

Research on Individual and Contextual Determinants of Entrepreneurial Entry and Exit of STEM-Educated Workforce in the U.S. with NLSY Data

馬 文 竜

Abstract

This article explores the existing literature on individual and contextual determinants of entrepreneurial entry / exit and proposes a testable model to study the STEM educated individuals in the United States (hereinafter “U.S.”). The literature review in the following areas provides a thorough background for this study: entrepreneurship and self-employment as a unit of study; entrepreneurship and self-employment as a career trajectory; STEM career trajectory and entrepreneurship development in the U.S. Entrepreneurship is a multidimensional notion whose definition is heavily dependent on the research topic. We are applying a more “Schumpeterian” definition, focusing on the perception of new economic prospects and the subsequent entry of novel ideas into the market. A threshold model is proposed under the framework of the eclectic theory of entrepreneurship, derived from the FDI decision-making structure, and the theory of entrepreneurial intention. We assume people will enter the entrepreneurial process when the expected value is higher than the value of an alternative position. For the exit part, we are going to apply the Cox proportional-hazard model, to identify the factors that influence the exit and on what degree. The National Longitudinal Survey of Youth (NLSY79) data will be used to test the model, thus is briefly introduced in the article.

1. Introduction

In this research paper, I explore the existing lit-

erature on determinants of entrepreneurial entry and exit of STEM educated individuals in the U.S. The goals of this paper are to:

1. Discuss the theories relevant to entrepreneurship, specifically to determinants of entrepreneurial entry and exit of STEM educated individuals in the U.S.
2. Discuss empirical research design relevant to determinants of entrepreneurial entry and exit.
3. Introduce the data to be used in the statistical analysis for the empirical research.

Since Schumpeter (1954) defined entrepreneurship as ‘the pivot on which everything turns’, researchers and writers have referred to this era as “the era of entrepreneurship” (Geoffee & Scase, 1987; Ronstadt, 1985; Jones & Wadhvani, 2006). After 1980s, entrepreneurship has emerged as a topic of growing interest among management scholars and social scientists, and the interest in this topic has grown over time, particularly in business schools (Cooper, 2005). Fostering entrepreneurship has become a topic of the highest priority in public policy as well, because small, new firms are perceived as a source of new jobs and ultimately as the mainspring of economic growth and development (Blanchflower & Oswald, 1998). Bull and Willard (1993) summarized exiting research into five categories: 1. Research that attempts to provide an accurate definition of the term “entrepreneur” 2. Research that analyzed personal and psychological characteristics of entrepreneurs; 3. Research that explored new venture creation under the entrepreneurial system; 4. Research that examined the strategies considered

critical to entrepreneurial success; 5. Research that investigated the individual and environmental factors influencing entrepreneurial decisions.

Science, technology, engineering, and mathematics (STEM) fields are notably important for innovation and technological development, which in turn drive social mobility and economic growth. The STEM disciplines increase the potential for technological innovation and development, resulting in higher competitiveness. When these inventions and developments are transferred to commercial service or products, it also creates job opportunities to the society. A diverse STEM workforce can provide a variety of perspectives and approaches to scientific and technological innovation, better reflect the global and culturally diverse economies and establish in a wide array of role models for future engineers and scientists (Hira, 2010; Stine & Matthews, 2009).

In this study, I investigate the determinant of STEM workforce's decision to become entrepreneurs. Previous studies have revealed various determinants of entrepreneurship. These determinants are divided into individual and contextual factors. The individual factors include demographic factors such as age, ethnicity, immigration status, and socioeconomic factors such as level of education, geographic and occupational mobility, early exposure to entrepreneurship, and entrepreneurial training and experience. Contextual factors include policy-related factors such as regulatory framework, market conditions, ease of access to loan, and entrepreneurial culture, such as risk attitude in society, attitudes towards entrepreneurs, entrepreneurship education, etc (OECD, 2015). While a number of past studies on STEM-entrepreneur have focused on gender imbalance and entrepreneurial intention of college students and academics (Dilli & Westerhuis, 2018; Geiger, 2020; Kuschel et al., 2020; Yang & Gao, 2021), other aspects of STEM-entrepreneurship such as determinants of entry and exit also deserve scrutiny.

The goal of this paper is to explore the research gap by going through existing literature on entre-

preneurial decisions through the lens of the various economic methodologies that are now accessible. To create a clear profile of STEM-educated business owners, we must conduct a longitudinal examination of their decision-making processes, while exploring the group's demographic and experiential diversity, and how much they are different from non-STEM entrepreneurs, and non-entrepreneurs. I draw on socioeconomic theories to frame the present research. The Eclectic Theory of Entrepreneurship (Verheul et al., 2002) is primarily used to examine supply and demand of entrepreneurship; whereas the Entrepreneurial Intention Theory (Krueger & Carsrud, 1993), derived from the Theory of Planned Behavior (TPB) (Ajzen, 1985), is primarily used to examine the personality characteristics of entrepreneurs. An integration of these two theories contributes to existing studies of entrepreneurship by identifying the individual / contextual factors of , and examining their effects on STEM entrepreneurship. It also provides practical implications to give practical meaning to policy makers on how to facilitate STEM entrepreneurship in the U.S. Being a multi-state country with independent state policies and one of the most active entrepreneurial economies in the world, the U.S. provides a perfect case study for research on entrepreneurship, especially when there are variables related to geographical differences.

