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FLORIDA INTERNATIONAL UNIVERSITY

Miami, Florida

THREE ESSAYS ON SELF-EMPLOYMENT TRANSITIONS, ORGANIZATIONAL CAPITAL, AND FIRM FORMATION

A dissertation submitted in partial fulfillment of the

requirements for the degree of

DOCTOR OF PHILOSOPHY

in

ECONOMICS

by

Fatma Deli

2011

To: Dean Kenneth Furton
College of Ats and Sciences

This dissertation, written by Fatma Deli, and entitled Three Essays on Self-Employment Transitions, Organizational Capital, and Firm Formation, having been approved in respect to style and intellectual content, is referred to you for judgment.

We have read this dissertation and recommend that it be approved.

Mihaela Pintea

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Date of Defense: July 11, 2011

The dissertation of Fatma Deli is approved.

Dean Kenneth Furton
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Interim Dean Kevin O'Shea
University Graduate School

Florida International University, 2011

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DEDICATION

I dedicate this dissertation to my parents, my brothers, my husband, and my little son. Without their patience, understanding, support, and most of all love, the completion of this work would not have been possible.

ACKNOWLEDGMENTS

I wish to thank the members of my committee for their support, patience, and good humor. And I would like to thank my major professor, Dr. Peter Thompson for his patience, edits, and valuable comments. Their gentle but firm direction has been most appreciated.

ABSTRACT OF THE DISSERTATION

THREE ESSAYS ON SELF-EMPLOYMENT TRANSITIONS, ORGANIZATIONAL CAPITAL, AND FIRM FORMATION

by

Fatma Deli

Florida International University, 2011

Miami, Florida

Professor Peter Thompson, Major Professor

This dissertation explores how economic, organizational, and personal factors affect self-employment transitions, occupational decisions, and firm formation activities of individuals at different positions in the skill distribution. The first essay of my dissertation studies how local unemployment rates differentially affect entry into self-employment by individuals at different places in the skill distribution. The empirical results show a positive correlation between local unemployment rates and entry into self-employment for low-ability workers, but not for high-ability workers. Including employer size to eliminate possible distortions showed that the positive association between unemployment and self-employment among low-ability workers is in fact driven by the small firm effect. Controlling for firm size yields a negative association between unemployment and self-employment among high-ability workers.

Effects of organizational capital, human capital and physical capital, on the firm formation activities of people at distinct skill levels depend on the type of the industry which is chosen for the new firm. Two types of industries, capital-intensive and ability-intensive, are utilized to explore this hypothesis in the second essay. A capital-intensive industry requires more physical investment, and consequently more funds, whereas, an ability-intensive industry requires more human capital. It is shown that high human capital requirements are associated with higher earnings among the most able individuals, and therefore makes them more likely to found firms in an ability-intensive industry. Wealthy people are more likely to establish both capital-intensive and ability-intensive firms, even though the amount of funds necessary for two industry types differs. Moreover, entry into both industries is predicted to happen later in life due to the removal of entry barriers constituted by required investment spending using savings when old. Empirical mixed results are observed.

The third essay investigates earning differentials between future entrepreneurs and their non-entrepreneurial colleagues. Results show that high-ability firm-owners in an ability-intensive industry were earning more than those that remained in wage-work, whereas, low-ability firm-owners in a capital-intensive industry were earning less than those remaining in paid-work.

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I. INTRODUCTION

Since the creation of new firms is an important driver of new product and job creation, entrepreneurship plays a crucial role in economic growth. The important role of self-employment has stimulated the interest of researchers in understanding its determinants. Much of the literature is focused on the importance of personal characteristics in the prediction of self-employment. However, there are still unanswered questions about the roles of existing economic conditions and their interactions with personal characteristics in transitions into self-employment. The three essays in this dissertation focus on how economic, organizational, and personal factors affect self-employment transitions, occupational decisions, and firm formation activities of individuals at different positions in the skill distribution.

Data taken from Panel Study of Income Dynamics (PSID) are used for empirical analysis in my research. The PSID is a longitudinal study of U.S individuals and family units. Because of PSID's longitudinal nature, I can observe personal economic activities in each year and therefore I can detect any changes in personal data. The longitudinal nature of the data set allows me to identify the timing of transitions from paid-work to self-employment for each person. Additionally, the PSID has data regarding personal characteristics including age, gender, education, work experience, occupation, wealth, prior employment, region, and annual labor income that are also crucial for my research. As indicated in the literature, individuals at the lower and upper ends of the skill distribution are more likely to be self-employed [Elfenbeim, Hamilton, and Zenger,

(2008)]. That is, these low and high ability people are the ones who found new firms. Therefore, workers are classified in my samples according to their ability levels, which is assessed in the following way: I use econometrically unexplained income as a proxy for ability, and to measure this, I use personal data to control for characteristics affecting labor income in the wage regressions.

