that ease the recall of information in the conceptualization process (Lindsay and Norman, 1977). Therefore, a high educational ability lays a foundation from which related information can easily be extracted during the conceptualization process. The conceptualization stage, an abstract process of recombining extracted information to produce generalizable knowledge (Fleming and Sorenson, 2001), does not differ from the creative process at the individual level (Cohen and Levinthal, 1990; Simon, 1985). Individuals with high creativity are more likely to extract more new, underlying combinations of information, which are sources of new generalizable knowledge (Lindsay and Norman, 1977). Since creativity is an important component of educational ability, entrepreneurs with a strong educational ability, on average, successfully perform the conceptualization process and effectively learn from their entrepreneurial experience.

Another characteristic of successful LBD by entrepreneurs is the ability to make decisions under time pressure and environmental complexity, situations in which collecting all necessary information and conducting a careful analysis are virtually impossible (Busenitz and Barney, 1997). In such situations, entrepreneurs adopt cognitive shortcuts such as biases and heuristics to make an appropriate decision (Busenitz and Barney, 1997). Since entrepreneurial LBD is a byproduct of and occurs simultaneously with the entrepreneurial decision making process, effective cognitive shortcuts determine the results of entrepreneurial LBD. As the use of heuristics and biases are associated with intuition and creativity, both of which are cognitive mechanisms that demand high educational ability (Busenitz and Barney, 1997), a strong educational ability is necessary for effective entrepreneurial LBD. All in all, because of limited experiential opportunities and situational complexity, LBD in an entrepreneurial context demands strong educational ability, and variation in such ability among individuals leads to heterogeneous results in entrepreneurial LBD. Thus, educational ability serves as a moderator in this process.

***Hypothesis 1:*** *Educational ability has a positive moderating effect on the relationship between entrepreneurial experience and the financial performance of an entrepreneurial venture.*

Although theoretical analysis indicates that entrepreneurs with strong educational abilities are expected to experience a stronger LBD effect, the above hypothesis is based on the assumption that the amount of knowledge worth learning is sufficient for all entrepreneurs. Some scholars are interested in cases in which individuals with high educational ability are already equipped with all or a majority of the knowledge they need to establish a firm while others are not. Thus, individuals with a weak educational ability, with more to learn, experience stronger LBD that impacts the moderating effect of educational ability. However, the empirical results of prior studies have shown that samples composed of a large proportion of entrepreneurs with strong educational ability are more likely to exhibit a stronger LBD effect than samples with a considerable number of individuals with weak educational ability. For example: Eesley and Roberts (2007) used a sample of MIT alumni to illustrate a positive learning effect of over 70% while Chen (2013) used a dynamic sample of serial self-employed individuals and found no LBD effect. Therefore, cases of interest are less likely to change the direction of moderating effects stemming from educational ability.

2.3 The moderating effect of occupational diversity

The entrepreneurship process entails a wide variety of tasks. To deal with all of the tasks, individuals with a broad business knowledge set are more likely to become entrepreneurs (Lazear, 2005) and to succeed (Astebro and Thompson, 2007). Consistent with former research, this paper proposes that entrepreneurs with a broad business knowledge set are more likely to have effective entrepreneurial LBD. An individual’s knowledge set serves as a benchmark in the reflection stage (Politis, 2005). The various types of activities involved in the entrepreneurship process demand a correspondingly broad business knowledge set in individuals so that they can effectively identify and digest useful information. Compared to entrepreneurs with a broad knowledge set, those who specialize can effectively reflect information in only their specialized categories, but they miss or ineffectively reflect information beyond their original knowledge base (Politis, 2005), which increases the amount of insufficient information in categories beyond their original knowledge set and cause difficulties during the conceptualization stage.

The conceptualization process is no different from the creative process (Cohen and Lavinthal, 1990), which begins with a “variation” phase, in which individuals generate new ideas through “combinatorial thought trials” (Singh and Fleming, 2010). The raw materials for the “combinatorial thought trials” includes both existing knowledge and reflected information. In conditions in which the stock of knowledge is equal, the broader the number of categories of knowledge is in an individual, the broader the categories to which the reflected information belongs, and the more diversified the generated new ideas are (Singh and Fleming, 2010). In the case of the latter, the more valuable knowledge is generated (Singh and Fleming, 2010). Since work is the major channel through which a large proportion of individuals acquire business knowledge, this study predicts that diversified occupational experience has a moderating effect on the entrepreneurial LBD process.

