

# Selection and Serial Entrepreneurs\*

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## ABSTRACT

There is substantial evidence that serial entrepreneurs outperform de novo entrepreneurs. But is this positive association between prior experience and performance the result of learning by doing or of selection on ability? This paper proposes a strategy that combines the fixed-effects model and IV estimations to distinguish empirically selection effects from learning. Using panel data from the *NLSY79*, I find that selection on ability is the more important determinant of serial business formation and the early performance of new businesses. In contrast, the effects of learning by doing are apparent only when the analysis focuses on founding new startups in sectors closely related to entrepreneurs' previous ventures.

*JEL Classification Codes:* J21, J24, J62, M13.

*Keywords:* Serial entrepreneurs, selection, ability, entrepreneurial experience, learning by doing.

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## 1. Introduction

What motivates some individuals to become serial entrepreneurs, and how does this influence their performance? Is serial entrepreneurship driven by taste or personal accidents of history, or are there more systematic predictors? Do agents become serial entrepreneurs because their prior business failed, or because their prior business was a success? Despite an emerging literature on serial entrepreneurship we continue to have little confidence in our answers to these questions.

Early work, largely based on small-sample interviews with serial entrepreneurs, suggest they are motivated by a variety of factors. Wright, Robbie, and Ennew (1997), for example, identify half a dozen disparate motivations. Prominent among them, some start a new venture because they want to explore new business opportunities, while others are attempting to rebuild a failed business. Williams (2000) also identified disparate motivations. While some interviewees were motivated by a desire to seize timely opportunities, Williams also documents instances in which serial entrepreneurs enjoy starting businesses because they can relate the products to their personal experiences.<sup>1</sup>

More recent work has exploited larger samples, focused on more objectively measurable attributes of serial entrepreneurs, and provided performance comparisons with first-time entrepreneurs (cf. Eesley and Roberts 2006a, Stam et al. 2006, Gompers *et al.* 2006). These studies have yielded the following evidence:

- Serial entrepreneurs are more likely to have successfully sold their prior ventures before starting a new business (Eesley et al. 2006b, Stam et al. 2006).
- Entrepreneurs whose business performs poorly are less likely to create a new business (Stam et al. 2006).
- The current firm has a higher chance of going public if the entrepreneur's previous venture was acquired (Eesley et al. 2006a).
- Entrepreneurs who succeeded in prior business have a much higher chance of succeeding in the current business, compared to first-time entrepreneurs and entrepreneurs who previously failed (Gompers *et al.* 2006).
- Additional evidence has also been provided by other studies that generally agree on a positive relationship between previous entrepreneurial experience and current business performance (Schilling *et al.* 2003, Delmar and Shane 2006, Stuart and Abetti 1990, Gompers *et al.* 2009, etc).

These findings are consistent with at least two distinct interpretations. Eesley and Roberts (2006a), and Stam et al. (2006) interpret their results as evidence that

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<sup>1</sup> Jeff Jacober, for example, started his first business when he was still in college, selling sportswear to fraternities and sororities. After his brother was diagnosed with chronic kidney failure, Jacober found Ocean Diagnostic Inc. which produced a home health test that helped people to self-diagnose various diseases.

learning from prior founding experience has a positive impact on serial entrepreneurial performance. Parker (2010) also agrees that knowledge acquired from previous business experience helps entrepreneurs enhance their performance on subsequent ventures, although the effect may be temporary. In contrast, Gompers *et al.* (2006) conclude that self-selection based on innate entrepreneurial skill, rather than learning by doing matters more for serial business formation and performance.

It has always been a challenge to empirically distinguish learning by doing from learning about ability. Thompson (2010) develops a simple framework incorporating these two types of learning, and highlights the difficulty in separating them in empirical analysis. To my knowledge, only two studies have attempted to do so in the area of occupational choice: one is by Farber (1994), who focuses on differences in the hazards of job separation implied by the two models; the other is by Nagypál (2007), who looks at firm-specific price shocks and their distinctive impacts on employee turnover in the two learning models [See Thompson (2008) for a more detailed discussion].

Identification is especially difficult in the study of serial entrepreneurship, as the variable that often attracts our greatest interest is entrepreneurial experience. This variable, usually proxied by business performance (*e.g.*, Gompers *et al.* 2006) or founding experience (*e.g.*, Eesley et al. 2006a), could easily capture both learning by doing and learning about entrepreneurial ability. To decide which learning model accounts more for the creation of serial entrepreneurs, this paper takes alternative approaches of fixed effects and IV estimations to empirically separate one type of learning from the other when entrepreneurial experience is revealed.

Compared to an emerging literature that emphasizes the effect of learning by doing on entrepreneurial activities,<sup>2</sup> there has been little empirical work that specifically examines the role of innate ability in serial entrepreneurship. However, the notion that selection on ability is an important determinant of serial entrepreneurship builds on reasonable theoretical grounds. According to Holmes and Schmitz' (1990) seminal theory of business turnover, selection on ability alone may serve as the mechanism that induces business turnover. In their theory, people differ in their ability to respond to business opportunities. High-ability people become entrepreneurs, specializing in forming new businesses, the low-ability concentrate on managing existing businesses, and those in the middle are indifferent between these two occupational choices. To pursue new business opportunities, entrepreneurs need to free up their resources, such as time, through discontinuing their previously developed businesses or selling them to their low- or middle-ability counterparts. An essential assumption of this model is that individuals can perfectly observe their abilities. Thus, serial entrepreneurship serves as a natural avenue for them to allocate their talents to the best use.

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<sup>2</sup> These studies focus on issues such as how serial entrepreneurs learn from their successful or unsuccessful prior experiences (Minniti and Bygrave 2001), or how experiential learning positively or negatively affects their entrepreneurial performance (Politis 2005, Corbett 2005, Pástor, Taylor, and Veronesi 2009.)

To provide more theoretical intuition for selection on ability, I present in the appendix a simple framework in which entrepreneurs do not perfectly observe their ability or the quality of business ideas *ex ante*, except for some prior beliefs. Each period, an entrepreneur receives two signals: one for his ability, and the other for his business idea.<sup>3</sup> In the spirit of Jovanovic (1979, 1982), the entrepreneur continuously updates his beliefs about his ability and business idea every time he observes new signals. He then makes a choice between staying in the current business, leaving the business to explore a new idea, or exiting to the wage sector. Although misleading signals may induce mistakes on the part of entrepreneurs, the model predicts that high ability entrepreneurs are more likely to form a serial business. This result has some notable implications for new business formation and performance. First, entrepreneurs who received higher returns to previous businesses generally have a higher probability of starting a new venture. Second, entrepreneurs with more founding experience are more likely to form a new business. Meanwhile, the performance of serial entrepreneurs is on average better than the performance of their first-time counterparts. These predictions are widely supported by empirical evidence that is often interpreted as the result of learning by doing. Thus, the model highlights the idea that selection on ability is sufficient to induce a positive correlation between entrepreneurial experience and serial business formation, as well as its subsequent performance.

The theoretical appendix of this paper, however, is not intended to undervalue the role of learning by doing in serial entrepreneurship. On the contrary, learning about one's ability and learning about how to do a business are certainly not mutually exclusive phenomena, and we would like to understand more about their relative importance.

The *NLSY79* is an ideal data source for the purposes of this study, because of its focus on a young cohort that was first interviewed between the ages of 14 and 22. The survey design allows me to trace individuals' employment histories almost from the first time they entered the labor market, thereby avoiding potential left-censoring problems. Starting in 1979, the survey was conducted annually through 1994 and biennially afterwards. In each survey round, respondents were asked to report up to five employers they had worked for since the last survey round. Detailed job information was also collected. Additional variables are available to link employers reported in two consecutive survey rounds, which provides a convenient way to identify a new job or business. This study is based on a sample that covers the period from 1981 to 2008. It consists of 3,265 individuals who were on average interviewed for 9.4 survey rounds and had been self-employed at least once prior to the current survey year. Nearly 32 percent of them reported ever forming a serial business. Their entrepreneurial experience is characterized by two variables. One is previous business

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<sup>3</sup> The examples for the signal of ability could be an entrepreneur's performance with respect to motivating employees, building strong networks, or adjusting firm strategy with market changes. The signal of quality of business idea could be the average earnings of the same kind of business in the market.

performance, measured by their average annual business income. The other is self-employment tenure, indicated by the cumulative years they spent in self-employment.

I first present an unconditional estimation of the determinants of serial business formation and its early performance. Consistent with the stylized facts, both measures of entrepreneurial experience are found to have strong explanatory power for new business formation and performance. Clearly, this result can be explained by either selection on ability, or learning by doing, or even both. To explicitly separate these two effects, I apply fixed-effects models to control for time-invariant ability. By fixing entrepreneurial ability, the remaining effects of entrepreneurial experience on new business formation and performance should be explained mainly by learning by doing. Neither of the two measures of entrepreneurial experience continues to have a positive impact on the likelihood of new business formation or early performance of new businesses. The robustness of this result is not subject to whether the analysis is performed among individuals whose average annual business income is located at the top end of the distribution. This finding casts the doubt on the relevance of learning by doing in explaining serial entrepreneurship associated with small business owners.

A perhaps better way to investigate how selection on ability affects serial business formation and its performance is to find instrumental variables that are closely related to the measures of entrepreneurial experience, but not correlated with learning by doing. The candidate variables include business income and the number of businesses founded in the first year of self-employment, entrepreneurs' age in the first year of self-employment, and average hourly rate of pay received in one's first year of full-time employment. These variables share a common feature that they are not subject to the impact of learning by doing because there has not been any previous working experience for learning to occur. However, entrepreneurs' initial performance in the labor market is certainly an indicator of their innate ability, and the latter further determines their subsequent business experience. The IV estimations find strong support for the selection effects on both new business formation and its initial returns. Thus, compared to learning by doing, selection on ability appears to be a dominant explanation for serial entrepreneurship observed in the current sample. The results remain when wealth constraints are taken into account, or when female entrepreneurs are excluded from the sample.

Is it possible that the effects of learning by doing are more pronounced if new startups are closely related to previous entrepreneurial experience? To explore this possibility, I provide additional analysis of learning by doing among entrepreneurs who started new businesses in industries where they had entrepreneurial experience before. Contrary to the previous fixed-effects results, the analysis shows that learning by doing not only has explanatory power for the likelihood of entrepreneurs starting a new business in a familiar industry, but it also accounts for a positive relationship between the early performance of new businesses and entrepreneurs' experience in the related industries. This result has an important implication for our understanding of entrepreneurial learning among small business owners. While selection effects ensure that high-ability people stay in entrepreneurship and explore different business opportunities, learning by doing does not work in the same way. The analysis shows that the outcome of learning by doing from previous businesses may not be easily

transferred to a new venture. Thus, learning by doing does not necessarily induce serial business formation. However, it becomes a relevant factor if entrepreneurs decide to establish a new business in a familiar sector.

This paper makes three distinct contributions to the literature. First, this is, to my knowledge, the first paper that attempts to evaluate both selection on ability and learning by doing in serial entrepreneurship. Selection yields some implications for serial entrepreneurship that can easily be misconstrued as the result of learning by doing, and therefore raises doubts about whether we have correctly understood some of the existing empirical evidence. Second, the paper offers a plausible way to empirically distinguish these two types of learning captured by previous entrepreneurial experience and examine their individual effects on the likelihood that an entrepreneur starts a new business and its early performance. The results shed light on some long-debated questions, such as what exactly (serial) entrepreneurs learned from their experience, and under what conditions learning improved entrepreneurs' performance or affects their future business decisions. Third, this paper focuses on a broad definition of entrepreneurs, *i.e.*, self-employed workers. Compared to previous empirical studies which usually use hand-collected data from a relatively small and specific survey sample, the empirical findings in this paper relate to a much more representative group of young small business owners in the US. Thus, the results provide us with a better understanding of serial entrepreneurship from the perspective of individual occupational choice.

The paper is organized as follows. Section 2 describes the *NLSY79* data, the sample, and the key variables constructed for the study. Section 3 analyzes the roles of learning by doing and selection on ability, respectively, in determining serial business formation and the initial performance of new businesses. Robustness checks are also presented in this section. Section 4 concludes.

## 2. The Data

### 2.1 Self-Employment and the *NLSY79*

The data used in this paper come from the *NLSY79*. The *NLSY79* is a national longitudinal survey of 12,686 young men and women, conducted annually from 1979 to 1994 and biennially from 1996 onwards. This youthfulness of the *NLSY79* cohort, who were between the ages of 14 and 22 when they entered the sample, is a unique feature of this data source that allows us to track each individual's employment history almost since his or her first entry into the labor market. The survey puts enormous emphasis on creating complete work histories by collecting information about all jobs that were taken by respondents between each two consecutive survey years, with more details on the employment that was active at the time of every interview. An identifier (sometimes two) is assigned to each job so that it can be linked to jobs reported in the previous survey. This design of the survey makes it feasible to characterize repeated entrepreneurial behavior within an individual's full employment history, and distinguish the formation of a new startup from the continuation of an old venture.

Like previous studies using public datasets, entrepreneurs in this paper are equivalent to self-employed or small business owners, and these terms are used interchangeably throughout the analysis. In the *NLSY79*, a respondent is defined as self-employed if he was the owner of at least 50% of the business, worked as the CEO or principal managing partner, or needed to file a form SE for federal income taxes. Respondents are also considered as self-employed if they were independent contractors, independent consultants, or freelancers. Thus, the sample of entrepreneurs in this study is very different from entrepreneurs characterized by venture capital financing, innovation, new product introduction, or entry of new firms (Gompers *et al.* 2006, Kerr and Nanda 2007, Audretsch and Feldman 1996). How different the results would be if the same analysis were to be performed based on a different sample is an interesting question, and I shall discuss it at the end of the paper.

## 2.2 Constructing the sample

To construct a sample of serial entrepreneurs, I start by creating a subsample in each survey year that consists of job observations from the current and all previous survey rounds since 1979. For instance, the 1988 subsample is a merger of observations from the 1979 to 1988 survey rounds, and the 1993 subsample contains observations from 1979 to 1993. In total, twenty-one subsamples are created each year from 1981 to 2008. The following two restrictions are imposed on the construction of these subsamples:

First, to avoid the censoring issue and obtain a complete record of individuals' employment history, I only include in the subsample individuals who had participated in all survey rounds prior to the current survey.

Second, to ensure all individuals are at risk of starting a serial business, I eliminate from the subsample respondents who had never reported any self-employment job in all previous survey rounds.

In each subsample, I examine whether respondents started a new business or returned to self-employment in the corresponding survey year. In both cases, the respondents are identified as serial entrepreneurs. These observations, together with other information pertaining to the related survey year, are kept in the subsamples. They are then pooled together to create the final dataset. This process keeps all prior self-employment records in the subsamples. In other words, if a respondent reported a self-employment job in 1979, this business is included in all subsamples where he appeared, and he is always considered as a potential serial entrepreneur. It is also expected that the final sample observes multiple serial businesses formed by the same individuals in different survey years.

The final sample consists of 68,565 observations on 3,265 individuals, who were on average interviewed for 9.4 years from 1981 to 1994 annually and 1996 to 2008 biennially. Fifty-five percent of the sample is male, 57 percent was married, 73 percent lived in urban areas, and 40 percent had a college degree. The average age of the sample was 19.9 in 1981 and 46.6 in 2008.

### 2.3 The key variables

The key variables created for the analysis include measures of serial business formation, entrepreneurial earnings in previous or current businesses, and tenure in self-employment. Below, I provide additional information on how these variables are constructed, followed by some descriptive results (Tables 1 and 2).

#### (1) *Serial business formation* (*Serial* = 1)

In each survey, the *NLSY79* records up to five jobs taken by the respondents after the last interview, among which the CPS job is specifically identified as the current or most recent employment. A variable, *class of worker*, is created in the survey to classify the employment type of each job. In the meantime, additional variables are available to link these jobs to the employers reported in the previous survey round. This information combined with the variable on employment type allows us to identify any self-employment job recorded in the current survey that appears to be different from those reported in the previous survey round.