The first essay of my dissertation studies how local unemployment rates differentially affect entry into self-employment by individuals at different places in the skill distribution. The study uses two samples, for the periods 1978-1983 and 1993-1995, from the PSID and exploits state and temporal variations in unemployment rates. Consistent with the literature on push-entrepreneurship and opportunity entrepreneurship, I expected to find a positive correlation between local unemployment rates and the probability of becoming self-employed for people at the low end, and a negative effect at the high end of the skill distribution. The results show a positive correlation between local unemployment rates and entry into self-employment for low-ability workers, but not for high-ability workers. Given relationships that have recently been reported between ability, firm size and employment choice, it is possible that results are distorted by the omission of controls for firm size. Controls for employer size are available for one of the two samples. Including them indicates that the positive association between unemployment and self-employment among low-ability workers is in fact driven by the effect of employer size. Controlling for firm size yields a negative association between unemployment and self-employment among high-ability workers.

My second essay explores the role of organizational capital in firm formation activities of individuals at different skill levels over time. Transitions into entrepreneurship are also influenced by the type of industry which will be chosen for the new firm. Whether the industry requires more capital or more ability is an important criteria for a potential entrepreneur to consider while founding a new firm. A capital-intensive industry refers to an industry requiring substantial investment in capital assets, and consequently requiring more liquidity for entry. An ability-intensive industry, however, is an industry requiring more human capital instead of physical capital for production. My research investigates how organizational capital, human capital and physical capital, constitute barriers to firm formation by individuals at different skill levels over time.

Since people have different skill levels and different amounts of initial wealth, required organizational capital for the new firm may constitute an effective entry barrier. Not having enough money constitutes an entry barrier for a capital intensive-industry, while not having enough skill constitutes an entry barrier for an ability-intensive industry. My study includes a model simulating interactions among a representative utility maximizing agent and his/her profit maximizing firm. I also analyze testable implications of my model empirically by using a sample, for the period 2003-2007, from the Panel Study of Income Dynamics.

My model illustrates the followings: Both industry types, capital-intensive and ability-intensive, require funds for investment spending in the model. However, the

amount necessary for a capital-based firm is greater than amount necessary for an ability-based firm. Moreover, high human capital is also necessary for an ability-based firm. Thus, a required high skill level induces the most able individuals to found firms in an ability-intensive industry. Firm formation by individuals in distinct places of the skill distribution depend on their initial wealth and saving behavior. That is, if they have high initial wealth, and if the monetary return from a capital-intensive industry is greater than the return from an ability-intensive industry and paid-work, then they prefer to found a firm in a capital-intensive industry when young. Another option of self-employment for young individuals who do not have high initial wealth is to form a firm in an ability-intensive industry if their skill levels allow. If the monetary return from an ability-intensive industry is greater than the return from a capital-intensive industry and paid-work, then they found a new venture in an ability-intensive industry in the first period of their life even though their initial wealth is limited. Otherwise, they stay at their current jobs and save to accumulate the required funds for investment in a capital-intensive or an ability-intensive industry. These latter individuals establish their own firm in the second period of their life by using their savings.

Mixed empirical results about the predictions of the model are observed. That is, more personal ability makes high-ability individuals more likely to establish ability-based firms. In contrast, low-ability individuals are more likely to work as wage-earners than to found their own firms when personal ability level increases. It is empirically shown that higher wealth makes people more likely to found both capital-based and ability-based

firms. The regression estimates indicate that entry into an ability-intensive industry often happen later in life for lower-skilled people. Entries into a capital-intensive industry also happens later in life for low-ability individuals but not for high-ability ones.

My third essay empirically analyzes earning differentials between future entrepreneurs and their non-entrepreneurial colleagues by considering the industries chosen by entrepreneurs. Two types of industries, ability-intensive and capital-intensive, are defined for the analysis. A sample from the PSID covering the period 2003-2007 is utilized to test my hypotheses. The empirical results are consistent with my hypotheses. That is, individuals who form firms in an ability-intensive industry were earning more than others remaining in wage-work. Since an ability-intensive industry requires a relatively high skill level, they are more likely to have higher ability. On the other hand, people who found firms in a capital-intensive industry were earning less than other employees remaining on the job. They are more likely to be lower-ability workers because capital-intensive industry requires more liquidity and less ability.

This dissertation is organized as follows: Section 2 presents the first essay Opportunity and Necessity Entrepreneurship: Local Unemployment and the Small Firm Effect, section 3 contains the second essay Organizational Capital and Barriers to Firm Formation, and the last section shows the third essay Who earns more? Future Entrepreneurs or Their Non-Entrepreneurial Colleagues.

II. CHAPTER 1 : OPPORTUNITY AND NECESSITY ENTREPRENEURSHIP: LOCAL UNEMPLOYMENT AND THE SMALL FIRM EFFECT

Introduction

Since entry into self-employment has an important place in the creation of many new firms, products, and services, it affects nearly all markets of the economy. The crucial role of entrepreneurship leads researchers to focus on the determinants of self-employment. Creation of new organizations by entrepreneurs depends on several parameters including personal characteristics, or existing conditions.