***Hypothesis 2:*** *Occupational diversity has a positive moderating effect on the relationship between entrepreneurial experience and the financial performance of an entrepreneurial venture.*

**3. Empirical Strategy**

3.1 Data

The 428 serial entrepreneurs surveyed in this study were drawn from the NLS97, which contains 8,984 individuals from 96,517 U.S. households that provided samples representing the U.S. population on critical factors such as demographic and household financial conditions. Such representation ensures the distributions of individual characteristics are large in variance, which facilitates the testing of moderating effects. In addition, NLS97 collects and records the employment information of individuals in 16 rounds of surveys that cover a period of 17 years beginning in 1997. The first survey sampled the individuals when they were 12 to 17 years old. The continuous tracking of work experience in this longitudinal study recorded successive changes in the individuals’ employment status beginning when they entered the workforce, which not only provided a sufficient number of serial entrepreneurs but also allowed the tracking of individual work experience.

The beginning of the selection process of this study involved deleting two types of entrepreneurs. First, as distinguishing the entrepreneurial income of multiple ventures established in the same survey year is virtually impossible, we deleted entrepreneurs that had established more than one venture in any survey year. Second, to reduce the noise of exogeneity unobservable in entrepreneurial performance, this paper deleted individuals who had had entrepreneurial experience before 2005. Based on data statistics, the proportion of the workforce and average individual income dramatically increased every year from 1999 to 2004 and remained relatively stable after 2005. This phenomenon indicates that the participation in the workforce of many individuals and their choices of entrepreneurial activities before 2005 had been significantly influenced by exogenous factors such as schooling and job-market friction. These factors influence entrepreneurial participation and LBD results. Unfortunately, these external factors could not be controlled for, and the only way of reducing such influence was to exclude those with entrepreneurial experience before 2005. The above two steps led to the deleted of 1,787 individuals. Among the remaining 7297 individuals, 644 were serial entrepreneurs with at least two entrepreneurial experiences between 2005 and 2013. After deleting individuals with missing data pertaining to important variables such as the treatment year income and average salary, the sample consisted of 484 serial entrepreneurs. Among the 484 serial entrepreneurs, we selected 428 for the empirical identification strategy, which will be discussed in the next section.

3.2 Identification strategy

A major challenge of this study was selection bias. Individuals select into entrepreneurship under the influence of both intrinsic human attributes such as capability of entrepreneurship, propensity to risk taking, and the need for autonomy and external conditions such as job market opportunities, family financial condition, and the political environment. The control variables in this paper includes educational ability, family financial condition, job market experience, and demographic characteristics. Although these control variables reduce selection bias in many ways, they are not able to control individuals’ evaluation of their entrepreneurship ability. Such individuals effectively acquire this ability from their entrepreneurship experience. Ideally, the study should control for the amount, the industry, the location, and the financial performance of the former entrepreneurial experience. Unfortunately, because of the large quantity of missing data pertaining to other variables, we can control only the number of employees in their former entrepreneurial firm in this study.

The limited control of entrepreneurial experience may lead to selection bias in which entrepreneurs in the treatment group, on average, have more entrepreneurial experience than entrepreneurs in the control group. To reduce selection bias, this study includes serial entrepreneurs in both the treatment and control groups, all of whom have had effective passive-learning experiences related to their entrepreneurial ability. In one study, Jovanovic (1982) stated that entrepreneurs passively learn entrepreneurial efficiency and external entrepreneurship conditions by participating in entrepreneurial practice and decide to become entrepreneurs again by comparing the tradeoff between self-employment and working for others. Although this learning process repeatedly occurs when individuals participate in entrepreneurship activities, it is most effective during an individual’s first entrepreneurial venture. This theory is supported by evidence presented in numerous empirical papers. For example, Kim, Aldrich, and Keister (2006) found that individuals with previous start-up experience, compared to first-time entrepreneurs, were 50% less likely to attempt another startup. In addition, entrepreneurs whose businesses have repeatedly performed poorly are less likely to create a new business (Stam et al., 2006), and entrepreneurs who have sold their prior successful ventures are more likely to start a new venture (Eesley at al., 2006).

To test the effect of entrepreneurial LBD, this study examines serial entrepreneurs who have started two ventures as the control group and serial entrepreneurs who have established three or more ventures as the treatment group. The summary statistics of serial entrepreneurs in the treatment and control groups are listed in columns 2 and 3 in Table 1, which shows that these two groups are similar in the majority of variables and different in three variables. To further reduce the imbalance between the treatment and control groups, this study adopted a coarsened exact matching method. Apart from the three imbalanced variables, this study also matched the education and work experience of the two groups to maintain overall balance of the two groups on all major factors. This procedure led to the deletion of 56 outliers, leaving a sample of 428 serial entrepreneurs, the summary statistics of which are shown in column 4 of Table 1. Because coarsened exact matching does not rely on a specific function form for covariates, and is typically referred to as “non-parametric” control of variables, controlling for potential non-linear influences that cannot be controlled for with the use of regular regression alone is possible. After the balanced treatment of the critical variables of the treatment and control groups, they consisted of comparable serial entrepreneurs, thus limiting the scale of potential selection bias.

