ENTREPRENEURIAL ENTRY THRESHOLDS

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ABSTRACT

Much of prior research recognizes that entry into entrepreneurship involves a comparison of expected economic returns in a venture to some threshold level of acceptable performance. Despite this recognition, theory commonly focuses on drivers of economic returns at the exclusion of threshold drivers. Moreover, typical empirical investigations of entry provide little insight into whether determinants influence expected returns, the required threshold, or both. Drawing from the Panel Study of Entrepreneurial Dynamics, we apply an empirical approach new to the entrepreneurial entry literature to investigate the drivers of both expected performance and the unobserved threshold, providing greater insight into entry determinants.

1. INTRODUCTION

Much of the research examining entry into entrepreneurship recognizes that it is conditioned by a comparison of an individual's expected economic returns in a venture to some required threshold level of performance.[1] Unfortunately, it is common that theory pertaining to entrepreneurial entry focuses on drivers of economic returns at the exclusion of drivers of required thresholds. Moreover, empirical investigations focus predominantly on simply identifying the determinants of entry, which obfuscates whether the determinants influence expected economic returns, the required threshold level of returns, or both. This paper addresses this theoretical and empirical gap.

Explicit consideration that entry is conditioned by the relationship between an entrepreneur's expected returns and required threshold contributes to the literature by clarifying the precise explanation for entry underlying a theory. We clarify the role of three fundamental determinants of entry identified in the literature: human capital (Lucas, 1978; Lazear, 2005), the presence of non-financial motives (Hamilton, 2000), and liquidity constraints (Evans and Jovanovic, 1989). For example, while Lazear (2005) has argued that individuals with greater skill diversity are likely to have higher payoffs in entrepreneurship, it is premature to claim confirmation of this theory through his observation that such individuals are more likely to enter entrepreneurship. In fact, a positive relationship between diversity and entry may obtain because diversity raises expected economic returns in the venture, or lowers thresholds because of less attractive alternatives outside of entrepreneurship, or both. While a number of studies have found that liquidity constraints inhibit entry into self-employment (e.g., Evans and Jovanovic,1989; Evans and Leighton, 1989), it remains ambiguous whether this is due to lower expected

[1] This view is consistent with economic theories (e.g., Lucas, 1978; Kihlstrom and Laffont, 1979; Lazear, 2005) that typically view entrepreneurship as a career choice between an entrepreneurial opportunity and wage work in which a potential entrepreneur chooses the option that maximizes his or her utility.

performance, or higher required thresholds due to more expensive capital, or both. We believe it is important to illuminate whether these prominent theories pertain to expected performance or required thresholds, and develop hypotheses around this.

We test our hypotheses by empirically identifying how theoretical constructs influence both expected performance and required thresholds. This is not trivial because there are challenges in doing so, including (i) the unobservability of expected performance when entry does not occur, (ii) the endogenous nature of the entry decision, and (iii) the unobservability of the threshold. We estimate expected returns and required thresholds using the same method employed by Gimeno, Folta, Cooper, and Woo (1997) to examine exit thresholds. We test our model using data on nascent entrepreneurs drawn from the Panel Study of Entrepreneurial Dynamics (PSED), a nationally representative, longitudinal data set of United States adults attempting to start new businesses along with a comparison group of individuals not starting new businesses. One other key advantage to this data for our purposes is that it includes a measure of expected performance. Nearly all other studies of entrepreneurial entry approximate expected performance through actual performance, which confounds whether effects are due to expectations or bias that is systematically linked to the difference between expectations and actual performance. Such biases may be highly pertinent in decisions around entrepreneurial entry, a context characterized by high levels of uncertainty in which potential entrepreneurs must rely heavily on judgment to create estimates or forecasts of future outcomes (Knight, 1921); judgements that have been shown to be subject to a number of decision making biases that imply expectations are unlikely to match actual outcomes (e.g., Busenitz and Barney, 1997; Hayward, Shepherd, and Griffin, 2006; Cassar, 2010). The availability of information on expected

performance avoids concerns about biases that may confound our ability to distinguish between expected performance and required thresholds.

The remainder of the paper proceeds as follows. We first summarize prior applications of the threshold model in other contexts. We next develop hypotheses around the effects of human capital, motivations, and wealth on expected performance and entry thresholds. After describing the data set, measurement issues, and the detail of estimating the threshold model, we review the results of our empirical tests. The final sections discuss and conclude.

2. THEORY AND HYPOTHESIS DEVELOPMENT

2.1. Entry as a Function of Expected Performance and Required Thresholds

While the determinants of entry are a carefully researched subject, research has not yet diagnosed whether they influence entry through expected performance or through thresholds. As noted by Parker (2006), "the most popular vehicle among applied researchers in the field" is the use of discrete choice models (e.g., logit and probit) to examine the likelihood of choosing to engage in entrepreneurship versus another option. As we explain in detail below, this provides little insight into the question of why certain determinants are related to entry.

Discrete choice entry models consider that individuals choose careers to maximize utility:

$$Choose \qquad \begin{array}{ll} Z = 1 & if\ U_E \geq U_A \\ Z = 0 & if\ U_E < U_A \end{array} \qquad (1)$$

Where, $Z = 1$ represents entry into entrepreneurship and Z = 0 represents no entry, or persistence in wage work; U_E and U_A represent expected utility from entrepreneurship and alternative employment, respectively. Equivalently, this estimates the probability that $Z^* \geq 0$, where $Z^* = (U_E - U_A)$, and Z^* is estimated as a function of a vector of independent variables.

$$Z^* = X\beta + \upsilon, \qquad (2)$$

where X is a vector of variables thought to influence entry, β is a coefficient vector, and υ is a normally distributed random variable. This approach has significant problems when U_E and U_A have separate determinants. Suppose

$$U_E = X\beta_E + \nu, \qquad (3)$$
$$U_A = X\beta_A + \mu \qquad (4)$$

where β_E and β_A are coefficient vectors, and ν and μ are normally distributed random variables. After substituting into equation 1, the probability of entry ($Z = 1$) becomes $\Pr(U_E \geq U_A) = \Pr(\nu - \mu \geq X\beta_A - X\beta_E)$. The use of discrete choice is problematic because only the difference between β_A and β_E can be identified for a particular independent variable. Consider, for example, the argument that higher levels of education increase U_E, but also increase U_A because of better alternative opportunities. If we let β_{Ei} represent the effect of education in an entrepreneurial venture and β_{Ai} represent the effect in wage work, we can test whether $\beta_{Ei} - \beta_{Ai} > 0$; however, this only provides information on the *relative* magnitude of the coefficients. It is possible that we find $\beta_{Ei} - \beta_{Ai} = 0$, but this does not refute the underlying hypothesis that both β_{Ei} and β_{Ai} are positive. Even if we find that $\beta_{Ei} - \beta_{Ai} > 0$, it is still possible that $\beta_{Ei} \leq 0$. In fact, Panel A of Table 1 demonstrates that there are five potential underlying relationships that are consistent with an association between higher education and entry. In only three of these scenarios are there associations between education and expected performance. Similarly, the meaning of a finding of no relationship between higher education and entry is unclear given that there are three potential underlying relationships consistent with this result as shown in Panel B of Table 1.