2. Theoretical Framework

Entrepreneurship theory and research continue to be critical for the field's progress. Wales et al. (2013) categorized previous entrepreneurial theories into six aspects: (1) economic entrepreneurship, (2) psychological entrepreneurship, (3) sociological entrepreneurship, (4) anthropological entrepreneurship, (5) opportunity-based entrepreneurship, and (6) resource-based entrepreneurship. These theories provide us with a reasonable opportunity to refocus our efforts on integrating divergent points of view and providing the empirical evidence that supports them.

2.1 Eclectic Theory of Entrepreneurship (ETE)

Entrepreneurship is influenced by numerous economic and societal factors. Also, many believe that government activities might influence the quantity of entrepreneurship (Storey, 1994). The government can directly or indirectly influence entrepreneurship through general policies, like market structure and the number and type of entrepreneurial possibilities by enacting competition policies. This section presents a framework for evaluating policy actions' impact on entrepreneurship.

Discipline, level of analysis, demand and supply components, and influences on actual and equilibrium rates of entrepreneurship can all be characterized. The impact of the economic environment, including scarcity, opportunity costs and yields, and technological developments on entrepreneurial activity and the environment cannot be confined to one discipline. From a regulatory perspective, the government can directly or indirectly influence entrepreneurship by establishing legislation (De Koning & Snijders, 1992; Storey, 1994; Audretsch & Thurik, 2001).

Entrepreneurial determinants can also be studied at micro, meso, and macro levels. Micro-level research focuses on individual decisions and reasons to become self-employed or entrepreneurs. Van Praag (1999); De Wit (2012); Evans & Leighton (1990) stress personal qualities such as psychologi-

cal features, formal education and other skills, financial assets, family background, and prior work experience. Meso-level entrepreneurship studies market-specific determinants of entrepreneurship, such as profit opportunities and entrance and exit choices (Bosma et.al, 2000). Environmental, technological, economic, and cultural aspects are all considered in the macro perspective (Noorderhaven et al., 1999; Wennekers et al., 2010).

Verheul et al. (2002) provide the eclectic theory of entrepreneurship (Fig. 1), which outlines broad categories of macro and micro components that determine a country's level of entrepreneurship. The basic categories of the theory (demand, supply, individual decision making, actual and equilibrium rates, government intervention, and culture) are described below.

It comprises both macro and micro elements to determine the actual rate of entrepreneurship (E), which may differ from the long-term equilibrium rate (E^*). Market forces or government (G) action can restore entrepreneurship's "disequilibrium". Entrepreneurial opportunities are created by people who can exploit possibilities if they have the resources, abilities, and preferences to do so. Personality attributes must also be compatible with entrepreneurship. Entrepreneurial possibilities and resources are considered, as well as skill, personality traits, and preferences. External resources, such as financial and technological resources, are identified, as are human contacts within networks. Contrarily,

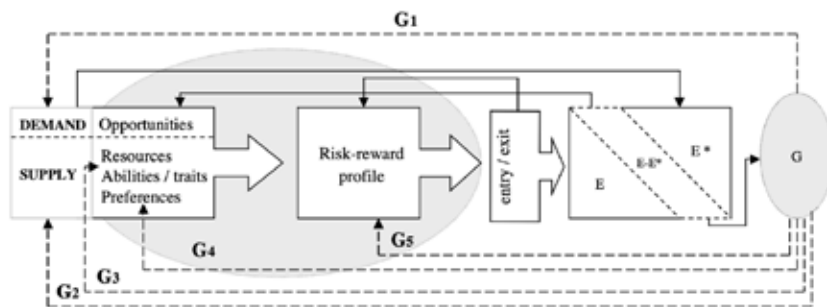


Figure.1 Eclectic Theory of Entrepreneurship (Verheul et al., 2002)

we distinguish between a person's internal attributes (aptitude, personality traits, and preferences), which impact professional decisions. The aggregate entrepreneurship entry and exit rates reflect these job selections. People considering various employment options can either create their own business, stay in their current position, or choose to forego self-employment, willingly or involuntarily. Entry and exit can affect the risk-reward profile of entrepreneurship. The "demonstration effect," in which the sheer chasms or dynamics of entry and exit influence the (perceived) desirability of self-employment, is a phenomenon. A significant number of people starting businesses without considering the potential or financial and/or intellectual resources needed to establish a successful firm may inspire others.