3.3 Variables

3.3.1 Dependent variable

The dependent variable used in this paper is the financial performance of the new ventures, that is, entrepreneurial income. Adopted from Hamilton (2000), entrepreneurial income is the sum of the draw, or the amount of money withdrawn in the form of a salary, and retained earnings, or the amount of reported profit of the business (Hamilton, 2000). Therefore, the entrepreneurial income is measured as the sum of salaries and profits. This measurement still lacks the income from reinvestment by entrepreneurs to expand their businesses. Hamilton (2000) solved this problem by adding the “year-to-year change in the amount of equity held in the business,” but NLS97 does not have similar variables. Therefore, the measurement of the dependent variable in this paper represents the lower bound of a firm’s financial income. Because entrepreneurial income is severely skewed on the right, this study uses the natural log of entrepreneurial income as the dependent variable.

As an experience-based learning process, the entrepreneurial LBD process parallels an individual’s entrepreneurial practice, which is linked to the development of a new venture (Cope and Watts, 2000). Although each venture unique, all firms generally face a similar development process and follows a predictable business life cycle (Churchill & Levis, 1989). During each of the five stages of the business life cycle, entrepreneurs participate in similar activities and face similar challenges, only in different contexts, which is determined by the industry and the background of the venture. This learning process is heterogeneous among entrepreneurs because some startups exit the market at an early stage while others experience all five stages. Since the majority of startups exit the market within five years, they experience only the early stage(s) of the business life cycle. In one study, Parker (2013) found that the only stage that all firms and entrepreneurs experience is the founding stage and that the LBD effect is temporal, disappearing after the first several years of the founding of a new venture. Therefore, this paper uses only the financial income of entrepreneurs during the first year to test the entrepreneurial LBD effect.

3.3.2 Independent variable

The main independent variable in this paper is a dummy variable that distinguishes the third venture of the treatment group, which includes individuals who have started three or more ventures, from the second venture of the control group, which includes individuals that started exactly two ventures. Because this paper is concerned only about the entrepreneurial experience at the founding stage, the number of ventures started by an entrepreneur is a clear measure of the entrepreneurial founding experience. Even though many serial entrepreneurs in the treatment group had started more than three firms, this study used only the incomes from the third businesses to ensure easily interpretable results. In the testing of the moderating effects, the independent variables are the interaction factors of the main independent variable and the corresponding moderators.

3.3.3 Control variables

This paper includes four categories of control variables, the purpose of which is to eliminate potential endogeneity from factors that simultaneously influence an entrepreneur’s decision to start another venture and the performance of the venture. Because high-ability individuals are more likely to become entrepreneurs and perform more successfully, the first category of control variables is the ability of entrepreneurs, which includes *SAT math scores*, *SAT verbal scores*, *the highest degree attained*, and *average wages* when the entrepreneur was an employee. It is important to note that only about 20% of the sample provided accurate self-reported SAT scores, another 14% of the SAT scores were converted from ACT scores, and the remaining two-thirds were assigned the mean SAT score based on the highest degree the individual had earned. An individual’s financial condition also simultaneously and positively influences the decision to become an entrepreneur and the performance of a new venture. The two variables used in this paper to control for entrepreneurial financial conditions are the natural log of family *financial assets* and *family non-financial assets* when they were 20 years old.

This paper also controlled for the work experience of entrepreneurs. The most common measure of work experience is the number of positions and the years of employment. Because all entrepreneurs in NLS97 were at similar age, so the variance in *the number of employment years* are not large. Because of data limitations, this paper used *the number of jobs individuals had before they became entrepreneurs* as a proxy for the number of different positions. The number of jobs before an individual became an entrepreneur has a mean of three and a max of 15, which means its distribution has a long tail. Apart from these variables, this paper also includes two demographic control variables: *gender* and *race*. The sample in this study is relatively balanced by gender and race, with a few more males and non-black/non-Hispanics.