---------- Insert Table 1 about here ----------

It is possible to avoid confounding effects attributable to expected performance and thresholds if there were a reasonable approximation of expected performance. Indeed, several

papers, including Rees and Shah (1986), Dolton and Makepeace (1990), Bernhardt (1994), and Taylor (1996) have utilized a structural probit approach to model the entry decision, by explicitly controlling for differences in predicted earnings in the entry decision. The key assumption in these papers is that predicted earnings can be approximated using actual performance outcomes. This approach will lead to misspecification in two cases: i) if there are factors that affect actual outcomes that decision makers do not incorporate into expectations or ii) if there are factors that influence expected outcomes but not actual outcomes.

As a result of the concerns noted above, existing tests of how variables influence entry have been relatively weak because (a) they have not disentangled effects associated with expected utility in entrepreneurship and wage work, and (b) they have relied on approximating expected performance through actual performance.

Our approach to jointly estimating expected performance and required thresholds is most closely related to the work of Gimeno et al. (1997), who isolated the determinants of required thresholds for entrepreneurial exit. They found strong support for the view that thresholds were fundamental to exit, having statistically different determinants than actual performance. Their focus was predominantly on the role of general human capital, specific human capital, and non-financial motives in determining performance thresholds. We differ in several important respects. The most obvious difference is our theoretical focus on entry and not exit. Second, we use expected performance rather than actual performance in our empirical estimation, an approach more aligned with the theoretical model. Third, we consider that there may be other determinants of performance thresholds, such as human capital diversity and liquidity constraints.

To be clear about how we extend their model, they specified exit would occur if

$$EP_E + PI_E < EP_A + PI_A - SC, \qquad (5)$$

where *EP* represents expected financial performance in either entrepreneurship (*E*) or alternative employment (*A*), *PI* represents psychic income, and *SC* represents the costs of switching from *E* to *A*. The threshold is a residual construct made up of factors that influence the exit decision but not expected performance, where exit occurs if:

$$EP_E < EP_A + (PI_A - PI_E) - SC, \quad (6)$$

Gimeno et al. (1997) argue that EP_E is a function of the quantity of general human capital (x_1) and human capital specific to the venture (x_2), while the threshold is a function of general human capital (x_1), human capital specific to the alternative (x_3), psychic income from entrepreneurship relative to alternatives (x_4), and switching costs (x_5). We start with the assumption that factors that affect threshold-based decision making in the exit decision should be similar to those that affect the entry decision. General and specific human capital should increase expected performance. The threshold will be increased with higher general human capital, decreased with higher relative psychic income from entrepreneurship, and increased with higher switching costs into entrepreneurship. We extend this view by considering the effects of diversity of human capital and wealth on performance and the threshold. Our model for entry is as follows:

Enter if:

$$EP_E (x_1, x_2, x_6, x_7) > EP_A (x_1, x_3, x_6) - (PI_E - PI_A) (x_4) - L (x_7) + SC (x_5), \quad (7)$$

where *L* represents liquidity, x_6 represents human capital diversity and x_7 represents individual wealth. x_6 will raise EP_E because diverse skills are valuable in entrepreneurship but not rewarded in alternative employment, lowering EP_A. *L* will influence the required threshold because individuals have liquidity constraints due to asymmetric information about the quality of the opportunity. Liquidity is primarily determined by an individual's wealth (x_7), and those with

more wealth will have a lower cost of capital and thus a lower required threshold. Overall, the threshold (T) is a positive function of expected performance in alternatives, a negative function of the difference between psychic income in entrepreneurship versus the alternative, a negative function of an individual's liquidity, and a positive function of switching costs. In the next section, we develop hypotheses around how EP_E and T are influenced by general and specific human capital, human capital diversity, non-financial motivations, and wealth.[2]

2.2. Amount of Human Capital

Human capital represents the knowledge, skills, and experience possessed by an individual that may be used to generate value in a business setting (Becker, 1964). Human capital investments that generate additional knowledge increase an individual's cognitive abilities, which allow the individual to work more productively and efficiently. Becker (1964) distinguishes broadly between general (x_1) and specific human capital (x_2, x_3).

2.2.1. General human capital. General human capital, such as formal education and managerial experience, is valuable across a number of contexts, so it should have a positive effect on both EP_E and EP_A. It is widely expected that entrepreneurial performance is enhanced with more formal education and managerial experience, and empirical results largely confirm this expectation (e.g., Bates, 1990; Cooper, Gimeno-Gascon and Woo, 1994). Interestingly, these same variables seem to have a much less robust effect on the likelihood of being self-employed or a nascent entrepreneur. Education has generated some positive results (Davidsson and Honig, 2003; Kim, Aldrich and Keister, 2006) but also a number of insignificant findings (Arenius and Minnitti, 2005; Mueller, 2006). Davidsson and Honig (2003) found no relationship between managerial experience and likelihood of being a nascent entrepreneur while Kim et al.

[2] We do not offer hypotheses around specific human capital for the alternative (x_3) or switching costs (x_4) because we cannot determine the alternative ex ante, although our empirical analysis attempts to control for switching costs that might be a function of tenure with current employer.

(2006) found evidence of an inverted U-shape. We argue that these "apparently" conflicting results are due, at least in part, to a failure to recognize the corresponding effects of human capital on the required threshold. Higher levels of general human capital generated through education and managerial experience not only increase expected performance in entrepreneurial activities but also financial returns from wage work. As just one example, Murphy and Welch (1992) note that U.S. men with a college degree earned 44 percent more than high school graduates over the 1963 to 1989 period. High school graduates earned 35 percent more than dropouts. Thus, we expect that those who have higher levels of general human capital will also have more valuable alternatives to entrepreneurship, leading to higher entry thresholds.

Hypothesis 1a: General human capital will increase expected financial performance in entrepreneurship

Hypothesis 1b: General human capital will increase the entry threshold.

Considering the opposing effects generated by higher levels of human capital (increased performance but higher threshold), the net effect on the likelihood of entering entrepreneurship will be indeterminate, *ex ante*.