Much of the research has focused on the roles of individual characteristics like age, education, and gender in the probability of entry into self-employment. These individual characteristics affect not only the likelihood of becoming self-employed, but also affect personal income which, in turn, is also related to the likelihood of becoming self-employed. The literature shows that incomes of wage-earners and self-employed individuals are not the same [Hamilton (2000)]. Hamilton (2000) finds that the median of three distinct measures of self-employment earnings reported in the 1984 Survey of Income and Program Participation (SIPP) were lower than wages, while their variance was greater. [1]

1 Gort and Lee (2007), found that average earnings of self-employed respondents in the NSF Scientist and Engineers Statistical Data System (SESTAT), were higher than those of wage-earners. However, the SESTAT sample is biased towards high earners, where self-employed incomes are higher. On the other hand, they find that incomes of wage-earners are higher than those of self-employed individuals at the lower end of the distribution.

The standard explanation for this result is that self-employment earnings and wages respond differently to variations in ability. Constructed models of employment choice show that return to ability is convex among the self-employed and linear among wage earners [Braguinsky and Ohyama (2008); Astebro, Chen and Thompson (2009)]. This induces individuals in the tails of the ability distribution to choose self-employment over wage work. Their models are consistent at the upper end of the earning distribution with the economics of superstars (Rosen, 1981), and at the lower end with Min's (1984) claim that lower end of the earnings distribution is populated by "misfits" who cannot work well with others.

Variations in returns to ability can explain the static distributions of self-employment earnings and wages, but they do not offer a clear explanation of how people enter into self-employment. Instead, transitions have been explained in the contexts of opportunity and necessity entrepreneurship. Block and Wagner (2006) define opportunity entrepreneurs as individuals who start a business in order to pursue an opportunity, and necessity entrepreneurs as individuals who are driven into self-employment because of limited opportunity in the wage sector. Because the former are attracted into self-employment by the identification of opportunities, they are more likely to establish new firms when economic conditions are good. In contrast, necessity entrepreneurs are often driven into self-employment after becoming involuntarily unemployed, so they are likely to be more common in periods of rising and high unemployment.

The present section links these two disparate lines of inquiry – variations in ability

and the distinction between necessity and opportunity entrepreneurs – by analyzing the effect of variations in the local unemployment rate on the propensity to enter self-employment for individuals of differing ability. Opportunity entrepreneurs tend to have high levels of creativity and personal ability and, as a result tend to be located in the upper end of the earnings distribution, both before and after entering self-employment. As a result, I expect that high-ability individuals are more likely to enter self-employment when local unemployment rates are low. Necessity entrepreneurs, on the other hand, see no better alternative for earning money than becoming self-employed. These people are not generally creative and are often low-ability employees. Consequently, we expect that high local unemployment rates stimulate entry into self-employment among individuals with low ability.

These hypotheses are tested using observations on a large sample of individuals in the PSID, matched in each year to the unemployment rate prevailing in the state of residence. Two panels are constructed, for the periods 1978-1983 and 1993-1995; the latter, shorter, panel is included because I will need to control for employer size in a number of regressions that follow.

Since the likelihood of opportunity and necessity entrepreneurship is related to personal ability, I construct an indicator for innate ability from the residuals obtained in a regression of earnings on age, gender, education, work experience, industry, occupation, and state of residence (cf. Behrman and Rosenzweig, 1999). Individuals are placed in five

ability groups, denoted by A1 through A5, with A1 representing the lowest ability group. These are not quintiles. Groups A1, A2, and A3 each account for 25 percent of the observations, A4 accounts for the next fifteen percent, and A5 represents the highest ten percent.

The main analysis consists of logistic regressions examining how the probability of transitioning from wage employment into self-employment is affected by the local unemployment rate, estimated ability, and interactions between ability and local unemployment. My hypothesis is that the coefficient(s) on the interaction between ability and unemployment will be positive among the low ability group(s), and negative for the high ability group(s). The key results are as follows. For the 1978-1983 sample, the probability of becoming self-employed is on average increasing in the local unemployment rate. However, when effects are allowed to vary by ability group, local unemployment stimulates entry into self-employment for groups A1 through A4, but not for the most able individuals, in group A5. These results are robust to the inclusion of controls for age, gender, education, and work experience. Qualitatively similar, but statistically insignificant results, are obtained for the 1993-1995 sample; the lack of statistical significance may be the result of the modest sample size resulting from only having two years of transitions. Because of the reduced sample size, I reduce demands on the data by merging groups A1 through A4 on the basis of personal skill level. While the point estimates continue to indicate that local unemployment stimulates entry into self-employment for the low-ability group but not for high-ability group, these results remain

statistically insignificant.

The results that have been obtained may be the result of failure to controls for firm size. Employees of small firms are far more likely to become self-employed than are employees of larger firms (Elfenbeim, Hamilton, and Zenger, 2008). Employment in small firms is more volatile and susceptible to negative economic shocks (Davis and Haltiwanger, 1992; Davis et al., 1996; Rob, 1995), and that residual earnings are increasing when employer size increases (Abowd et al., 1999; Brown and Medoff, 1989; Acs, 1999). Thus, the way that ability appears to mediate the effect of unemployment on entry into self-employment may be the result of employer size rather than ability.