We may learn more about the environment and persons that impact entrepreneurial entry and exit. Policy and institutional changes can affect either the major human decision-making elements that influence business ownership or the mechanism through which these factors influence business ownership decisions. The privatization or collectivization of various services and utilities is one example of how government policies affect the capacity to start a business (G1). Immigration policies may impact future entrepreneur supply and traits (G2). Growing the (venture) capital market or providing financial support can all effect an individual's resources and capacities, i.e., skills and knowledge (G3). It's harder to change one's own tastes. Change is difficult for them because of their cultural influences. The government's promotion of entrepreneurship may impact individual choices. This can be done through schools and media (G4). Other factors that affect employment choices include financial incentives, labor market regulation, and bankruptcy legislation (G5). Supply and demand influence individual career choices. The study found that supply-side factors affect (potential) entrepreneurs' personalities whereas demand-side factors affect their prospects. Resources, ability, personality traits, and preferences are key factors in assessing the risks and rewards of entrepreneurship vs other career options. We draw this conclusion from extensive research on

(micro-level) entrepreneurial drivers (Blanchflower and Oswald, 1998; Blanchflower and Meyer, 1994; Evans and Jovanovic, 1989; Birley and Westhead, 1994; Reynolds, Miller and Maki, 1995). On this page we won't go over anything in detail. Previous research has primarily focused on the country level or the individual level separately, but this study tries to connect these two levels directly. Individual decision-making processes and components will be presented briefly to show how and when an entrepreneurial decision is made.

2.2 Theory of Entrepreneurial Intention (TEI)

To act, we need to channel beliefs, perceptions, and other external variables into the impulse to act (Ajzen 1991). Exogenous influences predict intents well. Intentions toward the behavior, rather than attitudes, beliefs, personality, or demographics, best predict entrepreneurship.

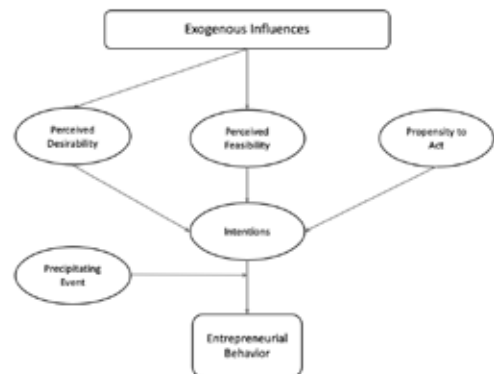


Figure.2 Intentions toward entrepreneurial behavior (Krueger, 1993)

Krueger (1993) presents a testable model based on planned behavior theory and modified for entrepreneurship research. Exogenous influences have an effect on attitudes or the intentions-behavior relationship in this paradigm (Fig.2). They rarely affect intentions or behavior directly. Exogenous variables often affect individual-situation variables like intentions indirectly (personal qualities, demographics). If exogenous influences affect purpose and conduct

by shifting attitudes, the only question is which externality affects which attitude. For example, we could investigate the impact of perceived resource availability on self-efficacy. Exogenous factors that aid or hinder ambition realization can also be studied. Examples of modifiers of intentions-behavior links are Shapero's "precipitating event" and Triandis' (1977) "resource availability."

3. Literature Review

This paper included a review of literature in the following areas to provide a more thorough background for this study: entrepreneurship and self-employment as a unit of study; entrepreneurship and self-employment as a career trajectory; STEM career trajectory and entrepreneurship development in the United States, and entrepreneurial intention.

3.1 Definitions and Measurement of Entrepreneurship

Entrepreneurship is a multidimensional concept whose definition is heavily dependent on the research topic. Hébert and Link (1989) make a distinction between financial capital supply, innovation, resource allocation among different applications, and decision-making. They define an entrepreneur as "someone who specializes in accepting responsibility for and making judgmental decisions about the placement, form, and usage of goods, resources, or institutions" (Hébert & Link, 1989). Wennekers and Thurik (1999) offer a more "Schumpeterian" definition, focusing on the perception of new economic prospects and the subsequent entry of novel ideas into the market. These economic definitions are distinct from those used in management. Stevenson and Sahlman (1988) offer the following definition to differentiate entrepreneurs from managers: "Entrepreneurship is a mode of management that entails seeking opportunity regardless of the resources already under management. Entrepreneurs discover opportunities, amass necessary resources, execute a practical action plan, and reap the rewards in a timely and flexible manner".

Second, and related to the first issue, quantifying and comparing the amount of entrepreneurship across historical periods and nations is difficult by the lack of a globally accepted set of measures. A static or dynamic perspective is possible (Wennekers & Thurik, 1999). The self-employment or firm ownership rate is a critical static indicator of entrepreneurial activity (EIM/ENSR, 1995). We will use the phrases business ownership and self-employment interchangeably with entrepreneurship in this study. Self-employment refers to individuals who work for themselves as business owners rather than seeking a paid job. Alternatively, the focus can be on a country's small and medium-sized businesses. By contrast, the dynamic approach emphasizes so-called embryonic and start-up activity, as well as the net entrance rate and turbulence rate (total of entry and exit).

Earlier research using the National Longitudinal Survey of Youth 1979 (NLSY79) used varying definitions of self-employment. The preceding definition stated that "...those individuals who identify as self-employed...in response to the class of worker question regarding their current or most recent job (Fairlie, 2005)" and excluded unpaid family workers, students, and those who worked fewer than 300 hours in the previous year. According to some, self-employment is defined as "self-claimed and the business must be incorporated" (Rissman, 2003; Evans & Jovanovic, 1989; Dunn & Holtz-Eakin, 2000; Taniguchi, 2002; Williams, 2004; etc.). In this study, we will use self-employment as a starting point to examine persons who engage in self-initiated economic activities throughout their lives. We will use a relatively broad definition of self-employment to encompass a broader range of such activities and chart the evolution of those activities through time.