2.2.2. Specific human capital. Specific human capital is human capital that is applicable only to a particular setting. We concentrate on entrepreneurship-specific human capital (x_2) or human capital that is "specific to the domain of operating a small business" (Wiklund and Shepherd 2003: 1924), and we expect that this human capital will increase EP_E. One clear means of building entrepreneurship-specific human capital is through prior entrepreneurial experience (McGrath and MacMillan, 2000; Baron and Ensley, 2006). While much of the early work indicated non-robust findings between start-up experience and performance, more recent work that overcomes a number of empirical limitations of earlier work (e.g., Delmar and Shane,

2006) confirms a positive relationship between entrepreneurial experience and entrepreneurial performance. We do not expect entrepreneurial experience to influence the value of alternatives outside of entrepreneurship (EP_A), and so we do not expect a relationship to the required level of performance (the threshold). Thus, we expect that entrepreneurial experience will influence entry only through an effect on expected performance.

Hypothesis 2: Entrepreneurial experience will increase expected financial performance in entrepreneurship

2.3. Motives and Psychic Income

Gimeno et al. (1997) argue that the individual motives are a key determinant of the psychic utility derived from entrepreneurship relative to alternatives outside of entrepreneurship ($PI_E - PI_A$). This view is consistent with a rich history in the entrepreneurship literature of examining non-financial motives (e.g., Shane, Kolvereid and Westhead, 1991; Baum, Locke and Smith, 2001; Carter, Gartner, Shaver and Gatewood, 2003). In concert with this literature, we have no ex ante expectation that motives impact performance expectations; rather, we anticipate that a lack of financial motive indicates a higher level of interest in the non-pecuniary aspects of entrepreneurship. The potential for psychic income from entrepreneurship has been offered as an explanation for the lower comparative earning of entrepreneurs versus wage workers. Hamilton's (2000) seminal analysis of the 1984 panel of the Survey of Income and Program Participation showed that the self-employed make significantly less than wage workers. Although his empirical analysis did not test for a threshold effect, Hamilton (2000) concluded that because the self-employed earn significantly less than wage workers, they must place a premium on the non-pecuniary benefits of entrepreneurship. Thus, we expect that those who are

not financially motivated are more drawn to the psychic income aspects of an entrepreneurial career, leading to lower thresholds.

Hypothesis 3: Non-financial motive will decrease the entry threshold.

2.4. Diversity of Human Capital

Recent research indicates that the diversity of human capital will influence the entry decision. Lazear (2005) presents a "jack-of-all-trades" view of entrepreneurship in which a diverse background will lead to higher entrepreneurial performance. As Lazear (2005: 676) argues, "entrepreneurs must be sufficiently skilled in a variety of areas to put together the many ingredients required to create a successful business." As such, his theory clearly argues for a positive relationship between human capital diversity and EP_E. In support of this view, he offered an empirical analysis showing that Stanford alumni with greater work and education experience diversity were more likely to start businesses. A relationship between experience diversity and propensity of becoming self-employed has also received support in a sample studying German self-employment (Wagner, 2003).

While Lazear focuses on the benefits to skill diversity in entrepreneurial settings, he is relatively silent around the implications to the thresholds, even though his model clearly implies such an effect, as we illustrate here. In his model, individuals possess two skills (y and z), and they may be specialists, in which case they receive income associated with their best skill (specialist income = $\max[y,z]$) or they can be entrepreneurs, in which case their income is limited by their weaker attribute (entrepreneur income = $\lambda \min[y,z]$).[3] This limiting function is driven by the claim that entrepreneurs must be talented at a variety of skills to succeed; therefore, that success will be constrained by their weaker skill. The model predicts that those who have

[3] Entrepreneurial income is multiplied by λ, a parameter that represents the market value for entrepreneurial talent.

invested to develop specialized skills ($y >> z$) will be drawn to wage work while those who have a more balanced skill investment ($y \approx z$) will be drawn to entrepreneurship.

We used Lazear's income functions to generate an illustration of his predictions in Figure 1. Consistent with the "jack-of-all-trades" view, payoffs to entrepreneurship increase in skill diversity; however, the model also indicates that payoffs to wage work *decrease* in skill diversity, which will have the effect of lowering EP_A, and thus lowering the required threshold.

---------- Insert Figure 1 about here ----------

Hypothesis 4a: Diversity of prior work experience will increase expected financial performance in entrepreneurship.

Hypothesis 4b: Diversity of prior work experience will decrease the entry threshold.

2.5. Wealth

Household wealth has featured prominently in prior research of the choice to enter entrepreneurship or self-employment. The liquidity constraints view (Evans and Jovanovic, 1989) argues that because of information asymmetry, entry will be affected by whether entrepreneurs have personal capital to fund the venture. The weight of prior empirical literature supports the importance of liquidity constraints. Beginning with Evans and Jovanovic (1989) and Evans and Leighton (1989), a number of studies have found a positive association between wealth levels and entry into self-employment.[4] What is not clear from the prior literature, however, is whether liquidity raises expected performance (EP_E) or lowers the required threshold. The literature appears to support both effects. First, in the absence of external sources of capital, potential entrepreneurs must fall back upon their personal resources to fund a new venture.

[4] Concerned with the potential for reverse causality in this relationship (that self-employment causes higher wealth), follow-on studies have examined the relationship between exogenous shocks to wealth ("windfalls" through inheritance or lottery winnings) and the probability of self-employment and have found positive relationships (e.g., Holtz-Eakin, Joulfaian and Rosen, 1994; Lindh and Ohlsson, 1996; Blanchflower and Oswald, 1998).

Unlike wealthy individuals, those lacking capital will "face a binding liquidity constraint and as a result use a suboptimal amount of capital to start up their businesses" (Evans and Jovanovic, 1989: 810). Thus, wealthy individuals should more adequately fund their businesses and thus have higher expected performance.

Liquidity constraints might also manifest themselves through the threshold. With little or no collateral to pledge to guarantee financing, low-wealth individuals may be required to accept more costly financing from capital providers, or even be completely constrained from starting their own businesses. Higher wealth individuals are able to self-finance opportunities or pledge collateral, so they are less affected by the cost of capital and the requirements of external capital providers. This suggests that, the required threshold decreases as wealth increases.[5]

Hypothesis 5a: Household wealth will increase expected financial performance in entrepreneurship.

Hypothesis 5b: Household wealth will decrease the entry threshold.

3. METHODS

3.1. Data

To study entrepreneurial entry, we need detailed data on entrants, including expected performance, and a control group of non-entrants. The Panel Study of Entrepreneurial Dynamics (PSED) is one of the few data sets meeting these requirements.[6] The PSED is a longitudinal data set of adults in the United States in the process of starting businesses. These nascent entrepreneurs were identified from a random digit dialing telephone survey of 64,622 individuals

[5] Several authors (e.g., Cressy, 2000; Parker, 2004) argue that an association between wealth levels and entry need not be indicative of liquidity constraints but may simply be evidence of decreasing risk aversion at higher levels of wealth. That is, higher wealth individuals have a lower entry threshold due to lower risk aversion. We control for risk attitude in our models; thus, we do not expect a wealth-threshold relationship driven by risk aversion.