3.3.4 Moderators

This study tests both moderating effects using discrete proxy indicators. This paper has four variables to control for educational ability: the SAT math score, the SAT verbal score, the average income as a worker, and the highest degree attained. Though a combination of math and verbal scores appears to be a reasonable proxy for educational ability, it cannot be used in this paper because of the large number of missing values. In addition, an individual’s average income as a worker is not only determined by educational ability but also strongly influenced by many unobserved abilities such as emotional intelligence; therefore, it is not suitable as the proxy for educational ability. The highest degree represents the educational attainment of an individual. Although educational attainment is related to many factors, this paper uses the variables of family financial background and individual demographic information to control for the major factors, which left education attainment to be strongly correlated with educational ability. Therefore, among the four variables related to educational ability in this paper, the highest degree attained is the most suitable proxy for educational ability.

The proxy indicator for educational ability, the highest degree attained, has seven values indicating high school dropouts, GED holders, high school graduates, associated college graduates, bachelor’s degree holders, master’s degree holders, and Ph.D., J.D., and M.D., holders. The proxy indicator for occupational diversity is the number of jobs an individual held before becoming an entrepreneur. Although an individual may have had several jobs in the same position, the number of jobs an individual has held is positively related to occupational diversity.

**4. Results**

4.1 The average effect of entrepreneurial LBD

Table 2 summarizes all major regression results. Models one to four are the results of regressions on the entire 484 serial entrepreneurial sample and models five to eight are the results of regressions on the sample after matching. Models two and six are baseline models, and models one and five are robust test models that include only the treatment dummy. The coefficients of the treatment dummy in these four models mentioned above, although slightly different in scale, are consistent and statistically significant. These results show that serial entrepreneurs in this sample experience, on average, a positive entrepreneurial LBD effect and those with an additional entrepreneurial experience enjoy an approximately 28% higher entrepreneurial income. To identify the differences between the regression results of the matched and non-matched samples, this paper employed the Hausman test and found that the results were statistically significant at a 5% confidence level. This finding indicates that after matching, the coefficients statistically differed from those of the non-matching sample. Thus matching likely reduced the endogeneity of the selection problem caused by heterogeneous motivation and the following analyses are based on the matched sample. However, the improved accuracy of the coefficients is mainly observed in the control variables.

Models three and seven test the moderating effect of educational ability, and models four and eight test the moderating effect of occupational diversity. The results show that after adding the interaction factor of the moderator and the treatment dummy, the coefficients of the LBD effect drops dramatically to around 6% to 7%, so it is no longer statistically significant. This finding indicates the lack of a steady across individual entrepreneurial LBD effect for the base groups of these regressions, which are the groups of high school dropouts and individuals who had held only one or no job before. These results also suggest that if a sample contains a large number of entrepreneurs with low educational ability or little occupational experience, then that sample is less likely to illustrate an entrepreneurial LBD effect, which explains the diversified results found by former papers.

4.2 The moderating effect of educational ability

Hypothesis 1 predicted that educational ability has a direct, positive moderating effect on the relationship between entrepreneurial experience of an individual and the financial performance of a venture. We observe a positive moderating relationship significant at a 10% confidence level in both models 3 and 7, the results of which support the hypothesis. However, the extent of the moderating relationship carries only an implied meaning and cannot be interpreted literally because the moderator we used, the highest degree attained, is a discrete variable, and the distance between any consecutive two levels might not be the same. In addition, the moderating relationship might be nonlinear, which questions the fitness of using OLS to test the moderating effect. To prove the robustness of the moderating effect of educational ability, this study divided the sample into four segments based on the highest degree attained and tested the treatment effect on each segment separately.

Table 3 presents the results of the entrepreneurial LBD effect in four segments. The 107 individuals in group 1 are high-school dropouts. Individuals in this group generally experience no effect of entrepreneurial LBD. In group 2, which includes 186 high-school graduates, the average LBD effect is positive but statistically insignificant. In group 3, comprised of 104 college graduates who hold either associate’s or bachelor’s degrees, the LBD effect is strong, positive (51.6%), and statistically significant. In the last group, all of whom hold graduate degrees, including master’s, Ph.D., J.D., and M.D. degrees, the LBD effect is the strongest, 58%. Figure 2 shows the LBD effect of the four segments with their confidence intervals.