The ideal way to identify serial entrepreneurs is by tracking each individual's entire job records (*e.g.* all five jobs reported in each survey round), and reporting serial businesses whenever a new business is discovered. This approach, however, complicates the panel data analysis as there would be no consistent time windows. Moreover, the linkage of current and previous jobs is only limited to two consecutive survey rounds. Thus, if a person reported two businesses sequentially in one survey round, it would be impossible to tell whether or not the second business was simply the continuation of the first one. As a result, the latter business, which did not appear in the previous survey, may be mistakenly identified as a new business, even though it was in fact the same as the former business held in the same survey round. To avoid this complication and obtain a clearer picture of the data, I follow previous studies by taking a snap shot at the time of each interview and focus on the respondent's CPS job (Fairly 2005).<sup>4</sup> A person was considered as becoming a serial entrepreneur in the current survey round if (1) he was self-employed at a new CPS job or (2) he did not have any business in the previous survey round, but returned to self-employment at the current CPS job.<sup>5</sup> Based on this definition, five percent of the sample corresponds to years in which individuals had formed a serial business, while 32 percent of respondents had formed a serial business at some point during the observation period. Conditional on a respondent ever forming a serial business, 15 percent of his or her observations are associated with a new venture.

Since the *NLSY79* only allows us to link jobs across two adjacent surveys, it is likely that a currently reported new business was the same as those reported in other prior survey rounds. One way to exclude this possibility is to redefine serial businesses as

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<sup>4</sup> To account for a person's self-employment history (*e.g.* how many different businesses a person started before), all reported jobs/businesses in each survey round are considered.

<sup>5</sup> Note that all individuals included in the sample reported at least one self-employment job during the previous survey periods, regardless of whether it was a CPS or non-CPS job. Thus even if they were not self-employed in the immediate previous period, they are still eligible to become serial entrepreneurs in the present survey round.

those associated with an industry in which respondents had never reported a self-employment job before. However, this approach is rather restrictive, since industries are broadly classified in the data using 1970 Census 3-digit code. Among 1549 serial businesses originally identified in the sample, only 41 percent of them meet this criterion, including those with missing industry information on previous businesses. Thus, I stick with the original identification approach.

(2) *Previous/current entrepreneurial performance*

Entrepreneurial performance is measured by business income in this analysis. In each survey round of the *NLSY79*, respondents were asked about their income from the previous *calendar* year, which includes wage and salaries, business income, and income from military services. Several issues arise when we use this information to measure returns to self-employment. First, reporting errors have been discovered in the income data as most self-employed workers in the *NLSY79* reported their earnings as wages and salaries, instead of business income (Fairly 2005).<sup>6</sup> To correct these reporting errors, Fairly (2005) suggests using the sum of income from all three sources to measure business earnings. I follow this approach to measure annual business earnings, but remove military income from the calculation.

Second, the reported income refers to all businesses an individual owned in the previous calendar year. Thus, when linking the income numbers to a particular business, we may overstate its return.

Third, the information of business income relates to businesses operated in each past calendar year, rather than the past survey round. As most surveys were conducted in the middle of the year, this gap causes a potential problem if we directly use business income of the past calendar year as a measure of returns to businesses that were recorded in the related survey round.

Figure 1 provides an illustration of this last problem. As shown, two businesses (*b1* and *b2*) are recorded in the 1991 survey round, and business *b1* was closed before 1991. In this case, it would be incorrect to use income reported in 1992 as a measure for earnings of businesses recorded in the 1991 survey. The figure shows that income reported in 1992 should be associated with businesses *b2* and *b3*, but the latter is not surveyed until 1992. Meanwhile, businesses recorded in 1991 survey include *b1* and *b2*, while *b1* ended before 1991.

[Insert Figure 1 here]

To solve this inconsistency, I use the information on job start and end dates to identify the calendar year in which a business was present. I then create 21 variables that record the number of businesses individuals had in each calendar year from 1981

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<sup>6</sup> Fairly(2005) points out the following reasons to explain the reporting errors. First, incorporating business owners often account their income as wages; second, due to the ordering of the questions, it is possible that respondents already reported their business income when being asked about wages, and did not make any revision on the answer afterwards; Third, some self-employed workers only reported their labor income from the business under wages and salary.

to 1994, and every other year from 1995 until 2007. The reason for creating these variables is to match them to the earnings data more precisely.

Five income variables are then created on this basis. All values are inflated to 2000 dollars.

*a. Business income received in each calendar year*

For individuals who had businesses in a calendar year, this variable equals the sum of reported wage, salary, and business income. On average, annual returns to self-employment is \$33,744 for the whole sample, \$42,447 for men, and \$19,765 for women. These numbers are lower than those reported by Fairly (2005),<sup>7</sup> the most likely reason being my exclusion of military earnings. In addition, the sample used by Fairly (2005) is based on full-time workers who had worked at least 1,400 hours each calendar year. In order to capture all self-employment jobs, I do not make such a restriction for the present sample. However, it turns out that the current sample does not include many part-time self-employment jobs. On average, the weekly working hours are 38.6 for all self-employment jobs in the sample, and 41.7 for the CPS jobs that are classified as self-employment, while a full-time job is typically defined by the Bureau of Census as one in which a person works 35 hours or more per week.

*b. Average annual business earnings*

The value of this variable equals the sum of total business income reported from all past calendar years except for the year before the current survey round, divided by the number of calendar years during which respondents were self-employed. This variable is used as the main measure for entrepreneurial experience. The mean of this variable is \$18,880 for the whole sample, \$25,406 for men, and \$10,911 for women.

Figure 2 explains why business earnings from the year prior to the current survey are excluded when previous business performance is measured. Assume a new business,  $b_t$ , is recorded in the current survey, say 1992, which in fact started in 1991 after the 1991 survey. If business income in 1991 is included to calculate average business earnings from previous years, we would incorrectly include the first-year earnings of the new business,  $b_t$ , in the measure of previous business experience. Thus, excluding business income in 1991 yields a more precise measure of previous business performance.

[Insert Figure 2 here]

Figure 3 provides a simple comparison of the earnings distributions between individuals who chose to found a new startup and those who did not. It clearly shows that serial entrepreneurs are associated with higher average annual earnings from previous businesses, although the difference starts to disappear at the top one percentile. Figure 4 displays a similar pattern when comparing the distributions of residual earnings, obtained after partialling out the contributes of age, gender,

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<sup>7</sup> The average self-employment earnings reported by Fairly (2005) is \$52,300 for men and \$28,217 for women from 1979 to 2002.

education, marital status, location, as well as average wages and employment by industry-year.

[Insert Figures 3 &4 here]

*c. Business earnings from the last self-employment calendar year*

This variable records business earnings from the last self-employment calendar year, excluding the year before the current survey round for the same reason as discussed above. The mean of this variable is \$21,520 for the overall sample, \$28,926 for the male, and \$12,330 for the female.

*d. Business earnings from the first self-employment calendar year*

This income variable is created to capture individuals' initial performance in self-employment. On average, individuals in the sample earned \$16,527 in the first year of self-employment. The earnings of men were substantially higher than women, which are \$22,493 and \$9,242, respectively.

*e. Initial earnings of new businesses*

For individuals who formed a new business, a variable is created to record business income received in the corresponding calendar year as a measure of new business performance at the early stage. The mean of this variable is \$27,859 for all serial business observations, \$37,229 for those associated with male entrepreneurs, and \$15,718 for female entrepreneurs.<sup>8</sup>

(3) *Tenure in Self-Employment*

As an alternative measure of entrepreneurial experience, this variable records the cumulative calendar years during which respondents reported a self-employment job prior to the current survey year. Based on the number of self-employed jobs reported in each survey round, a companion variable is created to record the total number of different businesses individuals had started before. On average, individuals in the sample stayed in self-employment for 3 years and reported 1.3 different businesses.

[Insert Tables 1 &2 here]

### **3. Empirical Estimations**

In this section, I present empirical estimations of the effects of selection on ability and learning by doing on new business formation and its early performance. I first replicate the baseline relationship between entrepreneurial experience and serial entrepreneurship that has been observed in previous studies, followed by an informal test of using passive learning model to explain this relationship. The fixed-effects

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<sup>8</sup> There is a concern that some entrepreneurs may have more than one business in a calendar year. In such a case, using annual business income as a measure of returns to one business may overstate its performance. Fortunately, there are very few cases like this. On average, there are only 6 serial entrepreneurs in each year who reported having more than one business. Thus, the bias associated with using this variable as a measure of early performance of new businesses is very limited.

model is then applied to focus on the role of learning by doing, as it eliminates the impact of time-invariant innate entrepreneurial ability or individual characteristics (*e.g.* taste for variety) that might lead to repeated entrepreneurial behavior. In the last part of the section, I employ IV estimations to partial out the contribution of learning by doing, and examine to what extent serial entrepreneurship could be explained by self-selection.

### 3.1 Unconditional baseline regressions

#### A. *The Likelihood of serial business formation*

I begin by estimating the relationship between a person’s entrepreneurial experience and the likelihood that he formed a new business in the following unconditional logit model,

$$\Pr(\text{SERIAL}_{it} = 1) = \frac{1}{1 + \exp[-(\alpha_0 + \beta_E \text{EXP}_{it-2} + \beta_M \text{MALE}_i + \bar{\beta}_z \bar{Z}_{it} + \bar{\beta}_x \bar{X}_{indus,t} + \varepsilon_{it})]}, \quad (1)$$

where  $\text{EXP}_{it-2}$  is the measure of a person’s previous entrepreneurial experience, the vector  $\bar{Z}_{it}$  is a set of time-varying individual characteristics (*e.g.* age, marital status, residence, completed highest grade), and  $\bar{X}_{indus,t}$  is a vector of controls for average wages and employment by industry-year in logarithm form.

Entrepreneurial experience could be divided into founding experience and previous business performance. The former is often measured by the number of previously-founded businesses, and the latter is measured by the outcome of the previous venture, such as IPO or acquisition. These two variables, however, cannot be used as proper proxies for entrepreneurial experience in this study for the following reasons. First, information on business exit is not available in the dataset for most survey years. Second, this dataset consists of a significant number of small businesses. For instance, among 4339 businesses that were identified as the current or recent employment of each survey year, 75% of them had no more than three employees. Thus, there is a concern that the number of different self-employment jobs reported by respondents captures more the frequency of job turnover than business founding experience. In contrast, average annual business income is a more reasonable measure of entrepreneurial experience, which takes into account the total returns to a person’s previous businesses and the cumulative years he had spent in self-employment. Thus, as an indicator of a person’s average performance in self-employment, this variable is used as the main measure of entrepreneurial experience in this analysis, and is referred as the *performance* measure for the rest of the paper. Additionally, an alternative variable, which records the cumulative years in which a respondent reported being self-employed, is used as a *tenure* measure of entrepreneurial experience.

Table 3 presents the baseline results. In the first column, the two standard measures of entrepreneurial experience, *earnings in the previous self-employment year* and *the number of businesses ever-founded*, are used in the estimation. Consistent with the stylized facts, both variables have a positive effect on the likelihood that an entrepreneur founded a new business in the current period. Column (2) adopts the alternative measure of entrepreneurial experience, and specifically examines the

relationship between entrepreneurs' average performance in previous businesses and the likelihood of new business formation. The log form of the performance measure is used in the estimation. To retain observations reporting zero business income, I follow Glaeser and Kerr (2009) by recoding these values as one dollar. As expected, the average performance of previous businesses has a positive and significant effect on the likelihood of new business formation. This relationship remains when respondents are weighted by the number of periods they stayed in the sample so that they are equally represented in the regression. The marginal effect suggests that a ten percent increase in average business earnings received from previous businesses is associated with a 0.8 percent increase in the probability that an entrepreneur started a new business. Column (3) replaces the performance measure with the tenure measure of entrepreneurial experience. The result shows that tenure in self-employment also has positive explanatory power for new business formation. The marginal effect indicates that an extra year spent in self-employment increases the likelihood of new business formation by seven percent. Column (4) reports the result from estimation with both measures of entrepreneurial experience included. Again, all relationships remain positive and significant at the one percent level. Individual demographic characteristics do not seem to matter. The only exception is age, which is shown to be positively related to the likelihood of new business formation. According to Fairly (2005), the rate of self-employment reached its peak in the *NLSY79* when the cohort was at the age between 42 and 55. In the current sample, the average age of respondents in 2008 was 46. Thus, the finding that older entrepreneurs in the sample exhibit a higher probability of founding a new business is consistent with the general pattern of the *NLSY79* data.

[Insert Table 3 here]

### *B. Serial business performance*

Table 4 presents the baseline results for the effects of entrepreneurial experience on the early performance of serial businesses in the following OLS regression,

$$\ln(INCOME_{it}) = \alpha_0 + \beta_E EXP_{it-2} + \beta_M MALE_i + \bar{\beta}_z \bar{Z}_{it} + \bar{\beta}_x \bar{X}_{indust,t} + \varepsilon_{it}, \quad (2)$$

The dependent variable is the log of the first-year income of the new business. Since all observations below the 50<sup>th</sup> percentile reported zero earnings in the first year, I again recode these values with one dollar business income. All right-hand side variables remain the same as in the logit specification (1). Similar to Table 3, column (1) presents the results with the standard measures of entrepreneurial experience included in the regression. It continues to show that previous entrepreneurial experience, measured by founding experience and business performance in the last self-employment year, are positively related to the initial performance of an entrepreneur's new venture. Columns (2) and (3) examine a similar relationship, using the new performance and tenure measures, respectively. The estimated relationship is still positive and significant for both measures. On average, ten percent increase in average annual business income results in 2.8 percent increase in the early earnings of new business, while one more year spent in self-employment increases the first-year earnings of new business by 19 percent. Demographic variables, including gender, education, marital status, and urban residence, all appear to have

positive impacts on new business performance. Column (4) shows similar results when both performance and tenure measures are incorporated in the regression.

[Insert Table 4 here]

The results above provide support for the general notion that serial entrepreneurship is positively associated with successful performance in previous ventures. But it remains unclear whether this relationship should be explained by learning by doing, as argued by the majority of studies in this line of literature, or should be attributed to selection on ability. These two types of distinct factors could be easily captured by measures of entrepreneurial experience. On the one hand, learning by doing occurs during business operation. The more an entrepreneur learned about running his businesses, the better performance he was able to achieve, and the longer he would stay in the business sector. From this perspective, the performance and tenure measures of entrepreneurial experience reflect the outcome of learning-by-doing from prior businesses. On the other hand, high-ability entrepreneurs tend to stay longer in businesses, and on average have better performance. From this point of view, entrepreneurial experience is also an indicator of innate entrepreneurial ability. The following analysis attempts to separate these two learning effects captured by the performance and tenure measures of entrepreneurial experience, and then examines the relevant importance of each type of learning in determining serial business formation and its subsequent performance.

### *C. An alternative test for passive learning model*

Before proceeding to the main analysis, I provide in this sub-section an additional test for the existence of these two types of passive learning in the present observations. Pakes and Ericson (1998) suggest a way to distinguish passive learning model from active learning model. According to their study, if passive learning exists, the current size of the firm should be strictly increasing in its initial size, regardless of how long the firm has survived. In a similar spirit, if selection on ability or learning by doing plays a relevant role in explaining serial entrepreneurship, we would expect to see the persistence of the effects of initial entrepreneurial experience on new business performance over time. The result presented in Column (5) of table 4 confirms this hypothesis. We can see that the initial entrepreneurial experience, proxied by business earnings received in a person's first self-employment year, has a positive explanatory power for early performance of the entrepreneur's new business, with the marginal effect similar to that of his most recent entrepreneurial experience, measured by his business earnings in the last self-employment year.

### 3.2 The fixed-effects regressions

To distinguish the effect of learning by doing from selection on ability, I first employ a fixed-effects model. As the fixed-effects regression removes the effect of time-invariant innate entrepreneurial ability, any surviving effects of the performance and tenure measures of entrepreneurial experience are likely due to learning by doing.

Table 5 reports the conditional logit estimations of the following model,

$$\Pr(\text{SERIAL}_{it} = 1) = \alpha_i + \beta_E \text{EXP}_{it-2} + \bar{\beta}_z \bar{Z}_{it} + \bar{\beta}_x \bar{X}_{indus,t} + \varepsilon_{it}, \quad (3)$$

where  $\alpha_i$  is the fixed effects of entrepreneur  $i$ .