[6] Gartner, Shaver, Carter and Reynolds (2004) provide an extensive review of PSED. An important feature of the PSED is that it surveys individuals concurrent with their efforts to establish a new business. This approach avoids concerns of survivorship bias that exists when surveying entrepreneurs having already launched ventures. An added advantage of PSED is that the concurrent nature of the surveying process avoids concerns of recall bias.

in 1998-2000, providing a starting sample representative of the entire population. Screening questions yielded 830 nascent entrepreneurs who were working to launch a new venture, and a comparison group of 431 non-nascent entrepreneurs that failed to meet the criteria for nascency. The telephone survey was followed by a more intensive written survey, which was completed by just over 70 percent of the respondents. After cleaning the data and eliminating individuals with missing data, we were left with 554 individuals.[7] We elected to drop team-based start-ups (groups beyond just an individual or individual and spouse) because expected performance and thresholds may be significantly different for groups of individuals, although the results are substantively similar if we retain the teams. This results in a final sample of 491 individuals (254 nascents and 237 comparison group members). We evaluated whether the final sample was representative of the initial sample by comparing means of the independent variables in the final sample against those dropped from the sample and found no significant differences.

To draw accurate inferences about the population in our empirical models, it is important that our sample be representative. Clearly, nascents are over-represented in the sample, relative to non-nascents. Moreover, minorities and women are also over-represented in the PSED sampling design. To correct for this in our empirical models, we weighted each subsample according to the recommendations developed by the Institute for Survey Research at the University of Michigan and recommended by Reynolds and Curtin (2004).[8]

3.2. Dependent Variable and Estimation Method

[7] We used a cleaning algorithm recommended by Kelly Shaver (http://www.cofc.edu/~shaverk/). This algorithm eliminated comparison group members who were actually in the process of working on a new firm and eliminated nascent entrepreneurs who should have already been classified as operating entrepreneurs. We also removed cases in which those expected to own part of the business were considered to be nonhuman or legal persons (Reynolds and Curtin, 2004).

[8] As Curtin and Reynolds (2004: 477) note, "the proper use of weighted data is critical for developing inferences regarding the population represented by the samples." We initially calculated weights within each sub-sample and then re-calculated after combining the two sub-samples to ensure that each case accurately represents its actual proportion within the U.S. population.

Our conceptual model, depicted in equation 8, predicts that the individual's threshold (T) and expected performance in entrepreneurship (EP_E) jointly determine whether the individual will enter (Y) the entrepreneurial process.

$$\begin{aligned} Y &= 1 \quad if\ EP_E \geq T \\ Y &= 0 \quad if\ EP_E < T \end{aligned} \tag{8}$$

We measure Y by whether they have entered nascency or not. EP_E is the log of the respondent's estimate of fifth-year sales of their new venture.[9] Estimated sales were used because we did not have data on projected profit. We emphasize that projected performance is more appropriate than *actual* performance because the theoretical model predicts that the entry decision is driven by a comparison of *projected* performance to the threshold.

There remain three methodological challenges from our specification: (a) we only have EP_E for individuals who have entered; (b) entry is a function of both EP_E and T; and (c) T is not directly observable. Fortunately, these challenges can be overcome with the use of the censored regression model with unobserved stochastic thresholds (e.g., Nelson, 1977). This model is particularly appropriate when the dependent variable (performance) is observed only when it exceeds a threshold, and this threshold varies across individuals as a function of a set of independent variables. This model has a number of advantages over other empirical approaches in the prior literature. First, it helps avoid potential problems associated with self-selection bias (Heckman, 1979) when modeling performance, and second, it allows identification of coefficients for variables affecting both expected performance and the threshold.

The underlying equations for EP_E and T are:

[9] While respondents provided estimates of both first-year and fifth-year sales, we elected to utilize fifth-year sales because the early sales figures from start-up ventures may not be reflective of the potential of the business. The results were not sensitive to this choice. We also report that the results were insensitive to a robustness check in which the sales variable is adjusted by industry medians.

$$EP_{Ei} = \boldsymbol{\beta}_1 \mathbf{X}_{1i} + \nu \qquad (9)$$

$$T_i = \boldsymbol{\beta}_2 \mathbf{X}_{2i} + \mu \qquad (10)$$

where ν and μ a are random disturbances assumed to follow a bivariate normal distribution with a zero mean vector and unknown variances (assumed co-variance = 0). After, substituting the above equations into the decision rule and re-arranging terms, the probability that we will observe entry then becomes

$\Pr\left(\nu - \mu \geq \boldsymbol{\beta}_2 \mathbf{X}_{2i} - \boldsymbol{\beta}_1 \mathbf{X}_{1i}\right)$, and $\left(\nu - \mu\right)$ is assumed to follow a univariate normal distribution with mean zero.

The probability of observing a non-entry (Nelson, 1977: 311) is given by:

$$\Pr\left(Y_i = 0\right) = \Pr\left(\nu - \mu < \boldsymbol{\beta}_2 \mathbf{X}_{2i} - \boldsymbol{\beta}_1 \mathbf{X}_{1i}\right) = \Phi\left(\frac{\boldsymbol{\beta}_2 \mathbf{X}_{2i} - \boldsymbol{\beta}_1 \mathbf{X}_{1i}}{\sqrt{s_1^2 + s_2^2}}\right) \qquad (11)$$

where s_1 is the standard deviation of the disturbance of the returns equation, and s_2 is the standard deviation of the disturbance of the threshold equation. The probability of entry is:

$$\Pr\left(Y_i = 1\right) = \frac{1}{s_1} Z\left(\frac{EP_{Ei} - \boldsymbol{\beta}_1 \mathbf{X}_{1i}}{s_1}\right) \Phi\left(\frac{EP_{Ei} - \boldsymbol{\beta}_2 \mathbf{X}_{2i}}{s_2}\right) \qquad (12)$$

where *Z(A)* is the unit normal density evaluated at A.

The likelihood function aggregates these probabilities by multiplying them over all of the observations in the sample. Taking the log transformation of this likelihood function gives the following function, which can be estimated via maximum likelihood.

$$\sum_{Y_i=0} \ln\left(\frac{\boldsymbol{\beta}_2 \mathbf{X}_{2i} - \boldsymbol{\beta}_1 \mathbf{X}_{1i}}{\sqrt{s_1^2 + s_2^2}}\right) + \sum_{Y_i=1} \ln\left(\frac{1}{s_1} Z\left(\frac{EP_{Ei} - \boldsymbol{\beta}_1 \mathbf{X}_{1i}}{s_1}\right) \Phi\left(\frac{EP_{Ei} - \boldsymbol{\beta}_2 \mathbf{X}_{2i}}{s_2}\right)\right) \qquad (13)$$

Coefficient estimates of the threshold model can be obtained as long as: (i) a variable in $\mathbf{X}_1$ is not included in $\mathbf{X}_2$; or (ii) the covariance between v and μ is 0 (Nelson, 1977). We impose the second restriction.