3.2 Individual and Environmental Determinants of Entrepreneurship

Researchers have been looking at the reasons why entrepreneurship occurs in certain areas at specific times. The answers are limited in three aspects: indi-

vidual characteristics; entrepreneurial opportunities are dependent on the context in which individuals live and work (Schoonhoven & Romanelli, 2001); and the importance of political institutions and rules of the game, such as property rights defense, labor, capital, and knowledge markets, and entrepreneurial culture and perceptions.

Following the first line of explanation, researchers investigate the psychological characteristics of successful entrepreneurs to see what personality traits they have. The quantity of people with these traits influences the economic activity indexes in a country. Innovative, risk-taking, and proactive activity are three aspects of entrepreneurial behavior. To put it another way, the ability to modify the way things are done, to accept the uncertainty that comes with change, and to take the initiative. Entrepreneurial activity, according to the second line of explanation, does not arise from the distinctive traits of the individual entrepreneur, who has ideas for new organizations, the ability to collect cash, and other essential material and human resources. Instead, entrepreneurial activity is influenced by the environment in which the individual operates, such as market size and growth, the availability of productive elements and natural resources, and human and technology capital. It is also critical to emphasize the geographical space. The emergence of new enterprises is determined by the firms and institutions that operate in a certain context where individuals learn and compete (Aldrich and Wiedenmayer, 1993; Romanelli, 1989). The third explanation has to do with how institutions work, as well as culture and societal ideals. These three explanations do not have to be mutually exclusive. Entrepreneurial activity is a human activity that does not occur on its own in the presence of the economic environment, institutional, technological, regulatory, and demographic changes.

3.3 Entrepreneurship and Self-employment as Career Choice

Self-employment is a lifelong decision that influences an individual's entire career. No single self-

employed phase ends an individual's entrepreneurial endeavors, and studies suggest that many self-employed people have multiple self-employed phases throughout their lives (Rissman, 2006). Existing research suggests that self-employment options vary depending on personal choices and circumstances. Contrary to popular opinion, people enter self-employment for a variety of reasons. Self-employment, according to Rissman (2006), may be a temporary state desired by dissatisfied wage earners. These inequalities contribute to differing outcomes in venture performance according to Kepler and Shane (2007). Another study found that family characteristics were a substantial predictor of women's self-employment status. Budig (2006) claimed that family issues predicted nonprofessional self-employment but not professional self-employment. These studies suggest that people enter and exit self-employment in a predictable way.

The study added a longitudinal dimension by treating self-employment as a career choice rather than a static status. People may engage in self-employment part-time to reduce the risk of entrepreneurship, and the dynamics of part-time and full-time work should be separated, according to previous study. Other studies looked at the links between early career choices and subsequent career results. Williams (2004) discovered that self-employed young adults were less likely to complete higher education and earned less over time than non-self-employed peers. Another study by Zissimopoulos and Karoly (2004) indicated that wage and salary workers retire at higher rates than self-employed workers, and that people transition from wage to self-employment as they age. The same authors found that older people with better working conditions, such as pensions and health insurance, were less likely to start their own firm (Zissimopoulos & Karoly, 2004). The above studies were rigorous and sound, but they did not account for variations in employment.

3.4 STEM Career Trajectory in the U.S.

Previous research on STEM labor force has been

mainly focused on the major choice, retention, gender and racial disparity and the disposition of labor force. For example, Speer (2017) concludes that college preparation does not explain the gender gap in STEM attrition. Using the NLSY79 database, he finds that women's higher probability of switching out of STEM majors is mostly driven by non-ability factors. He also found that both women and men switch out of majors when they can improve their grades. Interestingly, when women leave STEM, they switch into majors that are similar academically but have dramatically different gender composition. One of the reasons that STEM major students hold on to their "ground" is because of the higher return of the majors. STEM graduates in applied subjects such as engineering and computer science earn higher wages initially, because they learn job-relevant skills in school. Yet over time, new technologies replace the skills and tasks originally learned by older graduates, causing them to experience flatter wage growth and eventually exit the STEM workforce. Faster technological progress creates a greater sense of shortage, but it is the new STEM skills that are scarce, not the workers themselves. The earnings premium for STEM majors is highest at labor market entry and declines by more than 50 percent in the first decade of working life. This pattern holds for "applied" STEM majors such as engineering and computer science, but not for "pure" STEM majors such as biology, chemistry, physics and mathematics. Flatter wage growth coincides with a relatively rapid exit of STEM majors from STEM occupations. This requires longitudinal research on the subject which includes changing return, technological change and psychological status of individuals.