The results show that the moderating effect of educational ability is nonlinear and that the ability level of those acquiring a college degree has a threshold effect; that is, these individuals, on average, experience a strong entrepreneurial LBD effect. Indeed, according to absorptive capacity theory (Cohen and Levinthal, 1990), it is common for individual learning to reveal a threshold effect, whereby the sum of old knowledge and newly acquired knowledge must attain a given level before one’s performance experiences a jump in improvement. Without reaching a certain knowledge threshold, the performance of an individual might not exhibit any change even though the amount of the individual’s knowledge might vary. Based on the threshold theory, one possible explanation for the phenomenon found by this study is that college education has a treatment effect that increased individual’s educational ability and effectively helps students accumulate more prior knowledge. As a result, college graduates are able to reach the knowledge threshold after acquiring only a limited amount of external new knowledge in their entrepreneurial practice.

4.3 The moderating effect of occupational diversity

Hypothesis 2 predicted that the breadth of an individual’s occupational diverse experience has a direct, positive moderating effect on the relationshipbetween entrepreneurial experience and the financial performance of a venture. The result of Models 4 and 8 in Table 2, which tested this hypothesis, support the positive effect of LBD. Like the proxy moderator of educational ability, the proxy moderator of the extent of knowledge, which is the number of jobs before an individual had before becoming an entrepreneur, is a discrete variable. Furthermore, the distribution of the number of jobs was severely skewed to the right, which exacerbates any interpretation of the meaning of the coefficient of the moderator. For reasons similar to those above, we tested the robustness of the moderating effect of the extent of an individual’s knowledge set in four segments, the results of which are shown in Table 4.

The results show that the 114 specialists (individuals who have had only one or no job) in group one, on average, experience a very weak (7%), non-significant LBD effect. Individuals with two jobs, included in group 2, experience, on average, a 20% non-significant LBD effect. Individuals who have had three or four jobs, included in group 3, exhibit, on average, an LBD effect of 40%, but these results are also insignificant. People who have held five or more jobs before they became entrepreneurs, comprising group five, exhibit an average LBD effect of 53%, which is statistically significant. Figure 3 presents the LBD effect of each of these four segments with their confidence intervals. All in all, the extent of an individual’s diverse job experience set has a positive moderating effect on the entrepreneurial LBD process and this effect is comparatively linear.

**5. Discussion and Conclusion**

This study investigated the puzzle of why scholars found divergent results of the entrepreneurial learning-by-doing (LBD) effect and whether or not entrepreneurship LBD exists. Seeking answers to these questions at an individual level, the study applied experiential learning theory to analyze the entrepreneurial LBD process in four stages to find individual characteristics that could moderate the entrepreneurial LBD effect. From the analysis of a sample of serial entrepreneurs screened out of NLS97, this study found that entrepreneurial LBD effect is primarily individual-specific and that no steady cross-individual entrepreneurial LBD effect occurs. This finding reconciles the conflicting results of former studies.

The primary findings of this paper are that educational ability and occupational diversity positively moderate the relationship between accumulated entrepreneurial experience and entrepreneurial performance. These results have a practical value for all types of entrepreneurs and practitioners to use ability to predict the probability of the performance and the success of serial entrepreneurs from their experience and individual characteristics. At the same time, these results contribute to the body of knowledge in the entrepreneurship LBD literature by indicating the importance and feasibility of analyzing the characteristics of individuals to obtain heterogeneous results of entrepreneurial LBD. In addition, this paper represents an extension of a study by Lazer (2005), which states that entrepreneurship involves a broad category of activities and is more suitable for individuals with comprehensive business knowledge.