3.3. Independent Variables

General human capital variables (x_1) include education and years of *managerial experience*. *Education* is measured in years based on the individual's response indicating the highest category of education achieved. *Entrepreneurial experience* (x_2) is a dummy variable indicating whether the respondent has previously been involved in a start-up effort or is currently running a business or self-employed.

Non-financial motive (x_4) is based on responses to three questions around career reasons: (a) "earn a larger personal income"; (b) "financial security"; and (c) "build great wealth".[10] The respondents rated each item between 1 and 5 (the highest). We reverse coded this variable, such that high values indicated less interest in these financial outcomes, to get a measure of non-financial motive. The measure is an average across these three responses (alpha=0.76).

Experience diversity (x_6) is calculated using a Herfindahl index of years of experience across nine functional areas.[11] The Herfindahl index is calculated per the following formula across the j functional areas in which the respondent has experience:

$H_i = 1 - \sum_{j=1}^{n} \left(\frac{YearsExp_j}{TotalYearsExp} \right)^2$. This variable ranges from 0-1, with high values for those having diverse experience and low values for those having concentrated experience. For example, an

[10] Eighteen items in the mail questionnaire concerned the respondent career motivations. Factor analysis indicated that these three items loaded on one factor (c.f. Carter et al, 2003). For the nascents, each item was preceded by the question: "To what extent are the following reasons important to you in establishing this new business?" For comparison group members, each item was preceded by the question: "To what extent are the following important to you in your decisions about your work and career choices?"

[11] The nine functional areas are: Sales or marketing management; Accounting, Financial Control; Production, Plant Management; Personnel, Human Resource Management; Transportation, Distribution, Inventory Management; Financial and Capital Management; Technological and Innovation Management; Mathematics; Economics.

individual who has spent all their time in one functional area would have a value of zero. For those with zero work experience, diversity is set to zero.

In constructing our measure of *household wealth* (x_7), we follow the coding algorithms suggested by Kim, Aldrich and Keister (2004).[12] This approach employs a set of decision rules to generate final wealth values from a series of questions related to the underlying components of personal assets and liabilities.

3.4. Control Variables

We first control for the individual's general *work experience*, measured as years of work experience net of managerial experience.[13] Switching costs (x_5) are captured by the number of years the individual has served in his or her most recent job (*years in most recent job*). Individual income is unavailable, so we use logged *household income*. We expect that income may be related to the threshold, as it represents income that must be forgone in order to pursue an entrepreneurial venture. These values are calculated from exact reports when available and from midpoints of ranges when respondents were only willing to provide ranges of income.

Demographic controls include *gender*, *married*, *age*, *race*, and whether the respondent is *foreign-born*. To control for possible differences in thresholds or performance expectations across different geographical areas, we include a set of regional dummies that indicate in which of four US regions the respondent resides. Because the role of risk attitudes has featured prominently in the entrepreneurship literature, we also control for the respondent's risk attitude. Consistent with Xu and Ruef (2004), this measure is based on the response to a question regarding preferences among three hypothetical ventures whose expected payouts (probability of

[12] We are very grateful to Phil Kim for sharing coding algorithms for the wealth and income variables.
[13] As mentioned earlier, we elected not to hypothesize around the effects of human capital specific to wage work (x_3) because of the lack of a good measure for this construct. We recognize, however, that prior wage work experience may serve as a rough measure.

success times payout) were the same. The three options were a profit of $5,000,000 with a 20 percent chance of success; a profit of $2,000,000 with a 50 percent chance of success; and a profit of $1,250,000 with an 80 percent chance of success. The variable is coded such that higher values indicate higher levels of *risk aversion*. Descriptive statistics for the variables are included in Table 2. Table 3 presents a comparison of the means of the variables across the nascent sample and the comparison group.

---------- Insert Tables 2 and 3 about here ----------

4. RESULTS

Table 4 presents the results of two separate multivariate models. One model (Column 3) estimates the determinants of entry using a binary logit model. The other model jointly estimates expected performance (Column 1) and the entry threshold (Column 2) using the censored regression with unobserved stochastic thresholds. The results of this second model confirm the separate effects of both expected performance and the entry threshold on entry into nascency. As our theoretical model suggests entry is a function of both expected performance and threshold, it is useful to compare how variables impact entry, expected performance, and the entry threshold.

---------- Insert Table 4 about here ----------

Hypotheses 1a and 1b argued that general human capital would have a positive effect on both performance and the threshold, making its effect on entry indeterminate, *ex ante*. We test this with two measures of general human capital. As expected, *managerial experience* has a positive effect on both expected performance and the threshold. The coefficient of 0.056 on managerial experience indicates that each year of additional managerial experience is associated with an increase of approximately 5.6% in expected revenue.[14] More managerial experience,

[14] With a logged dependent variable, the percent change in the dependent variable for a one-unit increase in managerial experience is given by 100[exp(0.063)-1].

however, also increases the threshold by a nearly identical amount, 5.8%. With the increases in expected performance offset by the increases in the threshold, it is unsurprising to see an insignificant relationship between managerial experience and entry. *Education* does not have a significant effect on either expected performance or the threshold. This result was robust to alternative operationalizations of education, including the addition of a square term and replacing years with dummies for education categories. Thus, only one of two measures of general human capital supports Hypothesis 1.

Hypothesis 2 predicts that specific human capital in the form of prior entrepreneurial experience would be associated with higher expected performance, but not the threshold. The significant positive coefficient of 1.161 in Column 1 supports this hypothesis. Consistent with our expectations, we also see no significant relationship between entrepreneurial experience and the threshold. On net, the relationship between prior experience and probability of entry shown in Column 3 is in the predicted direction but does not quite reach significance.

Hypothesis 3 predicts that the strength of the individual's non-financial motive should lower the threshold and have no effect on expected performance. Our results confirm these expectations. Moreover, consistent with lower thresholds, these individuals are also more likely to enter. This result complements the findings of DeTienne, Shepherd and De Castro (2008) who noted an association between financial motives and performance thresholds in the *exit* decision.

The models provide strong support for Hypotheses 4a and 4b and their predictions that experience diversity would be linked to *both* higher expected performance and a lower threshold. The combination of higher expected performance and lower thresholds should lead more diverse individuals to have a higher likelihood of entry, which is the result shown in Column 3.