3.5 Entrepreneurship Development in the U.S.

The United States ranks third on the Global Entrepreneurship and Development Index (GEDI) (Acs & Szerb, 2010). The index builds on prior analyses by collecting both quantitative and qualitative data. It evaluates 71 nations' entrepreneurial performance using three subindices, 14 pillars, and 31 individual

and institutional variables. The U.S. excels in startup skills, competition, and new technologies, but lacks in cultural support, technology, and high-growth companies. The U.S. appears to do better on institutional elements than individual traits. Taxation, regulation, start-up costs and access to capital markets, and legal protection and property rights are identified as significant policies that effect entrepreneurship. Each policy is analyzed economically.

3.5.1 Taxation Policy

Taxation is required to run a functional government. While few would disagree, there is some debate over what constitutes "minimal." In any case, a tax on any activity boosts the cost, discouraging it.

Entrepreneurship success requires investment, consumption, and revenue generation. Incentives to labor, start or expand a firm, and invest are all reduced by a sales tax. A recent study estimated the influence of taxes on economic growth in the U.S. (Crain and Lee, 1999). Using data from 1977 to 1992, the researchers observed a negative and statistically significant connection between state per capita personal income growth and tax revenues. Various active and passive tax policies stimulate entrepreneurship across the U.S. According to a recent Kauffman Center for Entrepreneurial Leadership poll, many governments state they focus on lowering total tax burden through lowering tax rates or expanding tax exemptions (Kayne, 1999). Incentives targeted for corporate location, R&D, and capital needs are available in 10 states. Other state tax cuts include capital gains and inheritance reductions.

Entrepreneurial policymakers should be aware that taxes and growth are mutually exclusive. The costs of reduced economic growth and entrepreneurial activity must be weighed against the benefits of greater tax-funded government programs. Moreover, whereas targeted tax cuts may only stimulate certain types of businesses in specific locations, a more passive tax reduction plan may support a broader range of entrepreneurial activity.

3.5.2 Regulation

Labor and business rules can be costly for enterprises. However, the U.S. regulations are significantly less strict than European regulations (Poole & Wall., 2004). Many European countries, for example, limit the number of hours or late-night hours a firm can operate. There are also restrictions limiting the maximum work of 35 hours per week. Firms in Europe have less power to hire and fire people than in the U.S.

A less regulated labor market promotes American business. The Kauffman Center found that states have reduced regulatory expenses for U.S. entrepreneurs in numerous categories (Kayne, 1999). The survey found that nearly every state believes cutting regulatory compliance costs will boost entrepreneurs. Providing one-stop service centers for entrepreneurs, allowing electronic filing and storage to reduce paperwork, and standardizing compliance reporting across states all help reduce compliance expenses. This may not result in considerable cost savings, but it may influence where a new entrepreneur chooses to set up company.

Getting rid of all regulations would also help. The Kauffman Center found that five states have reduced regulatory costs to encourage entrepreneurship (Kayne, 1999). Tort reform, utility deregulation, and worker compensation laws have all helped states cut company costs. In addition to ensuring worker and business safety, governments should examine their legislation to ensure it is still applicable. Many rules are developed in a political atmosphere, and they may support particular interests rather than the public or corporations.

3.5.3 Costs, Legal safeguards, property rights, and economic liberty

The costs of starting a business are certainly a factor to consider. The time it takes to form a firm, the fees involved, and the required cash are all part of the start-up costs. It is estimated that launching a firm in the U.S. and Europe costs dramatically dif-

ferent amounts (Djankov et al., 2003). In Denmark, there are no costs. Fees range from \$210 in the U.S. to \$4,565 in Italy and \$8,115 in Greece. The U.S. and UK have negligible capital needs as a percentage of per capita income, but Greece has 145.3 percent. Forming a corporation takes four days in Denmark and the US, but 115 days in Spain. Given the high start-up costs around the world, the level of entrepreneurship in the U.S. should not be surprising.

Entrepreneurs cannot function or expand their firms without access to financial markets. Unrestricted access to adequate funding markets is the most promising avenue for entrepreneurship expansion. Many jurisdictions recognize the importance of financing for entrepreneurs and have created measures to ensure their access. Most states, according to the Kauffman Center survey, have active policies for providing loans to entrepreneurs. These loans usually have low interest rates and flexible repayment options. There are plenty of cash resources available to entrepreneurs, but no preparation or management is done. If entrepreneurs do receive the required funds, they may lack the essential expertise or abilities to properly manage it. State and local governments should act.

4. Empirical Research Design

There is a large body of literature about the relationship between human characteristics and their willingness to become entrepreneurs, that is, to establish a business or work for themselves. However, we will begin by outlining the general decision dilemma that every potential entrepreneur encounters, and then we will explain how agglomerative forces may influence potential entrepreneurs' judgments. The preassumption of this research is that latent entrepreneurs are well-informed, logical, and risk-averse decision-makers who will choose to start a new business if it is the best of all available options in terms of expected financial results. Even though a variety of additional reasons have been presented in the entrepreneurial literature, we presume that the

primary motivation for entrepreneurs is financial gain (Jayawarna et al., 2013). Whatever the incentive for starting a new firm, it will fail if it is not profitable.