The results are markedly different from the baseline outcome reported in Table 3. Columns (1) to (3) together show that the performance measure of entrepreneurial experience has no significant effect on the likelihood of founding a new business. Moreover, tenure in self-employment appears to affect the likelihood of new business formation in the negative direction. Since the selection effects have been partialled out from the regression, these results imply that learning by doing alone do not explain why experienced entrepreneurs are more likely to found a new business than their inexperienced counterparts, as suggested by the baseline results. Moreover, as shown in columns (2) and (3), entrepreneurs are less likely to start a new business if they had spent more years in self-employment.<sup>9</sup> These findings are at odds with the idea that entrepreneurial skills accumulated from previous business experience increases the probability that entrepreneurs explore new business opportunities in the future. First, the insignificant coefficient of the performance measure implies that there is probably little learning by doing involved in self-employment jobs such as those observed in the present dataset, which were often carried out at very small scale. Second, the negative relationship between self-employment tenure and new business formation indicates that learning by doing may result in the accumulation of specific rather than general entrepreneurial skills. Thus, the longer individuals stayed in self-employment, the more specific knowledge they have developed about the current businesses, and the less likely they would leave these businesses and form a new startup.

[Insert Table 5 here]

To show whether the initial performance of a new business depends on how much skills and knowledge an entrepreneur has accumulated from his previous experience, Table 6 examines the fixed-effects estimation of early performance of new businesses,

$$\ln(INCOME_{it}) = \alpha_i + \beta_E EXP_{it-2} + \bar{\beta}_Z \bar{Z}_{it} + \bar{\beta}_X \bar{X}_{indust,t} + \varepsilon_{it}, \quad (4)$$

The results, again, are in sharp contrast with those observed in the baseline regressions. Both the tenure and performance measures of entrepreneurial experience appear to have negative and significant impacts on the initial performance of an entrepreneur's new business. That is, among entrepreneurs who formed a new startup, those with longer experience or better performance in past businesses tend to achieve lower earnings at the earlier stage of the new venture. This finding emphasizes the idea that if learning by doing generated from previous entrepreneurial experience only enhances entrepreneurial skills that are specific to a person's prior ventures, it may become a disadvantage at the beginning when the entrepreneur formed a new startup.

### 3.3 Additional Analysis of Learning by Doing

As a robustness check, this subsection provides some additional analysis of the relevance of learning by doing in serial entrepreneurship. First, I examine the effect of

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<sup>9</sup> An unreported fixed-effects estimation including an extra quadratic term of the tenure measure further ensures that the probability of new business formation is strictly decreasing with entrepreneurial tenure.

learning by doing on the likelihood of founding a successful new venture. The analysis so far is based on all self-employed jobs observed in the data, with no distinction between successful and unsuccessful businesses. One may argue that compared to starting a business in general, founding a successful venture demands more entrepreneurial-specific capital accrued from previous entrepreneurial experience. Thus, the results reported in Table 5 may understate the role of learning by doing in serial entrepreneurship. However, distinguishing between successful and unsuccessful businesses is a little difficult in the *NLSY79* dataset because it provides no information on business outcomes. Nor does it have variables that consistently record business revenues or profits in all survey years. The only indicator of business performance is annual business income, which, however, has no negative values.<sup>10</sup> As a compromise, a new business is considered as successful if it reported positive earnings in the first year. This definition accounts for eighty percent of serial businesses identified in the data. Table 7 reports the effects of entrepreneurial experience on the likelihood of forming a successful venture estimated in the unconditional and conditional logit models, respectively. The results resemble those based on serial businesses in general. The effect of learning by doing remains negative on the creation of a successful venture.

Second, I examine the possibility that the negative result for learning by doing is attributed to the difference between learning from good and bad entrepreneurial experience. I estimate the fixed-effects regressions of new business formation and early business performance at the 50<sup>th</sup> and 90<sup>th</sup> percentiles of the previous earnings distribution, aiming to inspect whether the positive effects of learning by doing in serial entrepreneurship could be uncovered from entrepreneurs with more successful performance on prior businesses. The results presented in Tables 8.1 and 8.2 provide little support for this hypothesis. Learning by doing captured by the tenure measure of entrepreneurial experience continues to have a strong and negative effect on new business formation, while its effect on early performance of a new business is insignificant at both percentiles. The results for the performance measure also suggest that learning by doing is not sufficient to induce the creation of a new business, although the direction of its impact becomes positive for entrepreneurs with previous performance above the average. The relationship between the initial earnings of a new business and learning by doing indicated by previous business performance remains negative at the 50<sup>th</sup> percentile, and becomes positive but insignificant at the 90<sup>th</sup> percentile.

Lastly, I examine the role of learning by doing in serial entrepreneurship by focusing on the formation of new startups in industries related to entrepreneurs' previous ventures, and the effect of industry experience on early performance of new businesses. As previously discussed, the negative result for learning by doing obtained from the fixed-effects estimations implies that learning by doing may lead to the increase of industry-specific entrepreneurial skills that cannot be easily transferred to a new startup with little similarity to previous ventures. If this supposition is true, we

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<sup>10</sup> Respondents in the *NLSY79* are not reporting losses. If there is a loss, it is coded as zero.

would expect to see more evidence of learning by doing from entrepreneurs who founded a new startup in an industry he was familiar with, and from the relationship between their industry experience and the performance of new startups.

I create a variable, *INDUSYEAR*, which indicates a serial entrepreneur’s experience in the industry of his new business. For each individual who started a new business in the current survey year, this variable equals the number of prior survey years in which the individual reported being self-employed in the industry of his current new venture. A dummy variable, *SAMEINDUS*, is created, which equals one if the individual formed a new business in a familiar industry (the variable, *INDUSYEAR*, is greater than zero), and zero otherwise. Fifty-seven percent of new startups were founded in industries where entrepreneurs had formed a business before. I first examine the relationship between entrepreneurial experience and the likelihood that an entrepreneur forms a new business in a familiar industry. A positive correlation between the two provides evidence of learning by doing. I then analyze the effect of industry experience on early performance of new businesses. If learning by doing results in the development of industry-specific entrepreneurial skills, entrepreneurs with more experience in the related industry should be associated with higher earnings received at the early stage of their new businesses. As before, I continue with fixed-effects estimations to remove differences in innate ability. Table 9.1 reports the conditional logit regressions of the following model,

$$\Pr(\text{SAMEINDUS}_{it} = 1 | \text{SERIAL}_{it} = 1) = \alpha_i + \beta_E \text{EXP}_{it-2} + \bar{\beta}_z \bar{Z}_{it} + \bar{\beta}_x \bar{X}_{year,t} + \varepsilon_{it}, \quad (5)$$

where  $\bar{X}_{year,t}$  is a set of year dummies. All other variables remain the same as those included in previous regressions. In contrast to previous estimations where we find little evidence of learning by doing in serial business formation, the results suggest that among individuals who formed a new business, those who experienced more learning-by-doing, indicated by better performance or longer tenure in self-employment, are more likely to found a new startup in an industry where they had businesses before.

Table 9.2 estimates the following OLS fixed-effects regression similar to equation (4), with the dependent variable being the first-year earnings of new businesses and an additional independent variable, *INDUSYEAR*, as a measure of entrepreneurs’ experience in the same industry where the new startups were created,

$$\ln(\text{INCOME}_{it}) = \alpha_i + \beta_I \text{INDUSYEAR}_{it} + \beta_E \text{EXP}_{it-2} + \bar{\beta}_z \bar{Z}_{it} + \bar{\beta}_x \bar{X}_{year,t} + \varepsilon_{it}, \quad (6)$$

Column (1) reports the result when the variable, *INDUSYEAR*, is included as a single experience measure. It shows that the initial earnings of a new business are positively related to an entrepreneur’s previous business experience in similar industries. This result remains when the performance and tenure measures of entrepreneurial experience are added to the regressions, as shown in columns (2) and (3). Notice that these two measures continue to have negative but less significant effects on new business performance at the early stage. Since fixed ability effects have been removed from the estimation, these results highlight the importance of learning-by-doing on serial business performance for entrepreneurs who explored new business opportunities in related industries. Furthermore, the results provide some evidence of

business-specific learning that might explain the negative results for learning by doing observed in previous fixed-effects analysis.

### 3.4 The IV estimations

The fixed-effects analysis suggests that the positive relationship between entrepreneurial experience and serial business formation as well as its subsequent performance may be largely attributed to selection on ability. To further evaluate the role of selection on ability, I take a second approach by searching for instrumental variables that are correlated with entrepreneurial experience only through unobserved ability and then apply IV estimation to analyze the selection effect. This section first provides a discussion on the instruments, followed by the IV estimation results.

#### *A. The instruments*

The candidate instruments include three variables corresponding to the *first* year in which individuals became self-employed. These variables are annual business income, the number of reported businesses, and the entrepreneur's age. The fourth instrument is the average hourly rate of pay received by respondents in the *first* survey year during which they reported at least one full-time job.

The validity of these four variables relies on the fact that respondents had no prior entrepreneurial experience before the first year of self-employment. Thus, it is reasonable to argue that none of these variables has captured any effect of learning by doing. In contrast, all these variables are likely related to innate entrepreneurial ability, and therefore have a close relationship with the two measures of entrepreneurial experience adopted in this study. To see this, let us first look at business income received in the first year of self-employment. Because no skill has been accumulated from previous entrepreneurial experience, we expect an entrepreneur's initial performance in his first self-employment year to be heavily dependent on his innate entrepreneurial ability. Similarly, the number of businesses formed by respondents in the first self-employment year is likely to be associated with high entrepreneurial ability or taste for variety, although this variable may capture the possibility that low-ability entrepreneurs were forced to start more than one business in the first year because of prior failure. In this latter case, the number of businesses started in the first year of self-employment is an indicator of low ability, and therefore would be negatively correlated with entrepreneurial experience. However, the first-stage results reported below prove that this is not the case.

We may also expect that individuals with higher entrepreneurial ability are more likely to enter self-employment at a younger age. For example, Bill Gates formed his first venture at the age of 17, and Steve Jobs founded Apple when he was 21. Lastly, both theoretical (Jovanovic 1994) and empirical studies (Evans and Leighton 1989) have suggested a strong possibility that a person's wage-working ability is positively related to his entrepreneurial ability. Therefore, average hourly rate of pay in the first year of full-time employment is also considered as an instrument for innate entrepreneurial ability.

## *B. The results*

### (1) New business formation

I first focus on the effect of selection on the likelihood that an entrepreneur starts a new business. Table 10 presents probit results from two-step IV estimations. As before, columns (1) and (2) of Table 10 focus on the performance and tenure measures of entrepreneurial experience, respectively, while column (3) reports the result when both measures are included. The corresponding first-stage results are presented in the lower panel of the table.

In column (1), an entrepreneur's average annual business income is instrumented with his earnings in the first year of self-employment and average hourly rate of pay in the first year of full-time employment. The first-stage result displays a strong relationship between the two instruments and the performance measure of entrepreneurial experience. The overidentification test does not reject the null hypothesis that the two instruments are exogenous at conventional significance levels. The IV estimation result indicates that in the absence of learning by doing, previous entrepreneurial performance as a measure of innate ability has explanatory power for the likelihood that an entrepreneur forms a new startup. The marginal effect, however, is rather small, although positive and significant at the one percent level: a ten percent increase in the average of previous business income predicts an increase in the probability of new business formation by 1.6 percent.

A similar positive effect of entrepreneurial experience on new business formation is observed in column (2) where the tenure measure is evaluated. Self-employment tenure is instrumented with business earnings in the first year of self-employment and the number of businesses formed in that year. The first-stage result shows that both instruments have strong predicative power for how long an entrepreneur stays in self-employment. The second-stage probit result indicates that an entrepreneur's tenure in self-employment is positively associated with the probability that he would form a serial business. More important, the relationship is mainly explained by selection on ability. The marginal effect tells that one more year spent in self-employment increases the probability of an entrepreneur founding a new business by 22%.

Column (3) includes both performance and tenure measures of entrepreneurial experience. The first-stage results are similar to those displayed in the previous two columns. The IV estimation, however, is less precise. The effect of self-employment tenure on new business formation remains positive, but previous average business income has an unexpected negative effect on the likelihood of founding a new startup. Moreover, neither of the results is significant at conventional levels. The reason for these changes is probably because when both measures of entrepreneurial experience enter the regression and have to share the three instruments, there is less information available for either of them to explain the variation of the dependent variable.

### (2) Earnings from the Current Business

The second part of the IV analysis examines the effect of selection on ability on new business performance. Table 11 presents the IV estimation, followed by the results generated from the first-stage regressions. Again, the performance and tenure

measures of entrepreneurial experience are first evaluated separately in columns (1) and (2), and then combined together in column (3).

In column (1), the two variables, earnings in the first year of self-employment and average hourly rate of pay in the first year of full-time employment, remain as the instruments for the performance measure of entrepreneurial experience. A strong and positive relationship between them is consistently shown by the first-stage result. The IV estimation once again demonstrates the role of selection on ability in determining early performance of a new startup. It shows that a \$1000 increase in average annual income of previous businesses is associated with a \$566 increase in the first-year earnings of a new startup. The result is significant at the one percent level. Notice that demographic characteristics such as gender, education, and residence in urban areas also have some explanatory power for new business earnings, although they do not have any impact on new business formation.

Turning to the tenure measure of entrepreneurial experience, I find no evidence in the IV estimation that the number of years spent in self-employment predicts higher initial earnings of new businesses. It is worth noting the change of instruments used for the tenure of self-employment in column (2). This is due to the violation of the overidentifying restrictions when employing in the estimation the same instruments used in column (2) of Table 10. Thus, I use a person's age in the first year of self-employment as an alternative instrument. The first-stage result shows an expected negative relationship between the instrument and the tenure measure, but the IV estimation does not return any significant effect of selection on the early performance of new businesses.

Including both measures of entrepreneurial experience, column (3) shows that innate entrepreneurial ability indicated by previous entrepreneurial performance has stronger predicative power for new business performance. The magnitude of the marginal effect is comparable to that observed in column (1), when the performance measure entered the regression alone. The tenure measure affects new business performance in a positive direction, although the effect is not statistically significant.

The results presented in Tables 10 and 11 provide evidence that selection on ability is a proper explanation for the positive relationship between entrepreneurial experience and serial business formation, as well as its subsequent performance. The analysis shows that, even among low-tech entrepreneurs such as those observed in the present data, the ability of serial entrepreneurs is on average higher by comparison with the rest of the sample. Moreover, among serial entrepreneurs, those with higher ability tend to perform better, at least at the early stage of a new business.

It is also noticeable that the marginal effects of both measures of entrepreneurial experience appear to be larger in the IV estimations than those obtained from the baseline regressions. For example, we can see from Table 1A in the appendix that increasing previous business performance by ten percent raises the probability of forming a new startup by 0.8 percent in the baseline logit regression, but 1.6 percent in the IV estimation. Moreover, the baseline result implies that spending one more year in self-employment increases the chance of starting a new business by 7 percent, while the IV estimation returns a 22 percent increase. These differences in marginal

effects are consistent with the finding of the negative role played by learning by doing in serial entrepreneurship. After removing the negative effects of learning by doing, the IV estimations present even stronger effects of entrepreneurial experience on serial business formation and its early performance.

Lastly, thirty-five percent of observations in the sample report less than two years of entrepreneurial experience. For these observations, business earnings of the first self-employment year might be a noisy instrument for their entrepreneurial experience, or be serially correlated with their current business performance. In the appendix, I perform a robustness check of the IV estimations by dropping these observations. The results reported in Tables 2A.1 and 2A.2 remain the same as those presented in Tables 10 and 11.