Contrary to the expectations stated in Hypothesis 5, wealth levels do not appear to be related to expected performance, the threshold or entry. As some of the prior literature argues that wealth effects are either non-linear or constrained to only very high levels of wealth (e.g., Hurst and Lusardi, 2004), we checked for alternative functional forms. First, we used an alternative of logged wealth. Finally, we created a dummy variable to indicate only high-wealth individuals (set at the 75th and 95th percentile in different models). In no case did any of these alternative specifications generate significant results. In summary, our results suggest support for hypotheses 1-4, and they are robust to a number of alternative specifications of the model and transformations of variables.[15]

5. DISCUSSION

Our theoretical model and empirical results suggest that the entry decision is impacted by expected performance but not uniquely determined by it. Rather, individuals have different required thresholds, and entry is determined by whether performance falls above or below the threshold. This paper contrasts sharply with prior research that has focused on the determinants of entry, an approach that prevents a more complete understanding of whether variables affect entry through expected performance, the required threshold, or both. The exclusive focus on entry has perhaps been due to the severe methodological challenges of studying thresholds, or the ambiguity in how theory might differentially affect expected performance and thresholds. In

[15] One potential concern is a lack of controls for industry effects, which may impact performance and/or the threshold. Such industry controls may also ease concerns about the use of expected revenues to measure performance. The typical approach to control for industry effects is the inclusion of a set of industry dummies. The PSED does provide information on the intended sector of each start-up; however, no corresponding industry information is available for the comparison group members who are not pursuing an opportunity. Thus, industry dummies cannot be constructed for this part of the sample. We did, however, undertake an alternative analysis to control for industry effects. Another approach to controlling for industry effects is to adjust performance variables for industry averages (Dess, Ireland, and Hitt, 1990). To implement this approach, we divided each nascent's projected performance figure by the average sales level in their particular sector, using average sales figures for each sector from the 1997 Economic Census. We then used a logged version of this scaled performance figure as an alternative dependent variable. The results were robust to this alternative specification.

this paper, we contribute to the literature on entry by overcoming both problems. We clarify whether theories impact entry through expected performance, the required threshold or both. We empirically isolate the determinants of expected performance and the required threshold and demonstrate how they combine to influence entry. Some variables influence entry primarily through an impact on expected performance; some variables influence entry primarily through an impact on the required threshold; and some impact both. Several of the results are worth highlighting.

First, we found that individuals with more diverse human capital are more likely to enter because they have higher expected performance in their venture but *also* because they have lower required thresholds. We emphasize that Lazear's (2005) model is suggestive that those with diverse human capital will have lower thresholds because of less valuable opportunities, but this relationship is largely ignored by him, as his emphasis was on establishing a link between diversity, entrepreneurial performance and entry. However, as our theoretical model demonstrates, a relationship between experience diversity and likelihood of entry is not *necessarily* supportive of his view that entrepreneurship rewards diverse skills. A positive relationship between diversity and entry might result even if experience diversity had a negative or zero relationship to entrepreneurial performance.

Second, our findings suggest that general human capital as represented by prior managerial experience has no effect on entry, even though it increases expected performance and the required threshold. This finding accentuates the need to go beyond a focus on entry because a variable may have systematic influence on performance inside and outside a venture. This approach has potential to help us reconcile prior findings, such as those of Evans and Leighton

(1989) who found that neither education nor wage experience influenced the likelihood of self-employment entry but significantly increased earnings in self-employment.

Third, we found that some variables influence entry because of an exclusive impact on either expected performance or the required threshold. For example, prior entrepreneurial experience, which should represent human capital specific to entrepreneurship, influences entry only through expected performance. While this relationship is not surprising, a null effect on the threshold contradicts those who speculate that entrepreneurial experience might also proxy for a psychological willingness to engage in self-employment. Our results suggest that entrepreneurs with experience enter because they believe they can generate higher economic performance and not because they are more psychologically attracted to entrepreneurship. We also found that stronger non-financial motives increase entry exclusively through lower thresholds and have no expectations of higher performance. By emphasizing a significant threshold effect, our work complements existing work having demonstrated that entrepreneurs may be willing to trade-off income for non-monetary benefits (Hamilton, 2000). While the prior literature inferred this tradeoff by examining differences in total income, we explicitly demonstrate how non-financial motivation influences entry through lower thresholds and not expected performance.

These findings provide strong support for our threshold model of entrepreneurial entry and help us to reconcile some of the most prominent theories explaining entrepreneurship: human capital diversity and general human capital influence entry through both expected performance and threshold, specific entrepreneurial capital influences entry only through expected performance, and non-financial motivation influences entry only through the required threshold. This evidence suggests that agendas ignoring the individual's required threshold are incomplete.

Some of our expectations were not supported. The lack of findings for formal education are somewhat surprising, as prior research generally supports a positive relationship between education and probability of entry (e.g., Davidsson and Honig, 2003; Kim et al., 2006), although the particular form of the relationship varies across studies. We found that if we excluded non-financial motive from our models, the estimation generated a positive relationship between education and probability of entry, suggesting that perhaps the relationship between education and entry is driven by higher levels of non-financial motives among the more highly educated.[16]

The data also failed to provide support for a liquidity constraints view. We note that other studies of nascent entrepreneurs also produced an insignificant relationship between wealth and entry (Mueller, 2006), including those employing the PSED (Kim et al., 2006).[17] While the record of support for liquidity constraints is far from robust for the launch decision, there is some evidence they inhibit launch. We wonder whether liquidity constraints will become binding only at the launch decision, since nascents are merely *investigating* an entrepreneurial opportunity and have not yet committed to exploiting the opportunity.

Our threshold equation also highlights a methodological issue for studies of expected financial performance of new ventures. Since entry is more likely for higher expected performance, there is a potential selection problem that can lead to bias in the coefficient estimates of expected performance. Our censored regression with unobserved stochastic threshold model corrects for this bias, leading to substantively different conclusions from an

[16] The relationships of education to expected performance and the threshold remained insignificant even though the net relationship to probability of entry was significant.

[17] These results may also be explained by the fact that a significant number of new businesses do not require large amounts of initial capital. Reynolds (2005) noted that the typical start-up requires about $15,000 in initial capital while Hurst and Lusardi (2004) noted that The Federal Reserve's Survey of Small Business Finances reports that the typical new venture launch required initial capital of $22,700 (in 1996 dollars).

uncorrected ordinary least squares regression on expected performance.[18] Future research on the determinants of entrepreneurial financial performance should be sure to correct for selection bias, and the threshold model offers one means to do it.

An interesting question that remains open is whether these relationships to expected performance are different from those to actual performance. Unfortunately, the PSED data do not allow us to rigorously examine this question. Future waves of the data do provide some information related to sales level; however, these data are not true actual figures as they ask the nascent to estimate first year sales prior to year end. Moreover, only 89 of the 254 nascents in our sample achieved launch of their venture and reported estimated first year sales, raising concerns over statistical power to detect effects. This does provide an interesting avenue for future research. Comparing the relationships of variables to expected versus actual performance could provide greater insight into the specific sources of overconfidence in entrepreneurs.