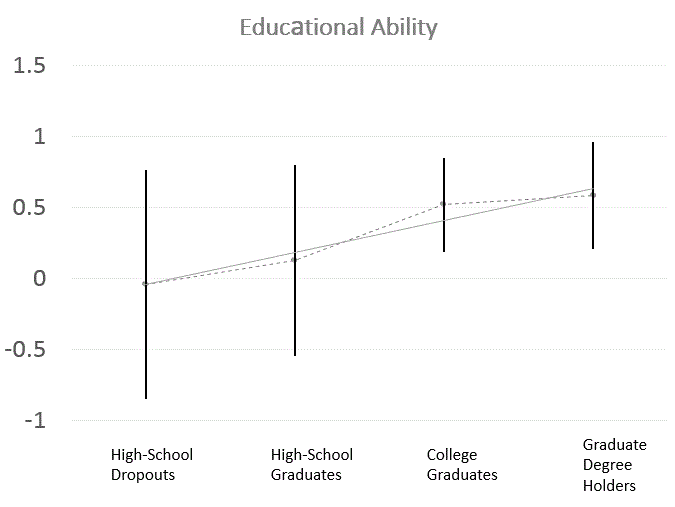


Figure 1. Educational ability of sample individuals

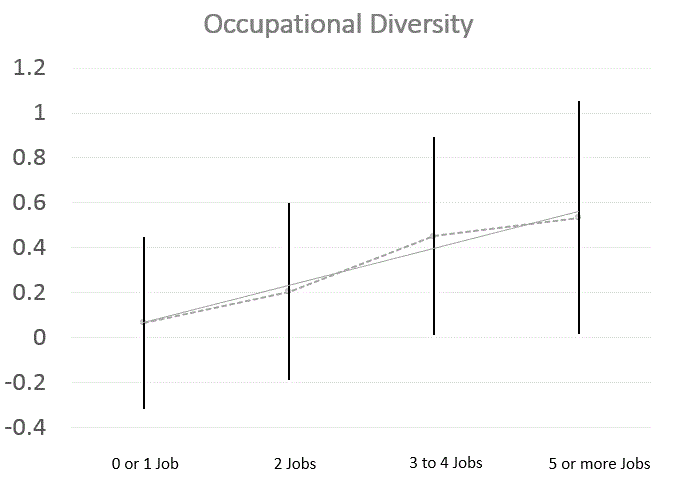


Figure 2. Occupational diversity of sample individuals.

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| **Table 1: Summary statistics** | | | | |
|  | Total | Treatment | Control | Matched |
| **Dependent Variable** |  |  |  |  |
| Treatment year entrepreneurial income | 31071.4 | 32688.5 | 29285.5 | 29488.1 |
| Treatment year Ln income | 9.9 | 10 | 9.77 | 9.8 |
|  |  |  |  |  |
| **Control Variables** |  |  |  |  |
| Demographic characteristics: |  |  |  |  |
| Gender | 0.45 | 0.4 | 0.51 | 0.45 |
| Race | 0.42 | 0.44 | 0.4 | 0.43 |
| Ability: |  |  |  |  |
| SAT math | 464.6 | 464.4 | 464.8 | 460.2 |
| SAT verbal | 466.3 | 465.8 | 466.9 | 462.9 |
| Highest degree | 2.41 | 2.31 | 2.47 | 2.35 |
| Average income as workers | 16526.1 | 15472.6 | 17689.7 | 15613.3 |
| Family assets: |  |  |  |  |
| Family financial assets at 20 years old | 2129.6 | 1842.2 | 2446.9 | 797.1 |
| Family’s non-financial assets at 20  years old | 14931.1 | 14302.4 | 15625.5 | 9545.7 |
| Work experience: |  |  |  |  |
| Total number of jobs in 2005 | 3.1 | 3.1 | 0.0597 | 3.1 |
| Years of work experience | 5 | 4.6 | (0.0674) | 4.9 |
| Others: |  |  |  |  |
| Average entrepreneurial income | 21243.4 | 22498.2 | 19857.6 | 19739.8 |
| Employee number in the previous  venture | 0.37 | 0.6 | 0.12 | 0.4 |
| Years of entrepreneurial experience | 3.2 | 3.6 | 2.7 | 3.2 |
| Number of Observations | 484 | 254 | 230 | 428 |
| Note: Gender, a dummy variable, equals 1 for women. Race, also a dummy variable, equals 1 for non-black and non-Hispanic individuals. Undergraduate or above equals 1 for individuals with a bachelor’s or higher degrees. | | | | |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Table 2: OLS estimation of entrepreneurial learning by doing** | | | | | | | | | |
| VARIABLES | Without Matching | | | |  | After Matching | | | |
|  | (1) | (2) | (3) | (4) |  | (5) | (6) | (7) | (8) |
| Gender |  | -0.425\*\*\* | -0.431\*\*\* | -0.421\*\*\* |  |  | -0.483\*\*\* | -0.491\*\*\* | -0.480\*\*\* |
|  |  | (0.102) | (0.101) | (0.101) |  |  | (0.113) | (0.113) | (0.112) |
| Race |  | 0.0748 | 0.0774 | 0.0906 |  |  | 0.0945 | 0.0949 | 0.109 |
|  |  | (0.103) | (0.103) | (0.103) |  |  | (0.112) | (0.112) | (0.112) |
| SAT math |  | 0.00247\* | 0.00237\* | 0.00252\* |  |  | 0.00272\* | 0.00269\* | 0.00270\* |
|  |  | (0.00135) | (0.00134) | (0.00134) |  |  | (0.00152) | (0.00152) | (0.00152) |
| SAT verbal |  | -0.000955 | -0.00102 | -0.000998 |  |  | -0.00180 | -0.00187 | -0.00185 |
|  |  | (0.00120) | (0.00119) | (0.00119) |  |  | (0.00133) | (0.00133) | (0.00133) |
| Highest degree |  | 0.145\*\*\* | 0.101\* | 0.144\*\*\* |  |  | 0.177\*\*\* | 0.134\*\* | 0.178\*\*\* |
|  | (0.046) | (0.052) | (0.046) |  |  | (0.054) | (0.061) | (0.054) |
| Financial assets |  | 0.0114 | 0.0104 | 0.0124 |  |  | 0.00334 | 0.00230 | 0.00460 |
|  | (0.0147) | (0.0146) | (0.0146) |  |  | (0.0166) | (0.0166) | (0.0166) |
| Non-financial assets |  | -0.0170 | -0.0174 | -0.0188 |  |  | -0.0546\* | -0.0536\* | -0.0545\* |
|  | (0.0234) | (0.0234) | (0.0234) |  |  | (0.0281) | (0.0280) | (0.0280) |
| Number of jobs |  | 0.00671 | 0.00493 | -0.0406 |  |  | 0.00823 | 0.00718 | -0.0348 |
|  |  | (0.0215) | 0.0597 | (0.0330) |  |  | (0.0235) | (0.0235) | (0.0368) |
| Average income |  | 0.00004\*\*\* | (0.0674) | 0.00004\*\*\* |  |  | 0.00004\*\*\* | 0.00004\*\*\* | 0.00004\*\*\* |
|  | (4.61e-06) | (4.61e-06) | (4.61e-06) |  |  | (5.65e-06) | (5.66e-06) | (5.65e-06) |
| Employee number |  | 0.0209 | 0.0192 | 0.0161 |  |  | 0.0154 | 0.0134 | 0.0107 |
|  | (0.0356) | (0.0355) | (0.0356) |  |  | (0.0379) | (0.0378) | (0.0379) |
| **Treatment** | 0.246\*\* | 0.285\*\*\* | 0.0169 | 0.0415 |  | 0.265\*\* | 0.289\*\*\* | 0.0657 | 0.0716 |
|  | (0.109) | (0.0986) | (0.175) | (0.162) |  | (0.118) | (0.108) | (0.188) | (0.179) |
| Treatment\*edu. |  |  | 0.112\* |  |  |  |  | 0.108\* |  |
|  |  |  | (0.0608) |  |  |  |  | (0.0643) |  |
| Treatment \*job No. |  |  |  | 0.0807\* |  |  |  |  | 0.0712 |
|  |  |  |  | (0.0428) |  |  |  |  | (0.0469) |
| Constant | 9.767\*\*\* | 8.491\*\*\* | 8.624\*\*\* | 8.627\*\*\* |  | 9.689\*\*\* | 9.008\*\*\* | 9.097\*\*\* | 9.156\*\*\* |
|  | (0.0789) | (0.519) | (0.523) | (0.523) |  | (0.0870) | (0.617) | (0.619) | (0.624) |
|  |  |  |  |  |  |  |  |  |  |
| Observations | 484 | 484 | 484 | 484 |  | 428 | 428 | 428 | 428 |
| R-squared | 0.010 | 0.251 | 0.256 | 0.256 |  | 0.012 | 0.246 | 0.250 | 0.250 |
| Standard errors in parentheses | | | | |  |  |  |  |  |
| \*\*\* p<0.01, \*\* p<0.05, \* p<0.1 | | | | |  |  |  |  |  |