### 3.5 Robustness Checks

This section performs some additional robustness checks of the results presented above. First, the analysis so far has been conducted for both male and female entrepreneurs. There is a concern that women are more likely to enter self-employment out of necessity. They work on average shorter hours and generate less business income. So selection on ability and learning by doing may have limited explanatory power for female entrepreneurship. As a robustness check, I repeat the whole analysis, with all female observations excluded from the sample. The new results presented in the appendix (Tables 3A.1 to 3A.4) are similar to those observed before. Selection on ability remains a strong determinant for both serial business formation and its early performance, in contrast to the negative effects observed for learning by doing.

Second, previous studies on wealth constraints faced by entrepreneurs suggest that wealthier people are more likely to start a business (*e.g.*, Evans and Jovanovic 1989; Chen 2010). Moreover, entrepreneurs with more personal wealth have enough startup capital to found a business at the efficient level, therefore are more likely to have better performance at the early stage of the business (Evans and Jovanovic 1989). In the previous sections, wealth effects were not considered in the analysis because of data limitations: information on assets was not available in the *NLSY79* until 1985. Including wealth would force all observations from 1981 to 1985 to be dropped. Nonetheless, as a robustness check, I include individuals' net wealth in the analysis and examine for this shorter panel whether incorporating this variable would affect the current results. The results presented in the appendix (Tables 4A.1 to 4A.4) show that an entrepreneur's net wealth is positively related to early performance of a new business, but has little impact on the likelihood of him forming a new startup. This finding may imply that, compared to the first-time business owners, financial constraints are getting weaker for incumbent entrepreneurs when they decide to form new ventures. More important, adding the wealth variable does not change the main finding that stresses the relevance of selection on ability in explaining serial entrepreneurship.

## 4. Conclusions

Serial entrepreneurs have increasingly become a popular topic in entrepreneurship studies, and previous business experience is broadly considered as an important determinant of serial business formation and new business success. Most studies interpret this relationship as a result of learning by doing that occurs during previous business operation. Little work has been done to examine another type of learning, *i.e.*, learning about one's innate entrepreneurial ability through previous business experience, and evaluate its effects on serial business formation and its subsequent performance. To circumvent the difficulty in empirically separating these two types of learning, this paper applies fixed-effects and IV estimations to analyze learning by doing and selection on ability, respectively. In contrast to previous findings, the fixed-effects results suggest that learning by doing is not the reason that entrepreneurs found serial businesses. On the contrary, the more entrepreneurs learned about how to run their current business, the *less* likely they would be to form a new startup. Moreover, among those who founded a new business, knowledge accumulated from previous experience becomes a disadvantage at the beginning and appears to have a negative effect on the early performance of new ventures. In contrast, results from the IV estimations provide evidence that selection on ability is the main explanation for the positive relationship between previous entrepreneurial experience and new business formation observed in the *NLSY79* dataset. Selection also has a strong and positive effect on the performance of new businesses at the early stage. However, the distinctive results for the two types of learning do not necessarily mean that learning by doing is irrelevant in serial entrepreneurship. A further examination of serial business owners in the data finds that learning by doing from previous entrepreneurial experience increases the likelihood of forming a new startup in an industry related to entrepreneurs' previous ventures. Moreover, learning by doing captured by entrepreneurial experience in a certain industry also has a positive impact on the initial performance of new startups formed in the same industry.

Although the present analysis is based on a sample of self-employed entrepreneurs operating businesses at small scales, the results are in general consistent with the insights provided by previous studies using different measures of entrepreneurship. The key finding that selection on ability plays a more dominant role in determining serial entrepreneurship than learning by doing echoes with Gompers et al (2006), who look at venture capital-backed firms and reckon that entrepreneurial skills rather than general entrepreneurial experience determines the success of businesses. Moreover, the evidence of learning by doing indicated by the positive effect of industry experience on the initial performance of new businesses has also been documented by Eesley and Roberts (2006a) with survey data on alumni from the Massachusetts Institute of Technology, as well as other studies using various data sources (Chatterji 2005, Bhide 2000).

The finding that entrepreneurial experience has a negative effect on the formation of new businesses and their early performance, generated from the fixed-effects estimations, is at odds with the common expectation that learning by doing prepares entrepreneurs with more founding and management skills to explore new business

opportunities and achieve higher business performance. This result may be driven by features peculiar to the current sample which is overly represented by low-income small business owners. The fact that 43 percent of new businesses observed in the data were founded in industries different from entrepreneurs' previous ventures implies that many of these business owners are likely to be necessity entrepreneurs who jumped around seeking profits in different self-employed jobs. Thus, learning by doing generated from these businesses is much more limited than what likely occurs in high-growth ventures with more learning opportunities within or beyond the organization. Nonetheless, the negative effects of entrepreneurial experience on early performance of new businesses may imply that learning from previous experience may become an obstacle to the development of new ventures when it is applied in a different context (Eesley and Roberts 2006a, Hiller and Hambrick 2005).

This study challenges the view prevalent among practitioners that entrepreneurship can be learned and the next business will always be better. For small business owners, the results suggest that learning by doing from previous businesses does not ensure the success of a new startup. However, learning by doing generates more value if entrepreneurs explore business opportunities in related sectors. In the meantime, this study emphasizes the essential role of innate entrepreneurial ability in entrepreneurship. For small business owners, selection may even have a dominant effect on new business formation and its subsequent performance.

Lastly, Figures 3 and 4 revealed an interesting characteristic of serial entrepreneurs. On average they are more likely to achieve higher earnings in previous ventures than those who did not form a new startup, but this difference vanishes at the top end of the earnings distributions. This pattern implies that serial entrepreneurship may reflect a process during which entrepreneurs search for the businesses that are the best match for their abilities, and high-ability entrepreneurs have more incentive to do so. The convergence of the two distributions implies that once entrepreneurs find the right business ideas, many of them choose to stay with these ventures.

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**Table 1 Summary Statistics**

	Obs.	Mean	Median	Std. dev.	Min	Max
Age (1981)	345	19.88	20	2.38	16	24
Age (2008)	2,009	46.65	47	2.28	43	51
Year	68,565	1,992.33	1991	7.93	1981	2008
Male	30,746	0.55	1	0.50	0	1
Married	30,746	0.57	1	0.50	0	1
City	30,746	0.73	1	0.44	0	1
Highest completed grade	30,633	12.98	12	2.42	1	20
Business income in the past calendar year	10,441	33,744.25	21,457.94	45,234.90	0	542,095.8
Business income in the past calendar year (male)	6,435	42,446.78	29,073.81	50,592.41	0	542,095.8
Business income in the past calendar year (female)	4,006	19,765.03	10,778.13	30,079.71	0	542,095.8
Average annual business income	30,746	18,880.00	11,202.60	24,521.22	1	448,105.6
Average annual business income (male)	16,903	25,406.43	18,327.54	27,927.59	1	448,105.6
Average annual business income (female)	13,843	10,910.91	4,983.50	16,360.10	1	289,618.5
Business income in the 1st SE year	30,746	16,526.91	7,278.11	26,654.87	0	306,778.7
Business income in the 1st SE year (male)	16,903	22,493.33	14,403.35	31,466.42	0	306,778.7
Business income in the 1st SE year (female)	13,843	9,241.61	2,356.75	16,507.81	0	276,158.1
Business income in the last SE year	29,517	21,520.53	11,801.87	33,088.63	1	542,095.8
Business income in the last SE year (male)	16,346	28,925.87	18,943.89	38,384.88	1	542,095.8
Business income in the last SE year (female)	13,171	12,330.07	4,870.62	21,739.51	1	542,095.8
Business income in the first year of new businesses	1,405	27,858.78	14,989.25	41,621.31	0	361,182.9
Business income in the first year of new businesses (male)	793	37,228.84	24,005.58	47,257.76	0	361,182.9
Business income in the first year of new businesses (female)	612	15,717.51	5,828.24	28,708.9	0	255,702.5
Average weekly working hours on SE jobs	6,722	38.65	40	19.00	1	168
Average weekly working hours on SE jobs (CPS)	5,107	41.69	40	18.78	0	168
Average weekly working hours on SE jobs (male)	4,203	41.76	40	18.67	1	110
Average weekly working hours on SE jobs (female)	2,519	33.45	35	18.39	1	168
cumulative years in previous SE	30,746	2.95	2	2.76	0	21
Number of prior businesses	30,746	1.32	1	0.68	1	11
Average hourly rate of pay in the first full-time employment year	29,953	6.12	6.285537	5.33	0	145.40
Networth	23,029	117,785	21080.34	302,000	-1,340,671	2,757,909

**Table 2 Descriptive Statistics on Self-Employment (CPS Jobs)**

	All Self-Employment	New Startups	Same Businesses	Serial Businesses
Mean annual counts	321	54.6	266.1	73.8
Overall frequencies	6741	1146	5588	1549
Percentage				
Overall	21.92	3.73	18.18	5.04
Between	55.38	25.98	48.62	31.94
Within	46.27	14.35	44.95	15.2
Counts by number of prior businesses (%)				
1	63.6	67.19	62.85	69.21
2	24.4	21.99	24.89	20.92
3	8.11	7.24	8.3	6.97
>3	3.89	3.58	3.95	2.91
Counts by industry (%)				
Primary	8.85	5.43	9.55	7.06
Construction	17.64	15.93	18.01	15.76
Manufacturing	4.39	3.87	4.51	4.18
Transportation	4.17	4.88	4.03	5
Wholesale and retail trade	12.12	12.71	12.02	12.54
Finance an real estate	3.04	4.51	2.74	4.32
Professional and related services	11.35	11.33	11.35	10.83
Other services	38.43	41.35	37.8	40.29
Counts by age (%)				
<30	30.97	31.76	30.8	34.67
[30, 40)	41.51	39.88	41.82	41.96
>40	27.52	28.36	27.38	23.37
Counts by gender (%)				
Male	60.64	54.89	61.86	56.81
Female	39.36	45.11	38.14	43.19

**Table 3 Serial Business Formation and Entrepreneurial Experience**

	Logit Regressions			
	Dept Var: =1 if starting a new firm in the current period			
	Standard Measures (1)	Performance Measure (2)	Tenure Measure (3)	Performance and Tenure (4)
Log of Ave. annual business income		0.085*** (6.76)		0.069*** (5.44)
Cumulative years in SE			0.071*** (8.05)	0.055*** (6.02)
Log of earnings in the last SE year	0.020** (2.26)			
Number of prior businesses	0.253*** (7.43)			
Age	0.025** (2.01)	0.031** (2.17)	0.040*** (2.89)	0.024* (1.71)
Male	0.007 (0.12)	-0.065 (-0.97)	0.003 (0.04)	-0.091 (-1.40)
Highest completed grade	0.002 (0.19)	-0.013 (-0.93)	-0.006 (-0.46)	-0.012 (-0.90)
Married	0.048 (0.81)	0.031 (0.49)	0.046 (0.72)	0.020 (0.31)
Urban	0.092 (1.43)	0.079 (1.10)	0.117 (1.65)	0.101 (1.43)
Controls for wages and employment by industry-year	Yes	Yes	Yes	Yes
Weighted	No	Yes	Yes	Yes
Ave. Log pseudolikelihood	-0.200	-0.125	-0.125	-0.12
Obs	29,410	30,633	30,633	30,633

Z-scores are in parentheses. Standard errors are clustered within individuals. Results are weighted by the number of periods respondents stay in the sample so that they are equally represented in the regression. Significance levels: \*\*\* 0.01, \*\* 0.05, \* 0.1. See Table 1A in the appendix for the marginal effects, and Table 5A.1 for the unweighted results.

**Table 4 Early Performance of Serial Business and Entrepreneurial Experience**

	Dept Var: Log of the 1st year earnings of new business				
	OLS regressions				
	Standard Measures	Performance Measure	Tenure Measure	Performance and Tenure	Initial & Last Performance
	(1)	(2)	(3)	(4)	(5)
Log of Ave. annual business income		0.280*** (5.76)		0.242*** (4.78)	
Cumulative years in SE			0.191*** (4.21)	0.131*** (2.84)	0.203*** (3.30)
Log of earnings in the first SE year					0.179*** (3.85)
Log of earnings in the last SE year	0.242*** (6.18)				0.111* (1.72)
Number of prior businesses	0.211 (1.48)				
Age	0.018 (0.39)	0.016 (0.33)	0.029 (0.62)	-0.007 (-0.14)	-0.057 (-0.93)
Male	1.679*** (7.06)	1.711*** (7.01)	2.107*** (9.14)	1.692*** (7.02)	1.426*** (4.63)
Highest completed grade	0.153*** (3.71)	0.167*** (3.84)	0.200*** (4.41)	0.164*** (3.75)	0.156*** (2.59)
Married	0.691 (3.03)	0.477** (2.04)	0.577** (2.45)	0.480** (2.06)	0.440 (1.54)
Urban	-0.006 (-0.02)	-0.089 (-0.38)	0.024 (0.10)	-0.028 (-0.12)	-0.085 (-0.31)
Industry-year controls	Yes	Yes	Yes	Yes	No
Weighted	No	Yes	Yes	Yes	Yes
R-squared	0.158	0.155	0.142	0.162	0.192
Obs	1372	1405	1405	1405	834

*t*-statistics are in parentheses. Standard errors are clustered within individuals. Industry-year controls are log of average wages and employment by industry-year from 1981 to 2008. Results are weighted by the number of periods respondents stay in the sample so that they are equally represented in the regression. Significance levels: \*\*\* 0.01, \*\* 0.05, \* 0.1. See Table 5A.2 in the appendix for the unweighted results.

**Table 5 Fixed-Effects Analysis of Learning by Doing (Serial Business Formation)**

	Dept Var: =1 if starting a new business in the current year		
	Conditional Logit Regressions		
	Performance Measure (1)	Tenure Measure (2)	Performance and Tenure (3)
Log of Ave annual business income	-0.022 (-1.57)		0.011 (0.76)
Cumulative years in SE		-0.385*** (-13.68)	-0.387*** (-13.57)
Age	-0.149 (-1.53)	-0.119 (-1.19)	-0.120 (-1.19)
Highest completed grade	0.047 (0.86)	-0.037 (-0.55)	-0.039 (-0.58)
Married	0.073 (0.75)	0.131 (1.26)	0.130 (1.25)
Urban	0.105 (1.03)	0.130 (1.24)	0.129 (1.24)
Industry-year controls	Yes	Yes	Yes
Weighted	Yes	Yes	Yes
Ave. Log pseudolikelihood	-0.176	-0.167	-0.167
Obs	12,810	12,810	12,810

Z-scores are in parentheses. Standard errors are clustered within individuals. Industry-year controls are log of average wages and employment by industry-year from 1981 to 2008. Results are weighted by the number of periods respondents stay in the sample so that they are equally represented in the regression. Significance levels: \*\*\* 0.01, \*\* 0.05, \* 0.1. See Table 5A.3 in the appendix for the unweighted results.

**Table 6 Fixed-Effects Analysis of Learning by Doing (Early Performance of New Business)**

	Dept Var: Log of the 1 <sup>st</sup> year earnings of new business		
	Fixed-Effects OLS		
	Performance Measure (1)	Tenure Measure (2)	Performance and Tenure (3)
Log of Ave annual business income	-0.223** (-2.14)		-0.208* (-1.91)
Cumulative years in SE		-0.276** (-1.97)	-0.258* (-1.83)
Age	0.873 (1.61)	0.874 (1.56)	0.958* (1.77)
Highest completed grade	0.187 (0.73)	0.179 (0.71)	0.205 (0.79)
Married	1.642*** (3.08)	1.512*** (2.89)	1.670*** (3.16)
Urban	0.047 (0.08)	-0.119 (-0.20)	0.009 (0.02)
Industry-year controls	Yes	Yes	Yes
Weighted	Yes	Yes	Yes
R-sq	0.114	0.114	0.123
Obs	1,405	1,405	1,405

t-statistics are in parentheses. Standard errors are clustered within individuals. Industry-year controls are log of average wages and employment by industry-year from 1981 to 2008. Results are weighted by the number of periods respondents stay in the sample so that they are equally represented in the regression. Significance levels: \*\*\* 0.01, \*\* 0.05, \* 0.1. See Table 5A.4 in the appendix for the unweighted results.