One limitation of this research is its focus on the characteristics of the individual to the exclusion of the characteristics of the opportunity. While individual characteristics have received a preponderance of attention in the entrepreneurship literature, Shane and Venkataraman (2000) argue for more attention to the nature of the opportunity being evaluated. The nature of the opportunity potentially affects both performance and the threshold. For example, thresholds and performance expectations may vary based on the industry, and the amount of uncertainty surrounding the opportunity may result in higher thresholds. Examining these characteristics is challenging, however, when they are not available for the control group. If a sample were large enough, it might be possible to randomly impose such characteristics on

[18] For example, the uncorrected regression indicates a negative relationship between non-financial motive and performance expectations. The threshold model, however, indicates that this erroneous conclusion is driven by the fact that those with stronger non-financial motives simply have lower entry thresholds. The uncorrected regression also fails to capture the relationship between experience diversity and performance expectations. Results available upon request to the authors.

the control group. Alternatively, this problem does not exist when examining nascents considering the launch decision. Discussion of the launch decision raises another possibility for an important extension to this work. It is an empirical fact that not all who enter the process will conclude it with a venture launch. Some will launch, others will quit, and some will remain stuck in the process. This variance in outcomes clearly implies that something changes between the entry decision and the launch decision. A promising area for future research is an investigation of how the determinants of threshold-based decision making change during the evaluation stage of the entrepreneurial process. A final limitation of this research is the use of expected sales as a measure of the expected economic performance of the venture. A measure of expected profit would provide a closer match to our underlying theoretical arguments; however, this measure was not available in the PSED data. If particular characteristics are associated with generating profits but not increasing sales, those relationships would not be captured by our empirical model.

6. CONCLUSION

This research advances our understanding of a central topic in the entrepreneurship literature, the decision to enter the entrepreneurial process. We extend prior investigations of this topic by offering and empirically testing an alternative conception of the entry decision. This work complements existing theory on the determinants of entry by making more explicit their causality through expected performance and threshold and isolating their determinants. It also complements work done on exit thresholds (Gimeno et al., 1997) by demonstrating their applicability to entry and extending the model to incorporate other dimensions of the threshold.

Most importantly, this research increases our knowledge of *why* certain factors are (or are not) associated with entry into the entrepreneurial process. The results provide clear evidence

that expected performance and thresholds differ across individuals as a function of their experiences and motives. Understanding these differences leads to a more complete view of the entrepreneurial entry decision.

This research adds a straightforward and powerful empirical model to the theoretical literature on entrepreneurial choice, which shows promise for illuminating the distinct causal pathways of entry determinants. The threshold model's applicability is not limited to the initial entry choice; it can be similarly applied to the launch decision in which performance measures are only observed for those who elect to launch. It is flexible enough to apply to other decisions relevant to entrepreneurs, including growth and expansion decisions.

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Table 1 – Indeterminacy in Findings from Discrete Choice Models of the Entry Decision

Panel A

Multiple underlying relationships are consistent with a positive relationship between a given x and pr(entry)

	Impact on Performance	***Impact on Entry Threshold***	***Relationship to Pr(Entry)***
Scenario A	+	0	+
Scenario B	++	+	+
Scenario C	+	--	+
Scenario D	0	--	+
Scenario E	--	-- --	+

A positive relationship between a given x and probability of entry could obtain if:

A. x increases performance and has no effect on threshold

B. x increases both performance and threshold, but performance effect is larger than threshold effect

C. x increases performance and decreases threshold

D. x has no effect on performance but decreases threshold

E. x decreases performance and threshold, and threshold effect is larger than performance effect

Panel B

Multiple underlying relationships are consistent with no relationship between a given x and pr(entry)

	Impact on Performance	***Impact on Entry Threshold***	***Relationship to Pr(Entry)***
Scenario 1	+	+	0
Scenario 2	0	0	0
Scenario 3	--	--	0

An insignificant (or zero) relationship between a given x and probability of entry could obtain if:

1. x increases performance and threshold to similar degree

2. x has no effect on either performance or threshold

3. x decreases performance and threshold to similar degree

Table 2 – Descriptive Statistics

	Variable	Mean	Std. Dev.	*Correlations**													
				(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1)	Education (years)	14.138	3.757														
(2)	Managerial Experience	9.103	14.673	0.06													
(3)	Entrepreneurial Experience	0.468	0.783	-0.11	**0.19**												
(4)	Non-Financial Motive	2.038	1.469	**0.25**	**0.18**	-0.08											
(5)	Experience Diversity	0.370	0.507	0.02	**0.26**	**0.21**	**-0.17**										
(6)	HH Wealth/10,000	21.251	75.952	**0.19**	0.22	0.06	-0.01	0.08									
(7)	Work Experience	10.731	14.103	-0.06	**-0.20**	0.07	0.02	**-0.23**	0.07								
(8)	Years in Most Recent Job	6.757	12.600	0.02	**0.36**	0.07	0.08	-0.04	**0.26**	0.20							
(9)	HH Income (Log)	10.692	1.088	**0.31**	0.08	0.02	-0.02	0.08	**0.25**	0.00	0.04						
(10)	Gender (male=1)	0.501	0.785	-0.03	0.09	0.06	-0.08	0.13	0.15	0.03	0.07	0.08					
(11)	Married	0.552	0.779	0.04	**0.16**	0.04	0.07	0.02	0.01	-0.03	-0.02	**0.31**	0.07				
(12)	Age	43.659	20.797	-0.01	**0.48**	0.12	**0.37**	-0.12	0.19	**0.47**	**0.46**	-0.03	-0.10	0.07			
(13)	Race (white=1)	0.793	0.515	**0.14**	**0.17**	0.03	**0.15**	-0.02	**0.11**	0.06	**0.14**	**0.17**	0.10	0.10	**0.14**		
(14)	Foreign-Born	0.052	0.310	-0.02	0.01	-0.10	-0.03	-0.01	-0.06	-0.01	0.03	0.01	-0.03	0.07	0.04	**-0.25**	
(15)	Risk Aversion	2.788	1.571	0.03	0.00	-0.04	**0.25**	-0.12	-0.03	0.11	**0.17**	-0.03	**-0.16**	0.03	**0.21**	0.00	0.12

n=491

** values in bold are significant at $p < 0.05$*

Table 3 – Mean Comparisons of Non-Nascents vs. Nascents

Variable	*Comparison Group*	*Nascent*	*Difference*
Education (years)	14.125	14.336	-0.211
Managerial Experience	9.152	8.335	0.817
Entrepreneurial Experience	0.460	0.588	-0.128 *
Non-Financial Motive	2.035	2.091	-0.056
Experience Diversity	0.360	0.524	-0.164 **
HH Wealth/10,000	21.751	13.412	8.339 *
Work Experience	10.784	9.890	0.894
Years in Most Recent Job	6.816	5.831	0.985
HH Income (Log)	10.694	10.657	0.036
Gender (male=1)	0.494	0.604	-0.110 *
Married	0.548	0.612	-0.063
Age	43.928	39.447	4.481 **
Race (white=1)	0.795	0.763	0.033
Foreign-Born	0.052	0.048	0.004
Risk Aversion	2.805	2.523	0.281 **
	n=237	*n=254*	