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| **Table 3: The moderating effect of ability** | | | | | | | |
| VARIABLES | High-School Dropouts |  | High-School Graduates |  | College Graduates |  | Graduate Degree Holders |
|  |  |  |  |
| Gender | -0.334 |  | -0.601 |  | -0.462\*\*\* |  | -0.138 |
|  | (0.429) |  | (0.375) |  | (0.175) |  | (0.189) |
| Race | 0.358 |  | 0.341 |  | 0.206 |  | 0.173 |
|  | (0.421) |  | (0.384) |  | (0.167) |  | (0.221) |
| SAT math | 0.00212 |  | 0.00550 |  | 0.00430\* |  | -0.000639 |
|  | (0.00692) |  | (0.00329) |  | (0.00219) |  | (0.00211) |
| SAT verbal | 0.00201 |  | -0.00242 |  | -0.00252 |  | 0.000773 |
|  | (0.00610) |  | (0.00278) |  | (0.00206) |  | (0.00188) |
| Financial assets | 0.00917 |  | 0.0581 |  | -0.0130 |  | 0.0105 |
| (0.0784) |  | (0.0487) |  | (0.0244) |  | (0.0278) |
| Non-financial assets | -0.156\* |  | -0.0605 |  | 0.0365 |  | -0.0131 |
| (0.0793) |  | (0.0802) |  | (0.0440) |  | (0.0431) |
| Number of jobs | -0.137 |  | 0.0558 |  | -0.0228 |  | 0.0273 |
|  | (0.101) |  | (0.0817) |  | (0.0369) |  | (0.0394) |
| Average income | 8.73e-05\*\*\* |  | 2.98e-05 |  | 4.65e-05\*\*\* |  | 2.43e-05\*\*\* |
| (2.25e-05) |  | (1.84e-05) |  | (7.92e-06) |  | (7.80e-06) |
| Employee number | 3.133\*\* |  | 0.0597 |  | 0.0228 |  | 0.00445 |
| (1.338) |  | (0.0674) |  | (0.0530) |  | (0.0510) |
| **Treatment** | -0.0474 |  | 0.124 |  | 0.516\*\*\* |  | 0.580\*\*\* |
|  | (0.408) |  | (0.340) |  | (0.166) |  | (0.189) |
| Constant | 8.296\*\*\* |  | 8.612\*\*\* |  | 7.796\*\*\* |  | 9.387\*\*\* |
|  | (2.075) |  | (1.691) |  | (1.099) |  | (0.884) |
|  |  |  |  |  |  |  |  |
| Observations | 107 |  | 186 |  | 104 |  | 31 |
| R-squared | 0.233 |  | 0.334 |  | 0.289 |  | 0.446 |
| Standard errors in parentheses |  |  |  |  |  |  |  |
| \*\*\* p<0.01, \*\* p<0.05, \* p<0.1 |  |  |  |  |  |  |  |