**Table 7 Founding Successful Businesses and Entrepreneurial Experience**

	Dept Var: =1 if founding a successful firm in the current period					
	Logit Regressions			Conditional Logit Regressions		
	Performance Measure (1)	Tenure Measure (2)	Performance and Tenure (3)	Performance Measure (4)	Tenure Measure (5)	Performance and Tenure (6)
Log. ave annual business income	0.113*** (7.60)		0.094*** (6.39)	-0.025* (-1.72)		0.010 (0.66)
Cumulative years in SE		0.081*** (8.64)	0.062*** (6.32)		-0.389*** (-12.33)	-0.390*** (-12.29)
Age	0.030** (1.96)	0.043*** (2.90)	0.022 (1.45)	-0.161 (-1.51)	-0.136 (-1.25)	-0.136 (-1.26)
Male	0.050 (0.67)	0.148** (2.09)	0.022 (0.30)			
Highest completed grade	-0.002 (-0.13)	0.007 (0.47)	-0.001 (-0.04)	0.021 (0.35)	-0.054 (-0.71)	-0.056 (-0.74)
Married	0.061 (0.85)	0.086 (1.20)	0.049 (0.69)	0.071 (0.68)	0.116 (1.05)	0.115 (1.04)
Urban	0.051 (0.65)	0.098 (1.27)	0.076 (0.99)	0.020 (0.18)	0.052 (0.45)	0.052 (0.45)
Industry-year controls	Yes	Yes	Yes	Yes	Yes	Yes
Weighted	Yes	Yes	Yes	Yes	Yes	Yes
Ave. Log pseudolikelihood	-0.107	-0.108	-0.107	-0.170	-0.161	-0.161
Obs	30,633	30,633	30,633	11,062	11,062	11,062

Z-scores are in parentheses. Standard errors are clustered within individuals. Significance levels: \*\*\* 0.01, \*\* 0.05, \* 0.1.

**Table 8.1 Fixed-Effects Analysis of Learning by Doing at the Upper  
End of Earnings Distribution (Serial Business Formation)**

Dept Var:=1 if starting a new firm in the current period		
Conditional Logit Regressions		
	50th Percentile (1)	90th Percentile (2)
Log of Ave. annual business income	0.241 (1.64)	0.105 (0.21)
Cumulative years in SE	-0.440*** (-10.70)	-0.561*** (-3.62)
Age	-0.269** (-2.01)	-0.420 (-1.51)
Highest completed grade	0.158* (1.78)	0.384 (1.12)
Married	0.062 (0.44)	0.115 (0.43)
Urban	0.039 (0.27)	0.222 (0.78)
Industry-year controls	Yes	Yes
Weighted	Yes	Yes
Ave. Log pseudolikelihood	-0.171	-0.171
Obs	6,683	1,277

Z-scores are in parentheses. Standard errors are clustered within individuals. Industry-year controls are log of average wages and employment by industry-year from 1981 to 2008. Significance levels: \*\*\* 0.01, \*\* 0.05, \* 0.1.

**Table 8.2 Fixed-Effects Analysis of Learning by Doing at the Upper  
End of Earnings Distribution (Early Business Performance)**

Dept Var: log of 1st year Earnings of new businesses		
Fixed-Effects OLS		
	50th Percentile (3)	90th Percentile (4)
Log of Ave. annual business income	-1.864*** (-2.80)	1.056 (0.38)
Cumulative years in SE	-0.197 (-1.38)	0.314 (0.88)
Age	1.128* (1.67)	-3.728* (-1.70)
Highest completed grade	-0.141 (-0.50)	1.131 (0.72)
Married	1.490*** (2.60)	0.840 (0.71)
Urban	0.435 (0.75)	-1.129 (-0.69)
Industry-year controls	Yes	Yes
Weighted	Yes	Yes
R-square	0.189	0.559
Obs	799	178

t-statistics are in parentheses. Standard errors are clustered within individuals. Industry-year controls are log of average wages and employment by industry-year from 1981 to 2008. Significance levels: \*\*\* 0.01, \*\* 0.05, \* 0.1.

**Table 9.1 Founding New Business in Familiar Industries and Learning by Doing**

Dept Var: =1 if starting a new business in a familiar industry			
Conditional Logit Regressions			
	Performance Measure (1)	Tenure Measure (2)	Performance and Tenure (3)
Log of Ave. annual business income	0.165** (2.04)		0.148* (1.80)
Cumulative years in SE		0.191** (2.12)	0.172* (1.85)
Age	-0.254 (-0.70)	-0.372 (-1.00)	-0.417 (-1.15)
Highest completed grade	-0.136 (-0.81)	-0.074 (-0.45)	-0.117 (-0.70)
Married	-0.197 (-0.59)	-0.107 (-0.32)	-0.257 (-0.76)
Urban	0.519 (1.39)	0.606 (1.59)	0.497 (1.35)
Controls for year	Yes	Yes	Yes
Weighted	Yes	Yes	Yes
Ave. Log pseudolikelihood	-0.232	-0.232	-0.229
Obs	431	431	431

Z-scores are in parentheses. Standard errors are clustered within individuals. Industry-year controls are log of average wages and employment by industry-year from 1981 to 2008. Significance levels: \*\*\* 0.01, \*\* 0.05, \* 0.1.

**Table 9.2 Early Performance of New Business in Familiar Industries and Learning by Doing**

Dept Var: Log of the 1st year earnings of new business			
Fixed-effects OLS Regressions			
	Industry Experience (4)	Add Performance Measure (5)	Add Performance and Tenure (6)
Log of Ave. annual business income		-0.199* (-1.85)	-0.177 (-1.57)
Cumulative years in SE			-0.313* (-1.95)
Industry experience	0.180** (2.18)	0.171** (2.09)	0.165** (1.98)
Age	0.458 (0.75)	0.546 (0.92)	0.662 (1.11)
Highest completed grade	0.263 (0.99)	0.303 (1.11)	0.321 (1.14)
Married	1.483** (2.48)	1.632*** (2.74)	1.667*** (2.83)
Urban	-0.174 (-0.28)	-0.050 (-0.08)	-0.088 (-0.14)
Controls for year	Yes	Yes	Yes
Weighted	Yes	Yes	Yes
R-square	0.112	0.120	0.133
Obs	1,322	1,322	1,322

t-statistics are in parentheses. Standard errors are clustered within individuals. Industry-year controls are log of average wages and employment by industry-year from 1981 to 2008. Significance levels: \*\*\* 0.01, \*\* 0.05, \* 0.1.

**Table 10 IV Estimation Analysis of Selection on Ability (Serial Business Formation)**

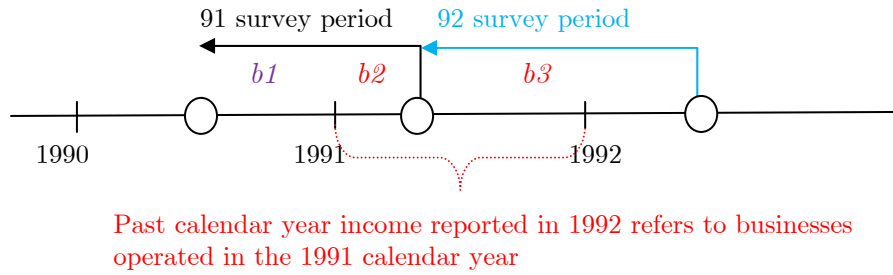
	Dept Var: =1 if starting a new business in the current year			
	IV two-step probit			
	Performance Measure (1)	Tenure Measure (2)	Performance and Tenure (3)	
Ave. annual business income	0.005*** (3.62)		-0.003 (-0.64)	
Cumulative years in SE		0.126*** (4.34)	0.200 (1.61)	
Age	0.038*** (4.83)	0.021** (2.17)	0.011 (0.59)	
Male	-0.033 (-0.87)	-0.071* (-1.71)	-0.093* (-1.77)	
Highest completed grade	-0.012 (-1.56)	-0.010 (-1.30)	-0.010 (-1.30)	
Married	0.031 (0.90)	0.013 (0.37)	0.007 (0.19)	
Urban	0.026 (0.70)	0.056 (1.47)	0.095* (1.65)	
Industry-year controls	Yes	Yes	Yes	
Weighted	No	No	No	
Obs	30,633	30,633	30,633	
Overid Test P-value	0.871	0.283	0.418	
	First-Stage			
	(1)	(2)	(3)	(4)
	Performance Measure	Tenure Measure	Performance Measure	Tenure Measure
Earnings from the first SE year	0.558*** (103.56)	0.023*** (21.57)	0.556*** (103.05)	0.023*** (20.74)
Ave. Hourly rate of pay in the first full-employment year	0.206*** (10.72)		0.206*** (10.75)	0.000 (-0.04)
Number of businesses formed in the first SE year		0.792*** (6.10)	3.375*** (5.24)	0.823*** (6.22)
Age	0.947*** (19.10)	0.166*** (17.18)	0.958*** (19.32)	0.182*** (17.84)
Male	7.200*** (31.94)	0.555*** (12.43)	7.244*** (32.14)	0.598*** (12.92)
Highest completed grade	0.508*** (10.60)	0.011 (1.11)	0.513*** (10.72)	0.011 (1.14)
Married	2.741*** (12.40)	0.208*** (4.69)	2.782*** (12.59)	0.235*** (5.17)
Urban	0.508** (2.10)	-0.316*** (-6.56)	0.502** (2.08)	-0.326*** (-6.56)
Industry-year controls	Yes	Yes	Yes	Yes
Adjusted R-sq	0.526	0.254	0.527	0.249
Obs	16,365	16,987	16,365	16,365

Z-scores and *t*-statistics are in parentheses for the IV and the first-stage regressions, respectively. Robust standard errors are reported. Industry-year controls are log of average wages and employment by industry-year from 1981 to 2008. Average annual business income and earnings from the first self-employment year are measured in \$1,000. Average hourly rate of pay in the first full-employment year is measured in dollars. Significance levels: \*\*\* 0.01, \*\* 0.05, \* 0.1. See Table1A in the appendix for the marginal effects, and Table 6A for alternative estimations without using earnings from the first SE year as the instrument.

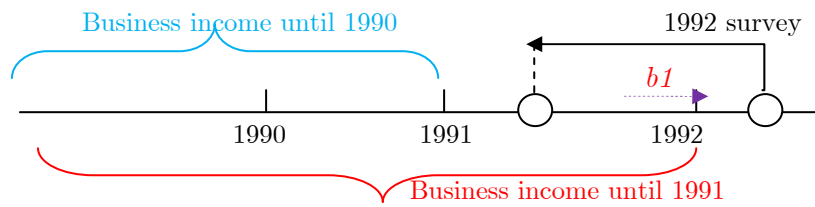
**Table 11 IV Estimation Analysis of Selection on Ability (Early Performance of New Business)**

Dept Var: New Business Income in the First Year				
IV 2SLS Regressions				
	Performance Measure	Tenure Measure	Performance and Tenure	
	(1)	(2)	(3)	
Ave. annual business income	0.566*** (5.92)		0.511*** (4.42)	
Cumulative years in SE		-0.242 (-0.26)	2.997 (0.93)	
Age	0.533 (0.93)	0.850* (1.78)	0.082 (0.11)	
Male	15.276*** (5.24)	25.586*** (11.09)	14.030*** (4.53)	
Highest completed grade	2.291*** (3.92)	3.223*** (6.67)	2.077*** (3.31)	
Married	4.192 (1.55)	10.102*** (4.55)	4.073 (1.47)	
Urban	4.793* (1.91)	5.736** (2.53)	5.728* (1.89)	
Industry-year controls	Yes	Yes	Yes	
Weighted	No	No	No	
R-sq	0.251	0.151	0.218	
Obs	819	1,405	819	
Overid Test P-value	0.483	---	0.475	
First-Stage				
	(1)	(2)	(3)	
	Performance Measure	Tenure Measure	Performance Measure	Tenure Measure
Earnings from the first SE year	0.512*** (7.66)		0.511*** (7.63)	0.011*** (2.85)
Ave. Hourly rate of pay in the first full-employment year	0.419*** (4.52)		0.419*** (4.53)	0.006 (0.41)
Age in the first SE year		-0.292*** (-15.54)	0.115 (0.45)	-0.146*** (-3.24)
Age	0.686*** (2.68)	0.402*** (13.59)	0.593* (1.82)	0.281*** (4.99)
Male	7.849*** (6.53)	0.473*** (3.75)	7.895*** (6.53)	0.501** (2.39)
Highest completed grade	0.933*** (4.05)	0.065*** (2.71)	0.930*** (4.04)	0.092** (2.25)
Married	1.760* (1.66)	0.112 (0.86)	1.770* (1.66)	0.060 (0.30)
Urban	1.276 (1.16)	-0.186 (-1.20)	1.281 (1.16)	-0.296 (-1.31)
Industry-year controls	Yes	Yes	Yes	Yes
Adjusted R-sq	0.552	0.340	0.552	0.338
Obs	819	1,405	819	819

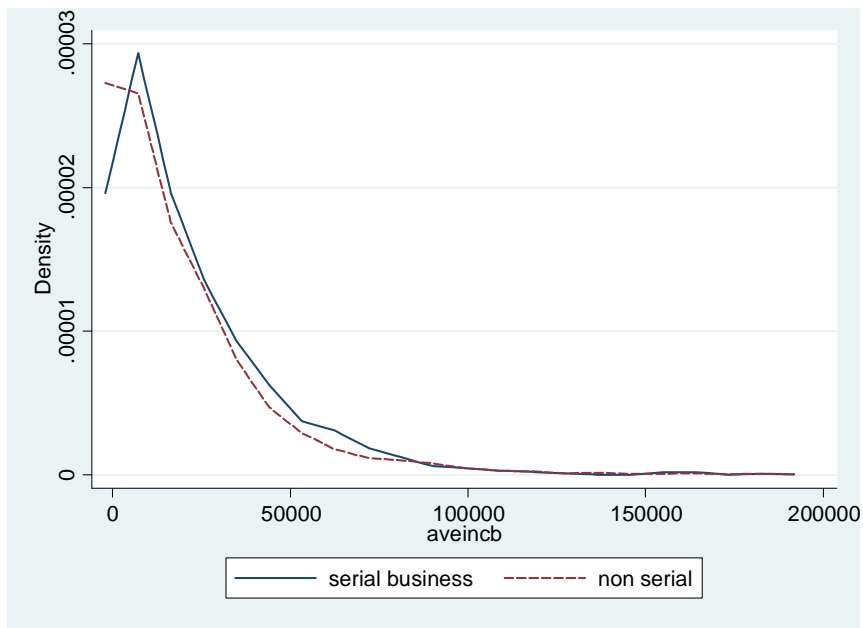
Z-scores and *t*-statistics are in parentheses for the IV and the first-stage regressions, respectively. Robust standard errors are reported. Industry-year controls are log of average wages and employment by industry-year from 1981 to 2008. Average annual business income and earnings from the first self-employment year are measured in \$1,000. Average hourly rate of pay in the first full-employment year is measured in dollars. Significance levels: \*\*\* 0.01, \*\* 0.05, \* 0.1. See Table 7A in the appendix for alternative estimations with standard errors clustered within individuals.