Notes:

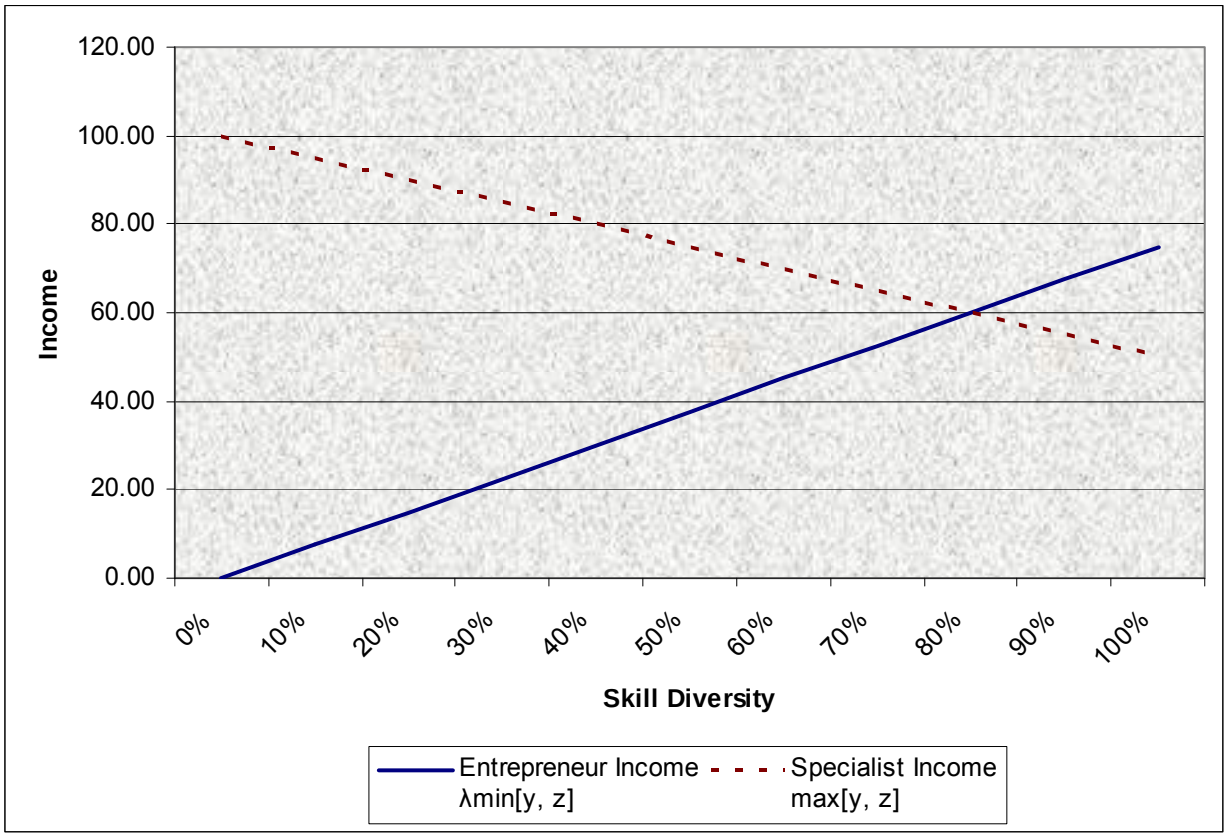
** p<0.05, ** p<0.01, two-tailed tests*

Table 4 – Parameter Estimates of Expected Performance, Entry Threshold, and Entry

		Joint Maximum Likelihood Model				Binomial Logit on Entry (Nascent=1)	
		Column 1 Expected Performance		*Column 2* Entry Threshold		*Column 3*	
	Variables	Coef.	SE	Coef.	SE	Coef.	SE
x_1	Education (years)	0.042	(0.080)	-0.065	(0.052)	0.070	(0.059)
x_1	Managerial Experience	0.056 *	(0.027)	0.058 **	(0.021)	-0.005	(0.022)
x_2	Entrepreneurial Experience	1.161 **	(0.354)	0.473	(0.242)	0.479	(0.249)
x_4	Non-Financial Motive	0.128	(0.198)	-0.374 **	(0.125)	0.337 *	(0.151)
x_6	Experience Diversity	1.453 **	(0.563)	-0.919 *	(0.393)	1.682 **	(0.417)
x_7	HH Wealth/10,000	0.000	(0.008)	0.011	(0.006)	-0.008	(0.005)
Controls							
	Work Experience	0.045	(0.027)	-0.003	(0.017)	0.035	(0.020)
x_5	Years in Most Recent Job	-0.009	(0.029)	-0.042	(0.021)	0.024	(0.021)
	HH Income (Log)	0.078	(0.255)	0.298 *	(0.137)	-0.118	(0.212)
	Gender (male=1)	0.801 **	(0.307)	0.409	(0.209)	0.224	(0.239)
	Married	0.186	(0.397)	-0.363	(0.318)	0.420	(0.252)
	Age	-0.067 **	(0.025)	0.009	(0.016)	-0.052 **	(0.018)
	Race (white=1)	-0.137	(0.369)	0.167	(0.275)	-0.166	(0.279)
	Foreign-Born	0.228	(0.780)	0.393	(0.461)	-0.253	(0.638)
	Risk Aversion	-0.282	(0.166)	0.073	(0.105)	-0.229	(0.126)
	Regional Dummies	YES		YES		YES	
	Constant	5.307 *	(2.591)	8.359 **	(1.445)	-2.108	(2.139)
	Log-Likelihood	-154.496				-101.844	
	Number of Observations	491				491	

** p<0.05, ** p<0.01, two-tailed tests*

Figure 1 – Relationship between Skill Diversity and Income



Notes

The payoff functions for the Entrepreneur and Specialist are drawn from Lazear (2005: 652).

Without loss of generality, we show an example of an individual who has 100 "skill units" to invest in either y *or* z *with a market value for entrepreneurial talent (λ) of 1.5.*

As skill diversity increases from 0 percent (invested totally in one skill) to 100 percent (invested 50/50 in each skill), entrepreneur income is increasing while specialist income is decreasing. The highest Entrepreneur payoff is reached at 100% diversity (50 percent investment in y *and 50 percent investment in* z*). The highest Specialist payoff is reached at 0% diversity (invest 100% in either* y *or* z*).*