Only the latter of the two PSID samples contains information about employer size. Therefore, the 1993-1995 sample is used to test the role of employer size on the previous results. I first evaluate the effect of firm size without considering unemployment levels. Consistent with the literature, I find that prior employment in a small firm dramatically enhances the probability of entering into self-employment. However, interacting an indicator for small firm size with ability, I find that employment in a small firm stimulates self-employment only for individuals in groups A1 and A2 (i.e., those with ability below the 50th percentile).

The results do not indicate any relationship between the probability of becoming self-employed and employment in a small firm for high-ability individuals. The result contrasts with the findings of Elfenbeim, Hamilton, and Zenger (2008), who found a

sizeable small-firm effect at the upper end of the ability distribution. Finally, I control jointly for a small firm effect and the local unemployment rate in regressions run separately by ability group.

Despite the modest sample sizes, the results are surprisingly sharp. For ability groups A1 and A2, employment in small firms raises the probability of entry into self-employment while variations in the local unemployment rate have no effect. In contrast, there is no small firm effect among ability groups A3 through A5, but increases in the local unemployment rate reduce the likelihood of entry into self-employment. As a result, I find no robust evidence that necessity entrepreneurship is stimulated by increases in local unemployment rates, but I do find evidence that opportunity entrepreneurship is stifled by high unemployment.

This section is organized as follows: The second part describes data and methods used, the third part presents results, and the last part concludes.

Data and Methods

I use two panels of data constructed from the Panel Study of Income Dynamics (PSID) and local unemployment rates at the state level[2]. My data contain 32,335 individuals in years 1978-1983 and 1993-1995. I add state unemployment rates to the data. These two time periods are chosen because they have all information that I need for

2 Source: U.S Bureau of Labor Statistics

this study. The 1978-1983 sample is chosen first to study the local unemployment effect. The 1993-1995 sample is added to the study because of the lack of firm size data in the first sample. Even though the 1993-1995 sample is small relative to the first one, it enables me to control for both local unemployment and small firm effects simultaneously. I use household heads in both samples because they are family members about whom the greatest amount of information is available.

Table 1: Summary statistics of annual total labor income for wage-earners and self-employed people for both samples.

	1978-1983		1993-1995	
	Wage-Earners	Self-Employed	Wage-Earners	Self-Employed
Mean	15,770	19,334	22,543	37,435
Std. Dev.	10,452	20,304	24,067	58,748
25th Percentile	7,140	6,419	10,568	9,891
50th Percentile	13,713	13,160	25,858	29,288
75th Percentile	17,660	18,040	33,015	40,533
90th Percentile	21,747	24,751	40,147	51,425
100th Percentile	32,552	42,946	55,316	66,559
Observations	22,752	3,220	5,471	664

Since my purpose in this chapter is to estimate the impacts of some existing personal

characteristics and conditions on the probability of becoming self-employed, there are both wage-earners and self-employed individuals in my samples. Incomes of wage-earners and self-employed people are not the same. Summary statistics of annual total labor income for wage-earners and self-employed individuals for different years are given in Table 1. The distributions of annual labor incomes of household heads for both wage-earners and self-employed can be seen in Figure-1 and Figure-2 for two samples.

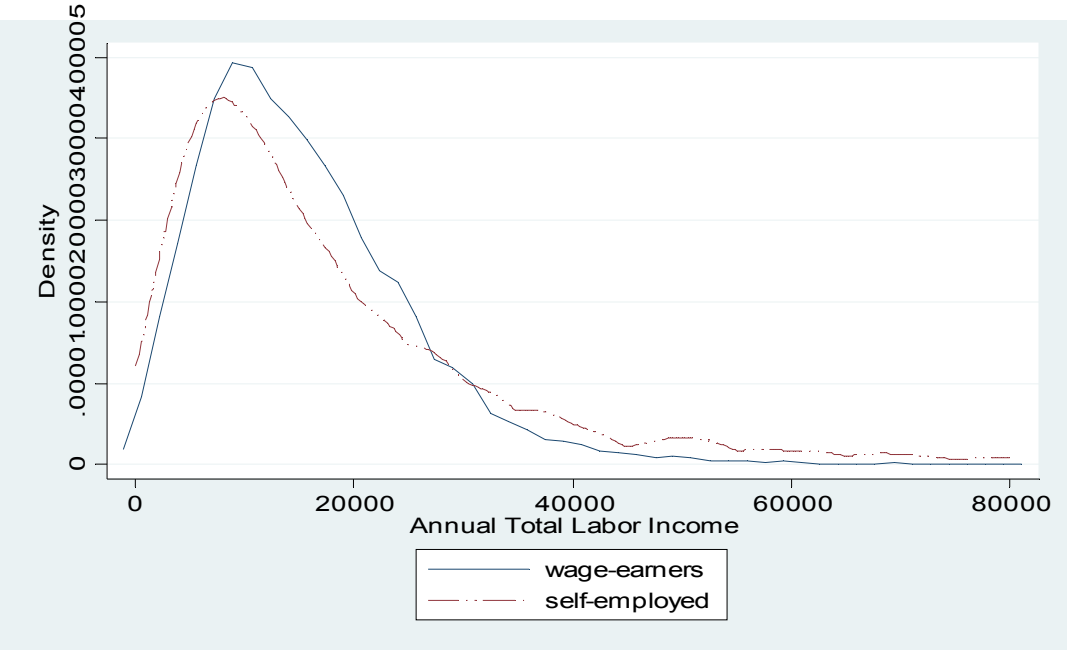

Figure-1: Distributions of income for wage-earners and self-employed; 1978-1983.