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| **Table 4: The moderating effect of the breadth of knowledge** | | | | | | | |
| VARIABLES | 0 or 1 Job |  | 2 Jobs |  | 3-4 Jobs |  | >=5 Jobs |
| Gender | -0.621\*\*\* |  | -0.250 |  | -0.318 |  | -0.264 |
|  | (0.212) |  | (0.199) |  | (0.245) |  | (0.261) |
| Race | -0.159 |  | 0.272 |  | 0.0442 |  | 0.336 |
|  | (0.196) |  | (0.207) |  | (0.248) |  | (0.285) |
| SAT math | 0.00869\*\*\* |  | 0.00262 |  | 0.00358 |  | 0.00271 |
|  | (0.00298) |  | (0.00248) |  | (0.00557) |  | (0.00342) |
| SAT verbal | -0.00562\*\*\* |  | -0.000378 |  | 0.00175 |  | 0.00422 |
|  | (0.00193) |  | (0.00260) |  | (0.00498) |  | (0.00318) |
| >=Undergraduate | 0.23 |  | 0.425 |  | 0.893\*\* |  | 0.378 |
| (0.272) |  | (0.277) |  | (0.401) |  | (0.298) |
| Financial assets | 4.33e-05 |  | -0.0182 |  | 0.0473 |  | -0.0285 |
| (0.0307) |  | (0.0303) |  | (0.0347) |  | (0.0418) |
| Non-financial assets | -0.0258 |  | -0.173\*\* |  | 0.0508 |  | -0.0352 |
| (0.0447) |  | (0.0760) |  | (0.105) |  | (0.0506) |
| Average income | 2.60e-05\*\*\* |  | 5.75e-05\*\*\* |  | 6.41e-05\*\*\* |  | 5.31e-05\*\*\* |
| (9.33e-06) |  | (1.16e-05) |  | (1.27e-05) |  | (1.49e-05) |
| Employee number | -0.0361 |  | 0.0754 |  | 0.184 |  | 0.0692 |
| (0.0607) |  | 0.0597 |  | (0.148) |  | (0.0805) |
| **Treatment** | 0.0656 |  | 0.204 |  | 0.402 |  | 0.534\*\* |
|  | (0.194) |  | (0.199) |  | (0.243) |  | (0.262) |
| Constant | 8.556\*\*\* |  | 9.216\*\*\* |  | 5.620\*\*\* |  | 5.345\*\*\* |
|  | (1.179) |  | (1.142) |  | (1.986) |  | (1.255) |
|  |  |  |  |  |  |  |  |
| Observations | 114 |  | 134 |  | 79 |  | 101 |
| R-squared | 0.293 |  | 0.235 |  | 0.401 |  | 0.291 |
| Standard errors in parentheses |  |  |  |  |  |  |  |
| \*\*\* p<0.01, \*\* p<0.05, \* p<0.1 |  |  |  |  |  |  |  |

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