4.1 Hypothesis Development

We have discovered that eclectic theory adequately describes entrepreneurship in terms of supply of entrepreneurial workforce and of opportunity. On the side of entrepreneurial workforce supply, i.e., the demographic and personal characteristics of potential entrepreneurs; their cumulative general and specific education and training. We will employ a variety of proxy variables that have been asserted to be significant markers of entrepreneurial activity. The variables include:

- Age (certain age group)
- Gender (being a man)
- Being of certain ethnic origins
- Level of education
- Type of education (entrepreneurial training, MBA. etc)
- Length of experience
- Occupation
- Work-mobility (having varied experiences)
- Entrepreneur in family
- Income

On the side of entrepreneurial opportunity supply, economic activities like entrepreneurship have regional variations that can be explained in part by their spatial arrangements and structures (Markusen, 1996; Krugman, 1999; Fujita et al., 1999). Clusters of new firms that produce specialized inputs and demand specialized infrastructure are common (Porter, 2000). The main notion is that large, diversified, and agglomerated urban areas generate more entrepreneurial opportunities than smaller, less diverse, and less dense areas. The elements that are predicted to influence the availability of entrepreneurial possibilities at the regional level will be discussed. The major factors include:

- Demand condition. It is self-evident that a

huge, easily accessible market, as well as one that is increasing, are beneficial to the supply of entrepreneurial opportunities.

- Supply condition. The rate of new firm formation in the region is positively related to the intention of potential entrepreneurs.

In particular start-up situations, we must also examine the impact of geographical variations, for instance, in:

- The availability of finance
- The availability of support services, counseling, and state incentives for potential entrepreneurs
- The availability of technological infrastructure
- The availability of market

With learning the research gap of prior studies and the well-established entrepreneurial intention model, we presented following hypothesis on the research topic:

- H1 Different demographic groups have different in rates of entrepreneurial activities.
 - H1.1 Male have higher chances of becoming entrepreneurs than female.
 - H1.2 White people have higher chances of becoming entrepreneurs than black, Hispanic or other ethnic groups in the U.S.
 - H1.3 STEM education will lower the gap within certain demographic group.
- H2 Working mobility influences the entrepreneurial entry of individuals.
 - H2.1 The number of different occupations which an individual has held is positively related to an individual's likelihood of entrepreneurial entry.
 - H2.2 The number of different industries within which an individual has held a job is positively related to an individual's likelihood of entrepreneurial entry.
 - H2.3 The number of moves between different geographic areas is positively related to an individual's likelihood of entrepreneurial entry.

- H2.4 Number of different occupations held; number of different industries an entrepreneur has held a job within, number of geographic moves have non-significant association with entrepreneurial exit.
- H3 Environmental factors play stronger role influencing entrepreneurial activities for STEM educated individuals than Non-STEM individuals
 - H3.1 Tax Policy, Regulation, Cost and Capital Access, Legal protection, and Economic Freedom positively influence entrepreneurial activities.
 - H3.2 Tax Policy, Regulation, Cost and Capital Access, Legal protection, and Economic Freedom have stronger influence on entrepreneurial activities for STEM-educated individuals than for Non-STEM individuals.
 - H3.3 Tax Policy, Regulation, Cost and Capital Access, Legal protection, and Economic Freedom have stronger influence on the exit of STEM entrepreneurs.

Derived from the entrepreneurial intention and eclectic entrepreneurship theory, we identified four sectors of inputs that will influence the individuals' decision to become an entrepreneur and furthermore work on their entrepreneurial activities. The four aspects are:

- Personal traits, which suggest demographic characteristics such as age, gender, race and ethnicity, etc.
- Individual inputs, which suggest personal factors like education, skills, ability (eg. AFQT¹ score), working experience (in this case, mobility), income and so on.
- Individual related environmental factors, which suggests the social-economic status of individuals' family wealth status, the first language spoken in the household, the atmosphere/ social-economic status of their neighbors and

the previous exposure to entrepreneurship.

- Contextual influence proximal to choose is also an important consideration of this research, which indicates the support or barriers that may facilitate or hinder one's ability to make a particular choice. In the study of entrepreneurship choice, we consider primarily most direct environmental factors such as: Tax Policy, Regulation, Cost and Capital Access, Legal protection, and Economic Freedom Level.

Factors like policy shift, change in occupations, industries and geographic locations, even age, all have longitudinal hints, which requires the research to focus on change, rather than characteristics. Responding to pleas in entrepreneurship research to apply longitudinal data that refuses survivor's bias, we will use the National Longitudinal Survey of Youth (NLSY79) database which contains demographic and financial information, including birth place registration, individual tax statements, financial records, etc.

4.2 Estimation Strategy

4.2.1 Entry of Entrepreneurship

The eclectic theory of entrepreneurship, derived from the FDI decision-making structure, has attempted to answer the question why entrepreneurship is a result of joint effect of individual and contextual determinants. As we stated in the presumption that people will enter the entrepreneurial process when the expected value is higher than the value of an alternative position, in other words, crossing the threshold of entrepreneurial entry over an alternative position, in this case, unemployed, and paid-employment.