Figures 1, 2, and Table 1 show that mean incomes of self-employed people are greater than those of wage-earners for both samples. The same is also true for the variances. That is, the variances of incomes for self-employed individuals are larger than those for wage-earners.

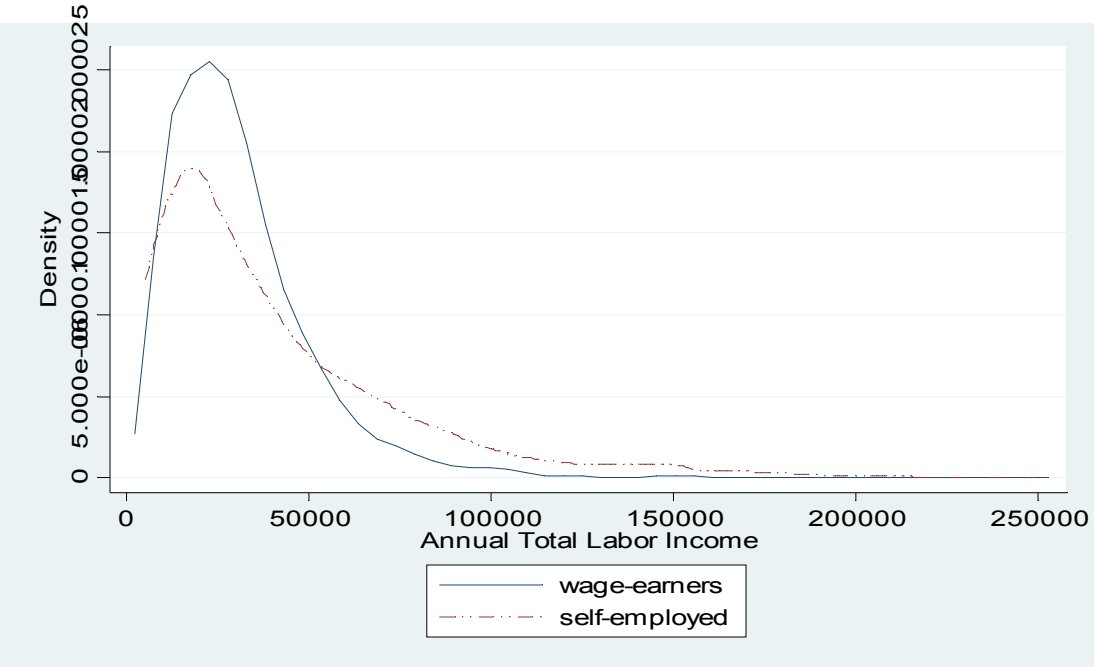

Figure-2: Distributions of income for wage-earners and self-employed; 1993-1995.

Incomes of self-employed individuals are lower than those of wage-earners at the 25th percentile and higher at the 90th percentile for the period of 1978-1983. Similarly, incomes of self-employed individuals are lower than those of wage-earners at the 25th percentile and higher at the 75th percentile for the period of 1993-1995.

The total labor income of an individual depends on individual characteristics like age, gender, education, work experience, industry, occupation, state of residence, and personal ability. We can measure age, gender, education, work experience, industry, occupation, and state of residence but we cannot measure personal ability directly. There are two way to measure ability used in literature. The first, which is used by Elfenbeim, Hamilton, and Zenger (2008) holds the education level constant. They construct a

percentile rank in the skill distribution separately for people having the same highest degree. They measure relative ability as the position of a given individual within the pay distribution in a given year among individuals with the same highest degree. The method used by Elfenbeim, Hamilton, and Zenger (2008) seems logical because we observe large income differences among people having identical observable human capital. However, this method ignores the impacts of work experience, age, gender, and state of residence on personal labor income. These additional characteristics can also create large differences in labor income. The one with more work experience can earn more than others although all have identical highest degrees. Similarly, earnings of a person can be different in two different cities even for people with same job.

The second way of measuring personal ability is to use residual income as a proxy. Juhn, Murphy, and Pierce (1993) use this method to determine ability levels of individuals and therefore their relative positions in the skill distribution. This is a more logical way of measuring ability level than the one used by Elfenbeim, Hamilton, and Zenger (2008). It controls for the effects of age, gender, and education level on personal labor income and uses the residual as a measure of ability. As Behrman and Rosenzweig (1999) indicate, ability has been used as the rubric for all unmeasured earnings endowments, which may include genetic endowments of ability, preschool human capital, or motivation.