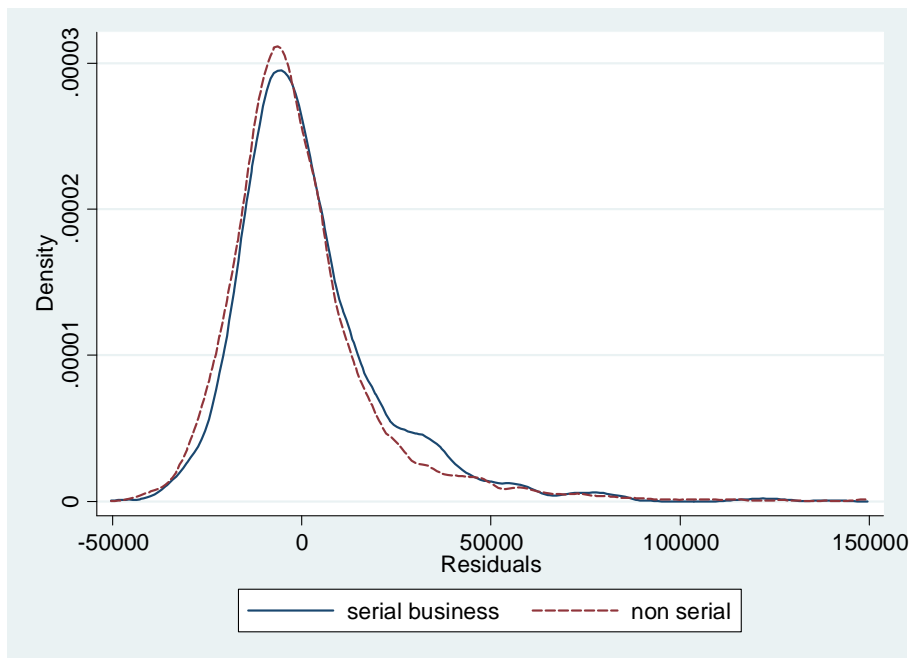
**Figure 1 An Example of Inconsistency between the Calendar Year and the Survey Round**



**Figure 2 An Example of Measuring Previous Business Performance**



**Figure 3 Distributions of Average Annual Earnings of Prior Businesses**



**Figure 4 Distributions of Residual Average Annual Earnings of Prior Businesses**

## Appendix A. Additional Tables

**Table 1A Marginal Effects of Entrepreneurial Experience on New Business Formation**

	Dept Var: =1 if starting a new business in the current period				
	Logit			IV Two-Step Probit	
	$d(\ln y)/dx$			$d(\ln y)/d(\ln x)$	$d(\ln y)/dx$
	(1)	(2)	(3)	(4)	(5)
Log of Ave. annual business income	0.081*** (6.76)		0.065*** (5.44)		
Ave. annual business income				0.156*** (3.33)	
Cumulative years in SE		0.067*** (8.05)	0.053*** (6.02)		0.228*** (3.67)
Industry-year controls	Yes	Yes	Yes	Yes	Yes
Weighted	Yes	Yes	Yes	Yes	Yes
Ave. Log pseudolikelihood	-0.125	-0.125	-0.125	-0.155	-0.153
Obs	30633	30633	30633	16365	16987

Z-scores are in parentheses. Average annual business income is measured in \$1,000. Additional controls include age, gender, education, marital status, location and average wages and employment by industry-year. Marginal effects are reported as (semi)elasticities. Significance levels: \*\*\* 0.01, \*\* 0.05, \* 0.1.

**Table 2A.1 IV Estimation Analysis of Selection on Ability (Serial Business Formation):  
Robustness check for dropping the observations with only one year of entrepreneurial  
experience**

	Dept Var: =1 if starting a new business in the current period			
	IV two-step probit			
	Performance Measure (1)	Tenure Measure (2)	Performance and Tenure (3)	
Ave. annual business income	0.003** (2.09)		0.002 (0.37)	
Cumulative years in SE		0.093** (2.33)	0.051 (0.47)	
Age	0.035*** (3.73)	0.022* (1.84)	0.028 (1.56)	
Male	-0.052 (-1.12)	-0.075 (-1.41)	-0.070 (-1.20)	
Highest completed grade	-0.005 (-0.60)	-0.006 (-0.69)	-0.006 (-0.69)	
Married	0.032 (0.79)	0.015 (0.35)	0.023 (0.50)	
Urban	0.013 (0.31)	0.053 (1.13)	0.039 (0.55)	
Industry-year controls	Yes	Yes	Yes	
Weighted	No	No	No	
Obs	19863	19863	19863	
Overid Test P-value	0.931	0.884	0.933	
	First-Stage			
	(1) Performance Measure	(2) Tenure Measure	(3) Performance Measure	(4) Tenure Measure
Earnings from the first SE year	0.493*** (73.71)	0.018*** (14.08)	0.491*** (73.41)	0.018*** (13.89)
Ave. Hourly rate of pay in the first full-employment year	0.260*** (10.67)		0.260*** (10.69)	-0.001 (-0.26)
Number of businesses formed in the first SE year		1.058*** (6.42)	3.427*** (4.00)	1.083*** (6.51)
Age	1.014*** (15.26)	0.177*** (14.20)	1.029*** (15.46)	0.186*** (14.42)
Male	9.570*** (31.51)	0.662*** (11.43)	9.596*** (31.61)	0.685*** (11.64)
Highest completed grade	0.827*** (12.80)	0.042*** (3.44)	0.830*** (12.85)	0.045*** (3.56)
Married	3.735*** (12.65)	0.303*** (5.36)	3.754*** (12.72)	0.330*** (5.76)
Urban	0.886*** (2.73)	0.453*** (-7.29)	0.899*** (2.77)	-0.471*** (-7.48)
Industry-year controls	Yes	Yes	Yes	Yes
Adjusted R-sq	0.485	0.238	0.4853	0.236
Obs	11200	11384	11200	11200

Z-scores and t-statistics are in parentheses for the IV and the first-stage regressions, respectively. Robust standard errors are reported. Industry-year controls are log of average wages and employment by industry-year from 1981 to 2008. Average annual business income and earnings from the first self-employment year are measured in \$1,000. Average hourly rate of pay in the first full-employment year is measured in dollars. Significance levels: \*\*\* 0.01, \*\* 0.5, \* 0.1.

**Table 2A.2 IV Estimation Analysis of Selection on Ability (Early Performance of New Business): Robustness check for dropping the observations with only one year of entrepreneurial experience**

Dept Var: =1 if starting a new business in the current period				
IV 2SLS Regressions				
	Performance Measure (1)	Tenure Measure (2)	Performance and Tenure (3)	
Ave. annual business income	0.615*** (6.15)		0.576*** (5.16)	
Cumulative years in SE		2.182 (0.82)	1.902 (0.79)	
Age	0.549 (0.92)	1.369* (1.95)	0.336 (0.50)	
Male	14.552*** (4.44)	22.896*** (6.76)	13.820*** (4.18)	
Highest completed grade	1.908*** (2.80)	2.364*** (3.59)	1.786*** (2.65)	
Married	5.798* (1.94)	8.496*** (2.74)	5.848* (1.94)	
Urban	5.697** (2.17)	8.926*** (2.99)	6.498** (2.15)	
Industry-year controls	Yes	Yes	Yes	
Weighted	No	No	No	
Obs	646	656	646	
Overid Test P-value	0.454	0.677	0.571	
First-Stage				
	1 Performance Measure	2 Tenure Measure	3 Performance Measure	4 Tenure Measure
Earnings from the first SE year	0.469*** (7.17)		0.466*** (7.04)	0.009** (2.21)
Ave. Hourly rate of pay in the first full-employment year	0.490*** (5.17)		0.486*** (5.09)	0.007 (0.50)
Number of businesses formed in the first SE year		1.190** (2.01)	2.632 (0.50)	1.071 (1.60)
Age in the first SE year		-0.196*** (-3.82)	0.104 (0.35)	-0.204*** (-3.98)
Age	0.641** (2.20)	0.305*** (4.98)	0.575 (1.54)	0.290*** (4.60)
Male	9.380*** (6.76)	0.647*** (3.00)	9.413*** (6.81)	0.522** (2.26)
Highest completed grade	1.134*** (4.14)	0.079* (1.68)	1.133*** (4.15)	0.093** (1.97)
Married	2.223* (1.75)	0.069 (0.31)	2.175* (1.74)	0.014 (0.06)
Urban	2.395* (1.84)	-0.295 (-1.19)	2.416* (1.84)	-0.373 (-1.48)
Industry-year controls	Yes	Yes	Yes	Yes
Adjusted R-sq	0.531	0.337	0.5303	0.338
Obs	646	656	646	646

Z-scores and t-statistics are in parentheses for the IV and the first-stage regressions, respectively. Robust standard errors are reported. Industry-year controls are log of average wages and employment by industry-year from 1981 to 2008. Average annual business income and earnings from the first self-employment year are measured in \$1,000. Average hourly rate of pay in the first full-employment year is measured in dollars. Significance levels: \*\*\* 0.01, \*\* 0.5, \* 0.1.

**Table 3A.1 Entrepreneurial Experience and Serial Business Formation (Male Entrepreneurs)**

	Dept Var: Serial=1 if foundng a successful firm in the current period					
	Logit Regressions			Conditional Logit Regressions		
	(1)	(2)	(3)	(4)	(5)	(6)
Log of Ave. annual business income	0.122*** (6.32)		0.109*** (5.68)	0.018 (0.95)		0.052*** (2.69)
Cumulative years in SE		0.057*** (5.15)	0.038*** (3.27)		-0.370*** (-10.72)	-0.377*** (-10.81)
Age	0.031 (1.62)	0.052*** (2.81)	0.026 (1.37)	-0.153 (-1.17)	-0.143 (-1.07)	-0.145 (-1.09)
Highest completed grade	-0.046** (-2.52)	-0.041** (-2.32)	-0.045** (-2.50)	0.052 (0.75)	0.048 (0.54)	0.038 (0.40)
Married	-0.140* (-1.69)	-0.080 (-0.97)	-0.146* (-1.77)	0.026 (0.20)	0.109 (0.79)	0.099 (0.72)
Urban	0.057 (0.63)	0.092 (1.02)	0.078 (0.86)	-0.058 (-0.44)	-0.005 (-0.03)	-0.010 (-0.07)
Industry-year controls	Yes	Yes	Yes	Yes	Yes	Yes
Weighted	Yes	Yes	Yes	Yes	Yes	Yes
Ave. Log pseudolikelihood	-0.129	-0.129	-0.129	-0.178	-0.169	-0.168
Obs	16854	16854	16854	7323	7323	7323

Z-scores are in parentheses. Standard errors are clustered within individuals. Results are weighted by the number of periods respondents stay in the sample so that they are equally represented in the regression. Significance levels: \*\*\* 0.01, \*\* 0.05, \* 0.1.

**Table 3A.2 Entrepreneurial Experience and Early Business Performance (Male Entrepreneurs)**

	Dept Var: Log. New Business Earnings in the First Year					
	OLS			Fixed-Effects OLS		
	(1)	(2)	(3)	(4)	(5)	(6)
Log of Ave. annual business income	0.332*** (4.01)		0.300*** (3.54)	-0.113 (-0.67)		-0.096 (-0.54)
Cumulative years in SE		0.152*** (2.64)	0.102* (1.77)		-0.233 (-1.57)	-0.226 (-1.50)
Age	0.026 (0.41)	0.050 (0.79)	0.007 (0.12)	1.136 (1.50)	1.228 (1.62)	1.241 (1.66)
Highest completed grade	0.140*** (2.65)	0.161*** (2.86)	0.142*** (2.66)	0.300 (1.12)	0.338 (1.31)	0.360 (1.35)
Married	0.712** (2.39)	0.895*** (3.04)	0.708** (2.38)	1.234** (2.01)	1.172* (1.93)	1.235** (2.03)
Urban	-0.190 (-0.67)	-0.107 (-0.37)	-0.131 (-0.46)	-0.034 (-0.07)	-0.129 (-0.25)	-0.072 (-0.14)
Industry-year controls	Yes	Yes	Yes	Yes	Yes	Yes
Weighted	Yes	Yes	Yes	Yes	Yes	Yes
R-sq	0.117	0.097	0.122	0.170	0.178	0.180
Obs	793	793	793	793	793	793

t-statistics are in parentheses. Standard errors are clustered within individuals. Industry-year controls are log of average wages and employment by industry-year from 1981 to 2008. Results are weighted by the number of periods respondents stay in the sample so that they are equally represented in the regression. Significance levels: \*\*\* 0.01, \*\* 0.05, \* 0.1.

**Table 3A.3 IV Estimation Analysis of Selection on Ability (Serial Business Formation; Male)**

Dept Var: =1 if starting a new business in the current period			
IV two-step probit			
	Performance Measure (1)	Tenure Measure (2)	Performance and Tenure (3)
Ave. annual business income	0.005*** (3.62)		-0.005 (-0.88)
Cumulative years in SE		0.148*** (4.31)	0.251** (1.96)
Age	0.031*** (2.92)	0.013 (1.05)	0.000 (0.02)
Highest completed grade	-0.030*** (-3.23)	-0.024** (-2.46)	-0.018 (-1.48)
Married	-0.074 (-1.64)	-0.076* (-1.68)	-0.070 (-1.48)
Urban	0.003 (0.06)	0.071 (1.39)	0.141 (1.62)
Industry-year controls	Yes	Yes	Yes
Weighted	No	No	No
Obs	16854	16854	16854
Overid Test P-value	0.498	0.289	0.876

First-Stage				
	(1)	(2)	(3)	
	Performance Measure	Tenure Measure	Performance Measure	Tenure Measure
Earnings from the first SE year	0.536*** (75.67)	0.021*** (16.74)	0.534*** (75.13)	0.021*** (16.46)
Ave. Hourly rate of pay in the first full-employment year	0.194*** (7.66)		0.191*** (7.56)	-0.004 (-0.92)
Number of businesses formed in the first SE year		1.064*** (5.19)	3.510*** (3.09)	1.082*** (5.19)
Age	1.394*** (18.07)	0.171*** (12.55)	1.391*** (18.04)	0.180*** (12.76)
Highest completed grade	0.407*** (5.74)	-0.040*** (-3.11)	0.409*** (5.77)	-0.039*** (-2.97)
Married	4.524*** (13.3)	0.177*** (2.88)	4.561*** (13.40)	0.173*** (2.77)
Urban	0.633* (1.73)	-0.516*** (-7.82)	0.669* (1.83)	-0.518*** (-7.72)
Industry-year controls	Yes	Yes	Yes	Yes
Adjusted R-sq	0.463	0.271	0.4631	0.266
Obs	9839	10067	9839	9839

z-scores and *t*-statistics are in parentheses for the IV and the first-stage regressions, respectively. Robust standard errors are reported. Industry-year controls are log of average wages and employment by industry-year from 1981 to 2008. Average annual business income and earnings from the first self-employment year are measured in \$1,000. Average hourly rate of pay in the first full-employment year is measured in dollars. Significance levels: \*\*\* 0.01, \*\* 0.5, \* 0.1.

**Table 3A.4 IV Estimation Analysis of Selection on Ability (Early Performance of New Business; Male)**

Dept Var: New Business Income in the First Year			
IV 2SLS Regressions			
	Performance Measure	Tenure Measure	Performance and Tenure
	(1)	(2)	(3)
Ave. annual business income	0.560*** (5.12)		0.441*** (2.63)
Cumulative years in SE		0.008 (0.01)	7.261 (0.96)
Age	0.495 (0.57)	0.849 (1.11)	-0.688 (-0.42)
Highest completed grade	2.476*** (3.17)	3.707*** (5.12)	2.141** (2.32)
Married	9.921*** (2.97)	18.935*** (6.01)	9.120** (2.51)
Urban	7.236** (1.97)	7.413* (1.91)	9.629* (1.86)
Industry-year controls	Yes	Yes	Yes
Weighted	No	No	No
Obs	501	793	501
Overid Test P-value	0.919	---	0.897
First-Stage			
	(1)	(2)	(3)
	Performance Measure	Tenure Measure	Performance Measure Tenure Measure
Earnings from the first SE year	0.477*** (7.19)		0.474*** (7.20) 0.008** (2.21)
Ave. Hourly rate of pay in the first full-employment year	0.426*** (4.44)		0.422*** (4.43) 0.006 (0.44)
Age in the first SE year		-0.312*** (-11.18)	0.533 (1.31) -0.101 (-1.61)
Age	1.066*** (2.82)	0.414*** (9.66)	0.663 (1.35) 0.257*** (3.41)
Highest completed grade	0.716** (2.21)	0.034 (1.02)	0.704** (2.19) 0.060 (1.15)
Married	3.811** (2.50)	0.245 (1.40)	3.909** (2.56) 0.156 (0.64)
Urban	1.679 (1.07)	-0.229 (-0.98)	1.533 (0.99) -0.275 (-0.89)
Industry-year controls	Yes	Yes	Yes
Adjusted R-sq	0.490	0.332	0.492 0.339
Obs	501	793	501 501

z-scores and *t*-statistics are in parentheses for the IV and the first-stage regressions, respectively. Robust standard errors are reported. Industry-year controls are log of average wages and employment by industry-year from 1981 to 2008. Average annual business income and earnings from the first self-employment year are measured in \$1,000. Average hourly rate of pay in the first full-employment year is measured in dollars. Significance levels: \*\*\* 0.01, \*\* 0.5, \* 0.1.