Gimeno's threshold equation (Gimeno et al., 1997) provides an estimation tool for the entry of entrepreneurship. The value of entrepreneurship or

¹ The Armed Forces Qualification Test (AFQT) score is what the military uses to determine enlistment eligibility. The AFQT score is calculated using your standard scores from the Arithmetic Reasoning, Mathematics Knowledge, Paragraph Comprehension, and Word Knowledge Subtests.

other employment options includes a mental income component, which can be read as work-life balance or job satisfaction, and SC in the equation refers to the cost of switching from a present job to entrepreneurship.

Enter if:

$$E[P_{V_p}] \geq T$$

Where:

$$T = E[P_{A_E}] + (PI_{A_E} - PI_{V_p}) + SC$$

$$E[P_{V_p}] + PI_{V_p} - SC \geq E[P_{A_E}] + PI_{A_E}$$

In the equation, T represents the threshold of becoming an entrepreneur; $E[P]$ and PI represent the expected financial performance and the psychic income of the two alternatives: entrepreneurship and paid employment. V_p represents entry into a proposed venture; A_E represents an existing alternative position, in this case, current employment; SC represents shifting cost from current position to entrepreneurship.

We consider the threshold and expected performance of proposed venture jointly determine the entrance (Y) of the entrepreneurial process (Nelson, 1977):

$$\Pr(Y_i = 1) = \frac{1}{s_1} Z\left(\frac{Y - \beta_1 X_1}{s_1}\right) \varphi\left(\frac{(1 - s_{12}/s_1^2)Y - \beta_2 X_2 + s_{12}/s_1^2 X_1}{\sqrt{s_2^2 - s_{12}^2/s_1^2}}\right)$$

Where $Z(A)$ is the unit normal density evaluated at A .

4.2.2 Exit of Entrepreneurship

We are going to apply the Cox proportional-hazard model, which is essentially a regression model commonly used in medical research, to identify which factors influence the exit of entrepreneurship and on what degree (Bruderl et al., 1992). The Cox model is expressed by the hazard function denoted by $h(t)$. Briefly, the hazard function can be interpreted as the risk of certain event happening at time t . For each individual at year, Cox regression models

$$Y = 1 \text{ if } E[P_{V_p}] \geq T$$

$$Y = 0 \text{ if } E[P_{V_p}] < T$$

Let:

$$E[P_{V_p}]_i = \beta_1 X_{1i} + v$$

$$T = \beta_2 X_{2i} + \mu$$

Where v and μ are random disturbances assumed to follow a bivariate normal distribution with a zero mean vector and unknown variances (assumed co-variance=0).

Substituting the equations, the probability of observing non-entry can be given as:

$$\begin{aligned} \Pr(Y_i = 0) &= \Pr(v - \mu < \beta_2 X_{2i} - \beta_1 X_{1i}) \\ &= \varphi\left(\frac{\beta_2 X_{2i} - \beta_1 X_{1i}}{\sqrt{s_1^2 + s_2^2 - 2s_{12}}}\right) \end{aligned}$$

Where s_1 is the standard deviation of the disturbance of the $E[P_{V_p}]$ equation; and s_2 is the standard deviation of the disturbance of the T equation; and s_{12} is the covariance of the errors.

The probability of entry is:

time (t) as a function of an underlying hazard h and a set of exponentiated beta coefficients (b_{ij}) and variables (x). The baseline hazard h is equal to 0 when all covariates (x) are equal, and it is pushed up or down proportionally as the covariates change. The equation can be briefly estimated as follow:

$$h(t) = h_0(t) \times \exp(b_1 x_1 + b_2 x_2 + \dots + b_i x_i) = h_0(t) \exp(\beta_{ij} x_{ij})$$

where :

- t represents the time when entrepreneurial entry/exit happen
- $h(t)$ is the hazard function determined by a set of p covariates (x_1, x_2, \dots, x_p)
- the coefficients (b_1, b_2, \dots, b_p) measure the impact (i.e., the effect size) of covariates.
- the term h_0 is called the baseline hazard. It corresponds to the value of the hazard if all the x_i are equal to zero (the quantity $\exp(0)$ equals 1). The 't' in $h(t)$ reminds us that the hazard may vary over time.

The quantities $\exp(b_i)$ are called hazard ratios (HR). A value of b_i greater than zero, or equivalently a hazard ratio greater than one, indicates that as the value of the i th covariate increases, the event hazard increases and thus the length of survival decreases.

In the regression findings, all coefficients will be displayed as hazard rates (HR), making it easy to interpret as marginal effects. We pay close attention to the HR for each hypothesis. A coefficient of 1.01 indicates that a one-unit increase in covariate x increases the likelihood of the outcome variable (entry or exit) by 1%, whereas a coefficient of .99 indicates that a one-unit increase in covariate x decreases the likelihood of the outcome variable by 1%.

5. NLSY Data Introduction

NLSY database is a nationally representative sample of 12,686 young men and women born during the years 1957 through 1964 and living in the United States when the survey began. The survey respondents were ages 14 to 22 when first interviewed in 1979. During the years since that first survey, the participants in this cohort typically have finished their schooling, moved out of their parents' homes, made decisions on continuing education and training, entered the labor market, served in the military, married, started families of their own, and thought about their retirement expectations. Data collected from the NLSY79 respondents chronicle

these changes and provide researchers with a unique opportunity to study the life-course experiences of American men and women.