I also use residual income in this study as a proxy to determine the position of an individual in the skill distribution. Unexplained incomes used in this chapter are residuals

from a regression of the logarithm of income on some observable individual variables. These variables are occupation, industry, state of residence, age, gender, education level, and work experience. A general form of the wage regression is given below.

$$\text{Ln(income)}_{i,t} = \alpha_0 + \alpha_1 X_i + \alpha_2 Y_{i,t} + \varepsilon_{i,t} \quad (1)$$

where the vector X_i represents a set of time-invariant individual characteristics, and the vector $Y_{i,t}$ represents a set of time-varying individual characteristics of person-i in year-t. As indicated by Garen (1984) and Weiss (1995), a regression of wage on education results in biased coefficient estimates. Thus, I used Heckman two-step correction to obtain unbiased parameters. Marital status and the number of children at home are used in the selection equation in addition to the other variables. The first stage estimates, presented in Part-B of Table 2, show that being married and having more education are positively correlated and that more educated people have fewer children.

Table 2 also presents estimates of the wage regressions for both samples, which includes 8 occupation, 10 industry, and 51 state of residence dummy variables in addition to age, gender, education, and work experience explanatory variables in the wage regressions. The results indicate that education raises earnings[3], work experience induces higher incomes, and males earn more than females. These are all familiar and unsurprising results. The lambda terms are negative and statistically significant.

3 This positive correction between education and earning is also shown by Becker and Chiswick (1966), Willis and Rosen (1979), Taubman and Wales (1974), and Jovanovic and Moffitt (1990).

Table 2 : Labor Income Regressions for Both Samples

	1978-1983	1993-1995
Constant	7.9309 (0.1290)	7.5821 (0.7840)
Age	0.0018** (0.0015)	0.0049** (0.0023)
Gender	0.5683*** (0.0123)	0.5749*** (0.0360)
Education	0.0580*** (0.0016)	0.0614*** (0.0071)
Work Experience	0.0107*** (0.0007)	0.0089*** (0.0031)
Lambda	- 0.3412*** (0.0261)	- 0.2013*** (0.0124)
R^2	0.3450	0.2408
First Stage Estimates		
Constant	0.2409** (0.0431)	0.1413** (0.0431)
Age	0.1703 (0.3100)	0.1529 (0.2123)
Gender	0.5380** (0.2079)	0.6401** (0.3085)
Married	0.1923* (0.0192)	0.1804* (0.0681)
Number of Children	- 0.4083** (0.0240)	- 0.3110** (0.0360)
Work Experience	- 0.1105 (0.2010)	- 0.2015 (0.3124)
R^2	0.2941	0.2403
Observations	26,200	6,135

Standard Errors are reported in parentheses. Regressions include 8 occupation, 10 industry, and 51 state of residence dummies.
***Significant at 1 % level; **Significant at 5 % level; *Significant at 10 % level

That is, the error terms in the selection and primary equations are negatively correlated for both samples. Thus, unobserved factors that make participation more likely tend to be associated with lower wages.

Table 3: Summary statistics of unexplained incomes

	1978-1983		1993-1995	
	Wage-Earners	Self-Employed	Wage-Earners	Self-Employed
Mean	0.015	- 0.121	0.0031	- 0.021
Std. Dev.	0.598	0.852	0.890	1.217
25th Percentile	-0.812	-0.853	-1.229	-1.202
50th Percentile	-0.062	-0.068	-0.034	-0.045
75th Percentile	0.204	0.259	0.430	0.326
90th Percentile	0.515	0.604	0.651	0.593
100th Percentile	0.876	1.037	1.287	1.449
Observations	22,752	3,220	4,312	603

Summary statistics of residual income for wage-earners and self-employed individuals for different years are given in Table 3. The table 3 along with Figures 3 and 4, show that mean residual income for self-employed people is smaller than that for wage-earners. However, the variance of unexplained income for self-employed people is larger. Unexplained income of self-employed individuals is lower than that of wage-earners at the 25th percentile and higher above the 90th percentile for both periods 1978-1983 and 1993-1995.