**Table 4A.1 Serial Business Formation and Entrepreneurial Experience (Wealth Effects)**

	Dept Var: =1 if starting a new business in the current period	
	Logit (1)	Conditional Logit (2)
Log of Ave. annual business income	0.050*** (3.13)	-0.173*** (-3.61)
Cumulative years in SE	0.058*** (5.20)	-0.500*** (-11.76)
Net wealth	0.000 (0.88)	0.000 (-1.55)
Age	0.026 (1.54)	-0.133 (-0.98)
Male	-0.099 -1.26	
Highest completed grade	-0.007 (-0.40)	-0.031 (-0.30)
Married	0.042 (0.55)	0.252* (1.75)
Urban	0.038 (0.45)	-0.004 (-0.03)
Industry-year controls	Yes	Yes
Weighted	Yes	Yes
Ave. Log pseudolikelihood	-0.132	-0.182
Obs	19959	6953

Z-scores are in parentheses. Standard errors are clustered within individuals. Results are weighted by the number of periods respondents stay in the sample so that they are equally represented in the regression. Net wealth is measured in \$1,000. Significance levels: \*\*\* 0.01, \*\* 0.5, \* 0.1.

**Table 4A.2 Early Performance of Serial Business and Entrepreneurial Experience (Wealth Effects)**

	Dept Var: Log. New Business Earnings in the First Year	
	OLS (1)	Fixed-Effects (2)
Log of Ave. annual business income	0.263*** (3.91)	-0.159 (-0.95)
Cumulative years in SE	0.086 (1.55)	-0.188 (-0.78)
Net wealth	0.000 (0.99)	0.001 (0.87)
Age	0.040 (0.69)	1.306 (1.56)
Male	1.91*** (6.54)	
Highest completed grade	0.123** (2.38)	0.242 (0.71)
Married	0.350 (1.28)	1.322* (1.71)
Urban	0.058 (0.21)	0.673 (0.81)
Industry-year controls	Yes	Yes
Weighted	Yes	Yes
R-sq	0.167	0.135
Obs	1002	1002

t-statistics are in parentheses. Standard errors are clustered within individuals. Industry-year controls are log of average wages and employment by industry-year from 1981 to 2008. Results are weighted by the number of periods respondents stay in the sample so that they are equally represented in the regression. Net wealth is measured in \$1,000. Significance levels: \*\*\* 0.01, \*\* 0.5, \* 0.1.

**Table 4A.3 Estimation Analysis of Selection on Ability  
(Serial Business Formation; Wealth Effects)**

Dept Var: =1 if starting a new business in the current period				
IV two-step probit				
	Performance Measure (1)	Tenure Measure (2)	Performance and Tenure (3)	
Ave. annual business income	0.004** (2.42)		0.004 (0.71)	
Cumulative years in SE		0.095*** (2.62)	-0.011 (-0.07)	
Age	0.036*** (3.82)	0.021* (1.78)	0.038 (1.58)	
Male	-0.052 (-1.13)	-0.073 (-1.46)	-0.051 (-0.83)	
Highest completed grade	-0.013 (-1.50)	-0.009 (-1.02)	-0.014 (-1.44)	
Married	0.022 (0.53)	0.023 (0.54)	0.019 (0.46)	
Urban	-0.017 (-0.37)	0.009 (0.20)	-0.019 (-0.28)	
Net wealth	0.000 (0.96)	0.000 (-0.69)	0.000 (0.39)	
Industry-year controls	Yes	Yes	Yes	
Weighted	No	No	No	
Obs	19959	19959	19959	
Overid Test P-value	0.587	0.628	0.588	
First-Stage				
	(1) Performance Measure	(2) Tenure Measure	(3) Performance Measure	Tenure Measure
Earnings from the first SE year	0.544*** (86.01)	0.022*** (16.99)	0.542*** (85.61)	0.022*** (16.37)
Ave. Hourly rate of pay in the first full-employment year	0.200*** (8.70)		0.201*** (8.74)	0.001 (0.13)
Number of businesses formed in the first SE year		0.904*** (5.70)	3.434*** (4.50)	0.907*** (5.69)
Age	0.957*** (16.40)	0.188*** (15.82)	0.969*** (16.59)	0.193*** (15.80)
Male	7.230*** (27.12)	0.564*** (10.28)	7.273*** (27.28)	0.580*** (10.42)
Highest completed grade	0.361*** (6.38)	-0.010 (-0.89)	0.365*** (6.46)	-0.013 (-1.11)
Married	1.826*** (6.92)	0.097* (1.79)	1.861*** (7.05)	0.107* (1.94)
Urban	0.579** (1.99)	-0.313*** (-5.21)	0.571** (1.97)	-0.311*** (-5.12)
Net wealth	0.012*** (22.41)	0.002*** (18.66)	0.012*** (22.45)	0.002*** (19.03)
Industry-year controls	Yes	Yes	Yes	Yes
Adjusted R-sq	0.552	0.220	0.5523	0.221
Obs	11246	11430	11246	11246

*z*-scores and *t*-statistics are in parentheses for the IV and the first-stage regressions, respectively. Robust standard errors are reported. Industry-year controls are log of average wages and employment by industry-year from 1981 to 2008. Net wealth and business earnings are measured in \$1,000. Average hourly rate of pay in the first full-employment year is measured in dollars. Significance levels: \*\*\* 0.01, \*\* 0.5, \* 0.1.

**Table 4A.4 Estimation Analysis of Selection on Ability  
(Early Performance of New Business; Wealth Effects)**

Dept Var: New Business Income in the First Year				
IV 2SLS Regressions				
	Performance Measure (1)	Tenure Measure (2)	Performance and Tenure (3)	
Ave. annual business income	0.501*** (4.45)		0.443*** (2.96)	
Cumulative years in SE		-0.237 (-0.20)	2.410 (0.60)	
Age	0.945 (1.40)	1.505*** (2.58)	0.576 (0.62)	
Male	16.575*** (4.56)	26.098*** (9.52)	15.403*** (4.02)	
Highest completed grade	2.053*** (2.72)	2.749*** (4.76)	1.945** (2.50)	
Married	4.364 (1.32)	9.163*** (3.53)	3.787 (1.10)	
Urban	6.437** (2.10)	6.672** (2.56)	7.371* (1.93)	
Net wealth	0.024** (2.53)	0.023*** (3.82)	0.022** (2.05)	
Industry-year controls	Yes	Yes	Yes	
Weighted	No	No	No	
Obs	578	1002	578	
Overid Test P-value	0.480	---	0.470	
First-Stage				
	(1) Performance Measure	(2) Tenure Measure	(3) Performance Measure	(3) Tenure Measure
Earnings from the first SE year	0.460*** (6.47)		0.460*** (6.45)	0.012*** (2.65)
Ave. Hourly rate of pay in the first full-employment year	0.395*** (4.10)		0.395*** (4.10)	0.007 (0.48)
Age in the first SE year		-0.282*** (-12.17)	0.025 (0.10)	-0.143*** (-2.79)
Age	0.870*** (3.35)	0.413*** (11.36)	0.849** (2.44)	0.294*** (4.51)
Male	7.912*** (6.27)	0.58*** (3.69)	7.917*** (6.27)	0.646** (2.48)
Highest completed grade	0.644*** (2.64)	0.050* (1.65)	0.644*** (2.63)	0.062 (1.24)
Married	0.974 (0.79)	0.114 (0.70)	0.980 (0.80)	0.234 (0.92)
Urban	1.963 (1.64)	-0.252 (-1.32)	1.966 (1.63)	-0.360 (-1.26)
Net wealth	0.011*** (3.31)	0.001* (1.91)	0.011*** (3.32)	0.001** (1.98)
Industry-year controls	Yes	Yes	Yes	Yes
Adjusted R-sq	0.566	0.280	0.5656	0.2693
Obs	578	1002	578	578

Z-scores and *t*-statistics are in parentheses for the IV and the first-stage regressions, respectively. Robust standard errors are reported. Industry-year controls are log of average wages and employment by industry-year from 1981 to 2008. Net wealth and business earnings are measured in \$1,000. Average hourly rate of pay in the first full-employment year is measured in dollars. Significance levels: \*\*\* 0.01, \*\* 0.05, \* 0.1.

**Table 5A.1 Serial Business Formation and Entrepreneurial Experience (Unweighted)**

	Dept Var: Serial=1 if starting a new business in the current year		
	Logit Regressions		
	Performance Measure (1)	Tenure Measure (2)	Performance and Tenure (3)
Log of Ave. annual business income	0.068*** (6.25)		0.052*** (4.73)
Cumulative years in SE		0.075*** (8.90)	0.062*** (7.07)
Age	0.021* (1.64)	0.023* (1.83)	0.013 (1.05)
Male	-0.039 (-0.64)	0.004 (0.08)	-0.066 (-1.10)
Highest completed grade	-0.006 (-0.46)	0.003 (0.21)	-0.004 (-0.31)
Married	0.016 (0.27)	0.021 (0.37)	0.002 (0.03)
Urban	0.096 (1.45)	0.127* (1.94)	0.115* (1.77)
Industry-year controls	Yes	Yes	Yes
Weighted	No	No	No
Ave. Log pseudolikelihood	-0.198	-0.198	-0.197
Obs	30633	30633	30633

Z-scores are in parentheses for logit and OLS regressions, respectively. Standard errors are clustered within individuals. Significance levels: \*\*\* 0.01, \*\* 0.5, \* 0.1.

**Table 5A.2 Early Performance of Serial Business and Entrepreneurial Experience (Unweighted)**

	Dept Var: Log. New Business Earnings in the First Year		
	OLS Regressions		
	Performance Measure (4)	Tenure Measure (5)	Performance and Tenure (6)
Log of Ave. annual business income	0.272*** (5.96)		0.243*** (5.10)
Cumulative years in SE		0.172*** (4.00)	0.108** (2.44)
Age	0.001 (0.03)	0.010 (0.22)	-0.017 (-0.36)
Male	1.763*** (7.47)	2.132*** (9.44)	1.740*** (7.41)
Highest completed grade	0.173 (4.24)	0.215*** (5.19)	0.174*** (4.26)
Married	0.596*** (2.62)	0.715*** (3.11)	0.594*** (2.62)
Urban	0.001 (0.00)	0.116 (0.49)	0.052 (0.23)
Industry-year controls	Yes	Yes	Yes
Weighted	No	No	No
R-squared	0.152	0.136	0.157
Obs	1405	1405	1405

t-statistics are in parentheses for logit and OLS regressions, respectively. Standard errors are clustered within individuals. Significance levels: \*\*\* 0.01, \*\* 0.5, \* 0.1.

**Table 5A.3 Fixed Effects Analysis of Entrepreneurial Experience and Serial Business Formation (Unweighted)**

	Dept Var: Serial=1 if starting a new business in the current year		
	Logit Regressions		
	Performance Measure (1)	Tenure Measure (2)	Performance and Tenure (3)
Log of Ave. annual business income	-0.015 (-0.91)		0.021 (1.31)
Cumulative years in SE		-0.407*** (-16.89)	-0.412*** (-16.86)
Age	-0.100 (-1.08)	-0.070 (-0.74)	-0.070 (-0.74)
Highest completed grade	0.063 (1.20)	-0.018 (-0.33)	-0.023 (-0.40)
Married	0.060 (0.67)	0.119 (1.28)	0.118 (1.26)
Urban	0.111 (1.14)	0.126 (1.26)	0.125 (1.25)
Industry-year controls	Yes	Yes	Yes
Weighted	No	No	No
Ave. Log pseudolikelihood	-0.259	-0.246	-0.246
Obs	12810	12810	12810

Z-scores are in parentheses for the conditional logit and fixed-effects OLS estimations, respectively. Standard errors are clustered within individuals. Industry-year controls are log of average wages and employment by industry-year from 1981 to 2008. Significance levels: \*\*\* 0.01, \*\* 0.5, \* 0.1.

**Table 5A.4 Fixed Effects Analysis of Entrepreneurial Experience and Early Performance of New Business (Unweighted)**

	Dept Var: Log. New Business Earnings in the First Year		
	OLS Regressions		
	Performance Measure (1)	Tenure Measure (2)	Performance and Tenure (3)
Log of Ave. annual business income	-0.188* (-1.82)		-0.172* (-1.66)
Cumulative years in SE		-0.267** (-2.06)	-0.249* (-1.93)
Age	0.824 (1.56)	0.846 (1.60)	0.895* (1.69)
Highest completed grade	0.151 (0.57)	0.141 (0.54)	0.163 (0.62)
Married	1.768*** (3.57)	1.667*** (3.40)	1.786*** (3.61)
Urban	0.012 (0.02)	-0.138 (-0.23)	-0.038 (-0.06)
Industry-year controls	Yes	Yes	Yes
Weighted	No	No	No
R-squared	0.115	0.117	0.123
Obs	1405	1405	1405

t-statistics are in parentheses for the conditional logit and fixed-effects OLS estimations, respectively. Standard errors are clustered within individuals. Industry-year controls are log of average wages and employment by industry-year from 1981 to 2008. Significance levels: \*\*\* 0.01, \*\* 0.5, \* 0.1.

**Table 6A IV Estimation Analysis of Selection on Ability (Serial Business Formation, Different Instruments)**

	Dept Var: =1 if starting a new business in the current period			
	IV two-step probit			
	Performance Measure (1)	Tenure Measure (2)	Performance and Tenure (3)	
Ave. annual business income	0.009* (1.87)		0.001 (0.11)	
Cumulative years in SE		0.126*** (4.34)	0.194 (1.56)	
Age	0.029** (2.30)	0.021** (2.17)	0.004 (0.17)	
Male	-0.094 (-1.28)	-0.071* (-1.71)	-0.145* (-1.78)	
Highest completed grade	-0.014* (-1.78)	-0.010 (-1.30)	-0.012 (-1.50)	
Married	0.008 (0.20)	0.013 (0.37)	-0.012 (-0.26)	
Urban	0.022 (0.59)	0.056 (1.47)	0.090 (1.56)	
Industry-year controls	Yes	Yes	Yes	
Weighted	No	No	No	
Obs	30633	30633	30633	
Overid Test P-value	0.116	0.283	---	
	First-Stage			
	(1) Performance Measure	(2) Tenure Measure	(3) Performance Measure	(3) Tenure Measure
Earnings from the first SE year		0.023*** (21.57)		
Ave. Hourly rate of pay in the first full-employment year	0.502*** (20.63)		0.502*** (20.63)	0.012*** (3.06)
Number of businesses formed in the first SE year	7.883*** (9.55)	0.792*** (6.10)	7.883*** (9.55)	1.009*** (7.55)
Age	1.846*** (29.42)	0.166*** (17.18)	1.846*** (29.42)	0.218*** (21.50)
Male	12.966*** (46.21)	0.555*** (12.43)	12.966*** (46.21)	0.835*** (18.37)
Highest completed grade	0.517*** (8.41)	0.011 (1.11)	0.517*** (8.41)	0.011 (1.14)
Married	4.689*** (16.57)	0.208*** (4.69)	4.689*** (16.57)	0.314*** (6.84)
Urban	0.907*** (2.92)	-0.316*** (-6.56)	0.907*** (2.92)	-0.309*** (-6.14)
Industry-year controls	Yes	Yes	Yes	Yes
Adjusted R-sq	0.219	0.254	0.2193	0.229
Obs	16365	16987	16365	16365

Z-scores and *t*-statistics are in parentheses for the IV and the first-stage regressions, respectively. Robust standard errors are reported. Industry-year controls are log of average wages and employment by industry-year from 1981 to 2008. Average annual business income and earnings from the first self-employment year are measured in \$1,000. Average hourly rate of pay in the first full-employment year is measured in dollars. Significance levels: \*\*\* 0.01, \*\* 0.5, \* 0.1.