The NLSY79 is an excellent source of data for conducting research on self-employment and entrepreneurship. The rich individual information available in the survey allows researchers to build various empirical models of entrepreneurial process. Measures of previous wage and salary, self-employment and unemployment experience can be created. The detailed asset categories, family background, AFQT scores, earnings, return of self-employment, job-satisfaction and family net worth are also included in the data set. Previous studies show that being male, white, older, married, immigrant and having a self-employed parent, more assets, and more education increase self-employment, which agrees to the findings of this study and we found that business owner ratio of STEM educated individuals is slightly higher than non-STEM educated personnel.

At this stage of the study, we extracted three STEM related majors based on the "field of study in college" question in the survey, namely, computer science, engineering and biological science, which are the most prevailing STEM majors under today's context.

Table 1. STEM-educated individual by Ethnicity

STEM by Ethnicity				
	Non-Engineer	Engineer	SUM	PERCENTAGE
Black	2958	216	3174	6.81%
Hispanic	1859	143	2002	7.14%
None-Black, Non-Hispanic	6910	600	7510	7.99%
	11727	959	12687	7.56%
STEM by Ethnicity				
	Non-CS	Computer Science		
Black	2845	329	3174	10.37%
Hispanic	1854	148	2002	7.39%
None-Black, Non-Hispanic	6939	571	7510	7.60%
	11638	1048	12687	8.26%
STEM by Ethnicity				
	Non-BS	Biological Science		
Black	3092	82	3174	2.58%
Hispanic	1933	69	2002	3.45%
None-Black, Non-Hispanic	7225	285	7510	3.79%
	12250	436	12687	3.44%

We found that individuals who take these three majors comprise up to 17% of the total population, around the same level of STEM work-force ratio in the whole labor force. We noticed that black ethnicity has a significantly high percentage in computer science and the reason is worth researching in the following study.

Previous study also finds that the probability of being self-employed in the current year increases significantly if the person was unemployed in the previous year. Also both cumulative work experience and the number of jobs ever held increase the rate of entry into self-employment and wage/salary employment, yet those studies were not occupational specific. We assume that the trend will vary for STEM educated individuals, a.k.a, the STEM educated individuals are less forced to be self-employed.

The longitudinal nature of NLSY79 enables us to compare earnings profiles for self-employed worker and wage/salary workers. Prior studies in year 2002 show that at the 10 years of experience and job tenure, self-employed business owners earn 18% less than wage/salary workers. But it has already been 18 years since the study, we will test the result with latest data in this study.

Table 2. STEM-education by Gender

STEM by Gender				
	Non-Engineer	Engineer	SUM	PERCENTAGE
Female	6139	144	6283	15.02%
Male	5588	815	6403	84.98%
	11727	959	12687	
	Non-CS	Computer Science	SUM	PERCENTAGE
Female	5743	540	6283	51.53%
Male	5895	508	6403	48.47%
	11638	1048	12687	
	Non-BS	Biological Science	SUM	PERCENTAGE
Female	6070	213	6283	48.85%
Male	6180	223	6403	51.15%
	12250	436	12687	

The gender distribution for computer science and biological science is considerably even, while for engineering major, it is very different. Among the 959 engineering majors, only 15% is female. That explains why many gender disparity researchers focus very much on engineers.

Table 3. Cross-sectional Ration on STEM-education and Business Ownership

Business Owner by STEM Education Background				
	Non-Engineer	Engineer	SUM	PERCENTAGE
Non-Business Owner	11573	817	12390	85.19%
Business Owner	154	142	296	14.81%
	11727	959	12687	
	Non-CS	Computer Science	SUM	PERCENTAGE
Non-Business Owner	11469	921	12390	87.88%
Business Owner	169	127	296	12.12%
	11638	1048	12687	
	Non-BS	Biological Science	SUM	PERCENTAGE
Non-Business Owner	12020	370	12390	84.86%
Business Owner	230	66	296	15.14%
	12250	436	12687	

Then we calculated the percentage of STEM educated business owner and the number agrees with previous research. Following study will be focused on the personal input, personal traits, background and context of individuals and the transit in/out of self-employment of this individuals, to understand better about the STEM educated workers' career choice in his/her life span.

At this stage, the data clearance and arrangement is still in progress. For the next step, we are going to select the exact variables according to the research design and reform it into time-series format.

6. Conclusion

This paper proposes a framework for identifying environmental and individual determinants of entrepreneurial entry and exit of STEM-educated workforce. Previous research has identified three levels of entrepreneurial determinants: At the micro-level, personal aspects such as psychological features, formal education and other skills, financial assets, family background, and previous job experience are highlighted in study regarding people's decisions to work for a wage or as self-employed individuals. At the meso level, market-specific factors of entrepreneurship, such as profit opportunities and entry and exit alternatives, are extensively explored. This work aims to contribute at the macro level, which brings arguments from the micro and meso levels together, concentrating on a wide range of environmental and individual elements. The proposed threshold model can answer the question "why an individual chooses to become an entrepreneur". While the NLSY data of the U.S. provides detailed information on a cohort's life cycle, we could expect fruitful results from the analysis.

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