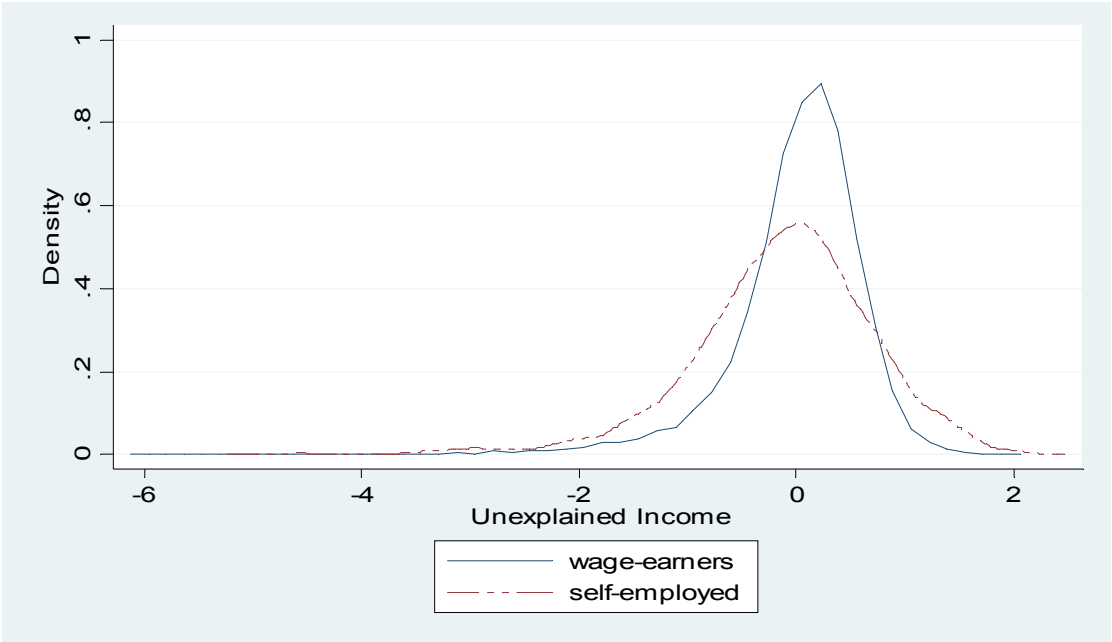

Figure-3: Distributions of unexplained income for wage-earners and self-employed; 1978-1983

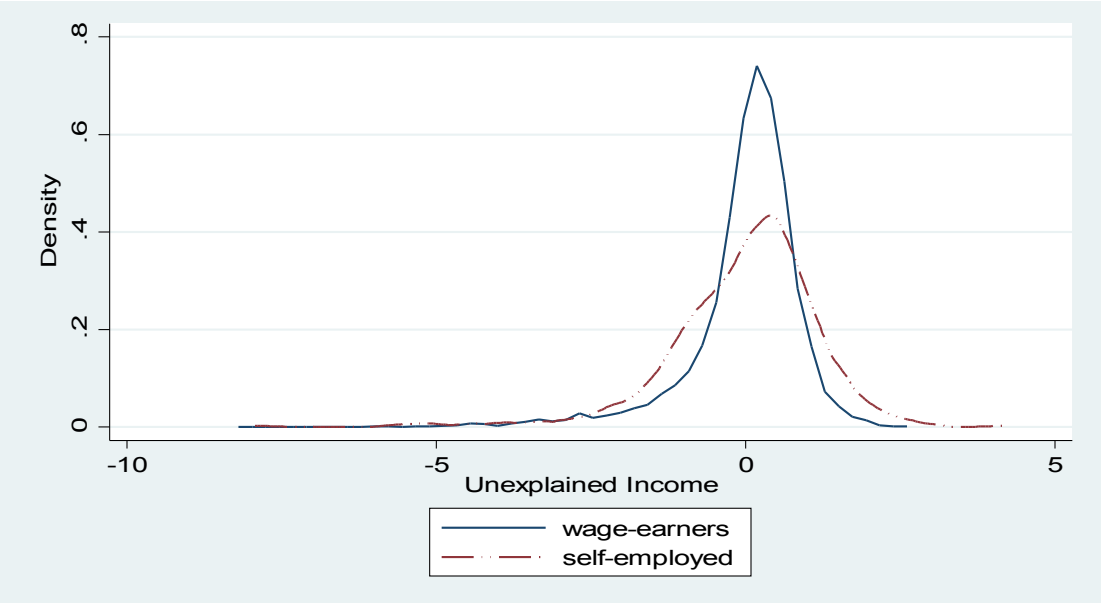

Figure-4: Distributions of unexplained income for wage-earners and self-employed; 1993-1995

As mentioned in the introduction, I use five ability groups to classify individuals in my samples according to their positions in the skill distribution. People below the first 25th percentile of the skill distribution are in A1. Since they are at the lowest end, they are called low-ability people in this chapter. People at the high end of the skill distribution are classified as high-ability people. They constitute the top 10 % of the skill distribution. People in between these two ends are divided into three additional groups as A2, A3, and A4. Groups A2 and A3 contain the second and the third quantiles of the skill distribution, respectively. People in A4 constitute the fifteen percent of the skill distribution above those in A3.

Table-4: Summary statistics of Annual Total Labor Income for Small Firm Employees and Self-Employed Individuals

	1993-1995		
	Small Firm Employees	Large Firm Employees	Self-Employed
Mean	24,456	31,795	37,435
Std. Dev.	17,936	33,818	58,748
25th Percentile	11,264	10,186	9,891
50th Percentile	21,950	27,501	29,288
75th Percentile	29,779	34,681	40,533
90th Percentile	35,280	43,259	51,425
100th Percentile	40,378	66,522	66,559
Observations	1,127	3,735	664

Since this chapter analysis the effect of the local unemployment rate on the likelihood of entrepreneurship, unemployment rates of U.S states are added to the data sets. The local unemployment effect is tested for the two samples with and without considering ability levels of individuals. The results of these tests are presented in the following section. In order to check the robustness of these results, I further control for firm size. The PSID contains information about the number of employees in last firm an individual worked in. I define a small firm as the one with fewer than 25 employees. The only constraint is that information about the size of the previous employer is available only for the 1993-1995 period. Thus, only the 1993-1995 data is used to control for firm size.