**Table 7A IV Estimation Analysis of Selection on Ability  
(Early Performance of New Business; Weighted; Standard Errors Clustered)**

	Dept Var: =1 if starting a new business in the current period			
	IV 2SLS Regressions			
	Performance Measure (1)	Tenure Measure (2)	Performance and Tenure (3)	
Ave. annual business income	0.548*** (5.56)		0.502*** (3.53)	
Cumulative years in SE		-1.012 (-0.87)	2.068 (0.48)	
Age	0.647 (1.05)	1.305** (2.36)	0.347 (0.38)	
Male	15.509*** (4.64)	25.894*** (10.00)	14.738*** (4.33)	
Highest completed grade	2.496*** (3.14)	3.358*** (5.82)	2.318*** (2.79)	
Married	4.877 (1.61)	9.513*** (3.70)	5.088 (1.61)	
Urban	6.118** (2.35)	6.471*** (2.63)	6.827** (2.04)	
Industry-year controls	Yes	Yes	Yes	
Weighted	Yes	Yes	Yes	
R-sq	0.245	0.143	0.229	
Obs	819	1405	819	
	First-Stage			
	(1)	(2)	(3)	
	Performance Measure	Tenure Measure	Performance Measure	Tenure Measure
Earnings from the first SE year	0.527*** (9.46)		0.525*** (9.44)	0.013*** (2.80)
Ave. Hourly rate of pay in the first full-employment year	0.434*** (4.89)		0.434*** (4.93)	0.005 (0.33)
Number of businesses formed in the first SE year				
Age in the first SE year		- 0.270*** (-11.67)	0.267 (1.06)	-0.111** (-2.28)
Age	0.621** (2.48)	0.408*** (11.37)	0.403 (1.25)	0.251*** (4.02)
Male	7.407*** (6.64)	0.546*** (3.55)	7.517*** (6.72)	0.488** (2.09)
Highest completed grade	0.838*** (3.56)	0.083*** (2.67)	0.834*** (3.57)	0.106** (2.20)
Married	1.512 (1.42)	0.032 (0.20)	1.533 (1.44)	-0.076 (-0.33)
Urban	1.683 (1.52)	-0.253 (-1.32)	1.704 (1.54)	-0.317 (-1.24)
Industry-year controls	Yes	Yes	Yes	Yes
Adjusted R-sq	0.551	0.310	0.552	0.310
Obs	819	1405	819	819

Z-scores and t-statistics are in parentheses for the IV and the first-stage regressions, respectively. Robust standard errors are reported. Industry-year controls are log of average wages and employment by industry-year from 1981 to 2008. Average annual business income and earnings from the first self-employment year are measured in \$1,000. Average hourly rate of pay in the first full-employment year is measured in dollars. Significance levels: \*\*\* 0.01, \*\* 0.05, \* 0.1.

## Appendix B The Model

### (1) Technology

The life-time value of an entrepreneurial firm,  $v$ , is given by

$$v(a, b) = e^{a+b} \quad (\text{B.1})$$

where  $a$  is entrepreneurial ability, and  $b$  is the quality of business idea. Neither  $a$  or  $b$  is perfectly observable ex ante, but entrepreneurs have some common prior beliefs about them. Let  $F_0(a)$  denote a common prior belief about  $a$ , and  $F_0(b)$  be a common prior belief about  $b$ . Both  $F_0(a)$  and  $F_0(b)$  are normal distributions with mean 0 and variances,  $\sigma_a^2$  and  $\sigma_b^2$ , respectively.

In period 0, an agent faces a choice between starting a business and working as a paid employee. If the agent starts his own business, the expected life-time value of a new start-up in period 0 is

$$E_0(v(a, b)) = \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} e^{a+b} \cdot \varphi_0(a, b) da db \quad (\text{B.2})$$

where  $\varphi_0(\cdot)$  is the joint density. Because  $a$  and  $b$  are independent, we can rewrite equation (2) as

$$E_0(v(a, b)) = \int_{-\infty}^{\infty} e^a f_0(a) da \int_{-\infty}^{\infty} e^b f_0(b) db = e^{(\sigma_a^2 + \sigma_b^2)/2} \quad (\text{B.3})$$

where  $f_0(\cdot)$  is the density.

Assume the life-time earnings in wage employment,  $W$ , are constant for all individuals, although in reality returns to wage employment may be related to entrepreneurial ability. To further simplify the problem, I assume  $W < e^{(\sigma_a^2 + \sigma_b^2)/2}$ , so that all individuals start from the business sector.

Each period, the entrepreneur observes one signal,  $s_{at}$ , of his ability, and the other signal,  $s_{bt}$ , of his current business idea. Let

$$s_{at} = a + \varepsilon_t \quad (\text{B.4})$$

and

$$s_{bt} = b + \mu_t \quad (\text{B.5})$$

where  $\varepsilon_t \sim N(0, \sigma_\varepsilon^2)$  and  $\mu_t \sim N(0, \sigma_\mu^2)$ .

Based on the signals, the entrepreneur revises his prior beliefs about  $a$  and  $b$  through Bayesian updating. His posterior beliefs at period  $t$  also follow the normal distributions. That is,

$$F_t(a) \sim N(\tilde{a}_t, \tilde{\sigma}_{at}^2)$$

and

$$F_t(b) \sim N(\tilde{b}_t, \tilde{\sigma}_{bt}^2)$$

where  $\tilde{a}_t = t\bar{s}_a\sigma_a^2/(\sigma_\varepsilon^2 + t\sigma_a^2)$ ,  $\tilde{\sigma}_{at}^2 = \sigma_\varepsilon^2\sigma_a^2/(\sigma_\varepsilon^2 + t\sigma_a^2)$ ,  $\tilde{b}_t = t\bar{s}_b\sigma_b^2/(\sigma_\mu^2 + t\sigma_b^2)$  and  $\tilde{\sigma}_{bt}^2 = \sigma_\mu^2\sigma_b^2/(\sigma_\mu^2 + t\sigma_b^2)$ .

The new beliefs subsequently induce an updated expectation of the life-time value of the firm, which can be written as

$$E_t(v(a, b)) = \int_{-\infty}^{\infty} e^a f_t(a) da \int_{-\infty}^{\infty} e^b f_t(b) db = \exp[\tilde{a}_t + \tilde{b}_t + \frac{1}{2}(\tilde{\sigma}_{at}^2 + \tilde{\sigma}_{bt}^2)] \quad (\text{B.6})$$

## (2) The entrepreneur's decision

The entrepreneur has three career choices at the end of each period. He can either choose to stay with the current venture, or start a new business with a different idea, or switch to the wage sector.

Two additional assumptions are imposed for the ease of the analysis. First, there is no market for business ideas. In other words, the price of an old business is set to be zero. Second, no cost is incurred for starting a new venture or abandoning an existing venture. Under these assumptions, the option of starting a new business is preferred at the end of period  $t$  if

$$E_t(v(a, b^0)) > W \quad (\text{B.7})$$

and

$$E_t(v(a, b)) < E_t(v(a, b^0)) \quad (\text{B.8})$$

where  $E_t(v(a, b^0))$  is the expected life-time value of a new business, given the entrepreneur's belief about his ability,  $a$ , in period  $t$ .

Expanding both inequalities (7) and (8) yields

$$\tilde{a}_t > \ln(W) - \frac{1}{2}(\tilde{\sigma}_{at}^2 + \sigma_b^2) \quad (\text{B.9})$$

and

$$\tilde{b}_t < \frac{1}{2}(\sigma_b^2 - \tilde{\sigma}_{bt}^2) \quad (\text{B.10})$$

Expressions (9) and (10) describe two independent conditions for forming a new business. That is, the entrepreneur's expectation of his ability,  $\tilde{a}_t$ , exceeds a certain value; while his expectation about the existing business,  $\tilde{b}_t$ , falls below a certain value.

The posterior means,  $\tilde{a}_t$  and  $\tilde{b}_t$ , are both normally distributed, with

$$\tilde{a}_t \sim N\left(\frac{t\sigma_a^2}{\sigma_\varepsilon^2 + t\sigma_a^2}, \frac{t\sigma_a^4\sigma_\varepsilon^2}{\sigma_\varepsilon^2 + t\sigma_a^2}\right)$$

and

$$\tilde{b}_t \sim N\left(\frac{tb\sigma_b^2}{\sigma_\mu^2 + t\sigma_b^2}, \frac{t\sigma_b^4\sigma_\mu^2}{\sigma_\mu^2 + t\sigma_b^2}\right)$$

Thus, the probability that an entrepreneur starts a new business,  $P(nb|a, b)$ , can be easily written as

$$P(nb|a, b) = \int_{\ln(w) - \frac{1}{2}(\tilde{\sigma}_a^2 + \sigma_b^2)}^{\infty} \int_{-\infty}^{\frac{1}{2}(\sigma_b^2 - \tilde{\sigma}_{b_t}^2)} f(\tilde{b}_t|b) d\tilde{b}_t f(\tilde{a}_t|a) d\tilde{a}_t \quad (\text{B.11})$$

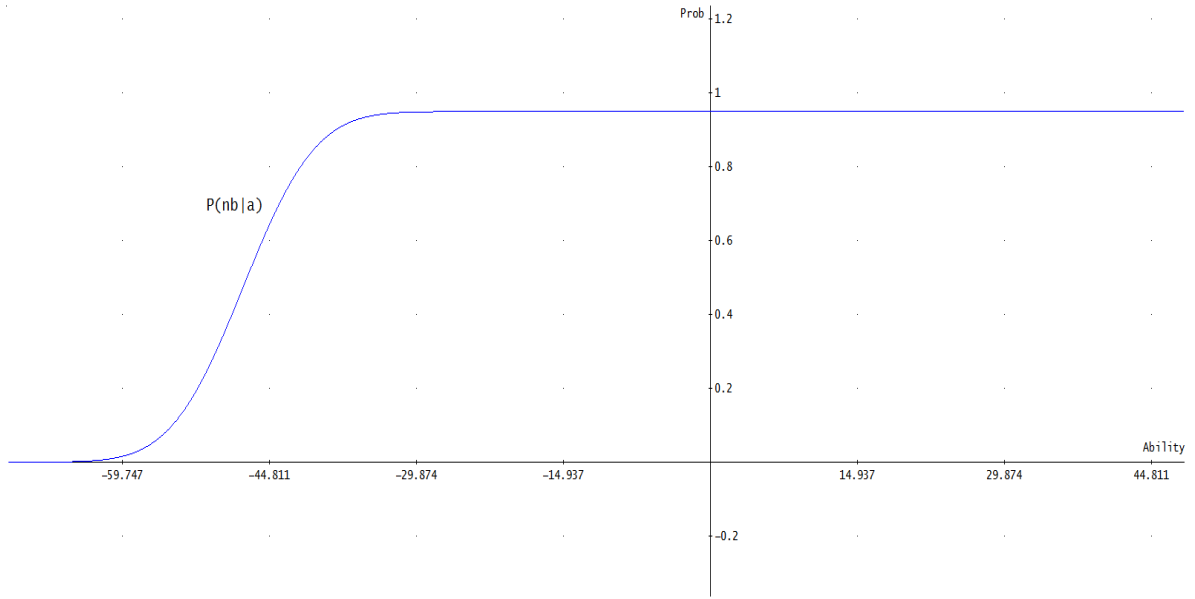
where  $f(\cdot)$  is the density function.

From equation (11), we can derive the likelihood that an entrepreneur forms a new business, averaged over all possible business ideas he might have for the current venture, which can be expressed as

$$P(nb|a) = \int_{-\infty}^{\infty} P(nb|a, b) dF_0(b) \quad (\text{B.12})$$

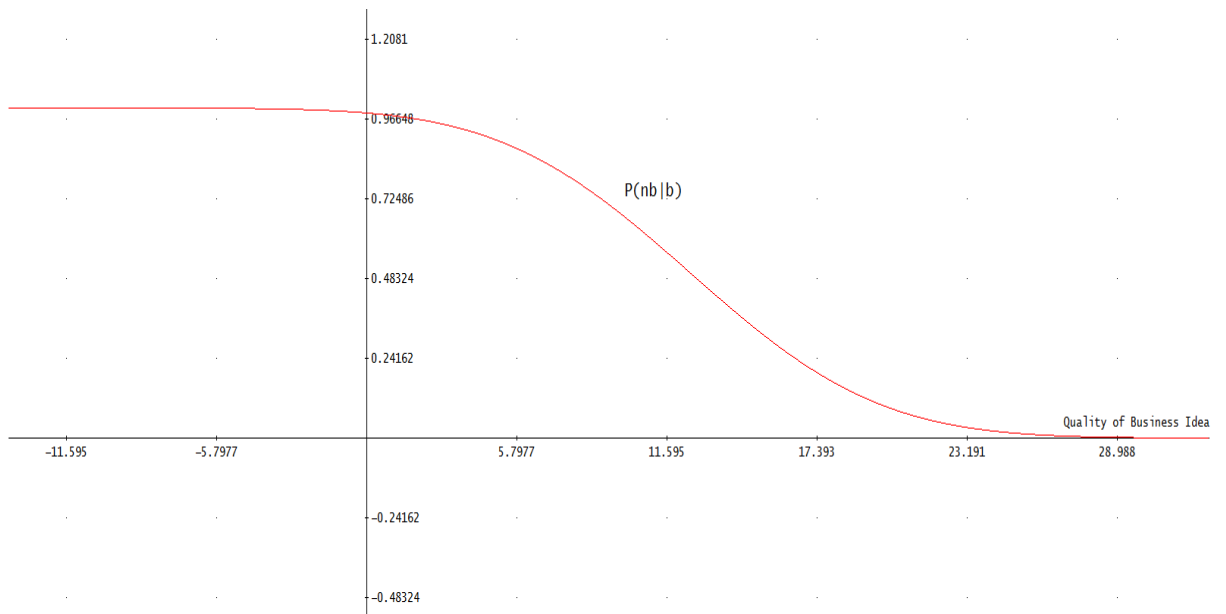
It is easy to see that  $P(nb|a)$  is a function of an entrepreneur's true ability,  $a$ . However, the expression is complex, and it is a challenge to show algebraically how this conditional likelihood responds to the change of true ability values. Thus, I resort to numerical evaluation to characterize the relationship between serial business formation and entrepreneurial ability. As a comparison, I also plot the likelihood of new business formation averaged over all values of entrepreneurial ability,  $P(nb|b)$ , against the quality of current business idea. There are six parameters: the variances of prior beliefs,  $\sigma_a^2$  and  $\sigma_b^2$ ; the variances of two signals,  $\sigma_\varepsilon^2$  and  $\sigma_\mu^2$ ; the length of time a person stayed in the current business,  $t$ ; and the reservation wage,  $W$ . I set the values of  $\sigma_a^2$  and  $\sigma_b^2$  equal to 5, the values of  $\sigma_\varepsilon^2$  and  $\sigma_\mu^2$  equal to 10, the values of  $t$  and  $W$  as 3 and 0.5, respectively. The simulation results are illustrated in Figures B1 and B2. The downward sloping curve indicates that new business formation is less likely to occur if an entrepreneur has a higher-quality business idea, given all possible levels of entrepreneurial ability. Since new business ideas are assumed to be random draws, it is not surprising that entrepreneurs who received good signals about their current businesses would be hesitant to take on the risk of founding a completely new venture.

More importantly, we see clearly from the upward sloping curve that the likelihood of starting a new business is strictly higher for entrepreneurs with higher ability, given all possible values for the current business idea. This result indicates that serial entrepreneurs are a selective group of people whose ability is stochastically higher than those who stayed in the current business or switched to the wage sector.



**Figure B1. The Probability of Forming a New Business vs. Entrepreneurial Ability**

(Parameter values:  $\sigma_a^2 = \sigma_b^2 = 5$ ;  $\sigma_\varepsilon^2 = \sigma_\mu^2 = 10$ ,  $t = 3$ , and  $W = 0.5$  )



**Figure B2. The Probability of Forming a New Business vs. Quality of Business Idea**

(Parameter values:  $\sigma_a^2 = \sigma_b^2 = 5$ ;  $\sigma_\varepsilon^2 = \sigma_\mu^2 = 10$ ,  $t = 3$ , and  $W = 0.5$  )