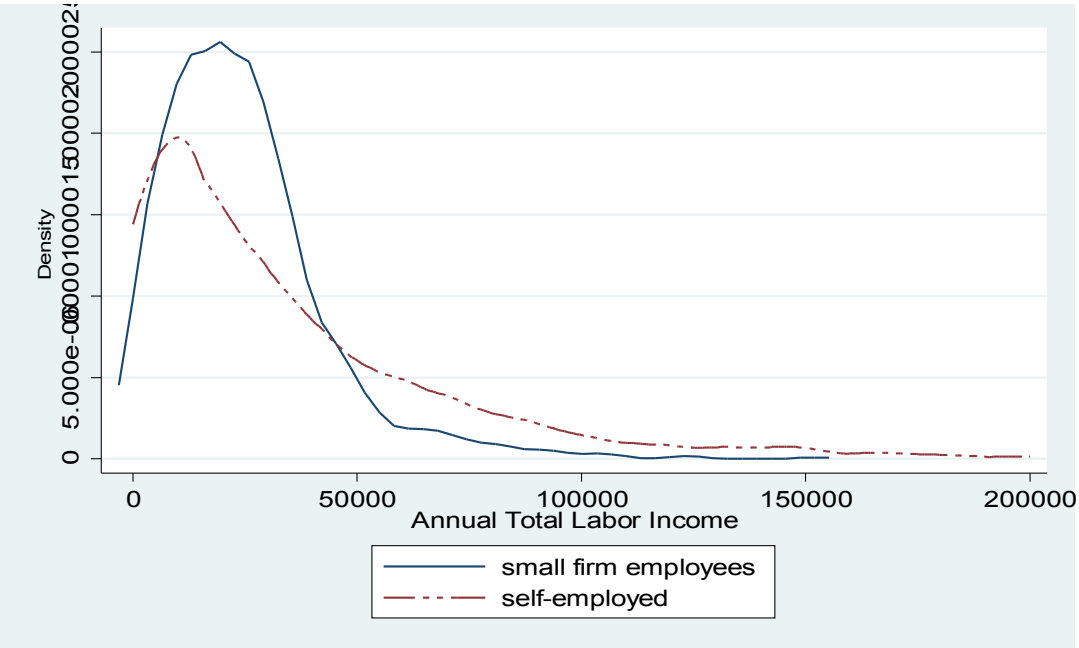

Figure-5: Distributions of annual total labor income for small firms employees and self-employed individuals

Total labor incomes of small firm employees and self-employed people are not the same. Figure-5 plots their distributions. Summary statistics of annual total labor incomes for small-firm employees, large firm employees, and self-employed individuals are given in Table 4. Figure 5 and Table 4 indicate that mean income of small-firm employees is less than that of self-employed people, while the variance of incomes for self-employed individuals is larger than that for small-firm employees. Incomes of self-employed individuals are lower than those of wage-earners only at the 25th percentile. When we compare incomes of three groups presented in Table 4, we observe that large firm employees earner more than small firm employees, whereas they earn less than self-employed individuals. Incomes of small firm employees are greater than those of large firm workers only at the 25th percentile.

I use year-pairs in my logistic regressions because my aim is to estimate the probability of entry into self-employment from paid-work in the second year by considering individual characteristics and conditions given in the first year. Three main forms of my logistic regressions are given in equations (2), (3), and (4). The dependent variable in each specification is equal to one if person-i is self-employed in the current year and zero otherwise given that he/she was a wage-earner in the previous year. Analogous to specification (1), X_i and $Y_{i,t}$ are two vectors used to test the impacts of individual characteristics on the likelihood of entry into self-employment in all regressions. While the vector X_i represents a set of time-invariant individual characteristics, the vector $Y_{i,t}$ represents a set of time-variant individual characteristics of

person-i in year-t.

$$PR(SEL_{i,t+1} = 1 \mid SEL_{i,t} = 0) = \beta_0 + \beta_1 X_i + \beta_2 Y_{i,t} + \beta_3 LU_{i,t} + \varepsilon_{i,t+1} \quad (2)$$

where $LU_{i,t.}$ is a vector consisting of the unemployment rate in year-t of the state of residence of individual-i, and interactions[4] of the unemployment rate with ability. The effect of firm size is tested with the specification

$$PR(SEL_{i,t+1} = 1 \mid SEL_{i,t} = 0) = \theta_0 + \theta_1 X_i + \theta_2 Y_{i,t} + \theta_3 SF_{i,t} + \varepsilon_{i,t+1} \quad (3)$$

where $SF_{i,t}$ is a vector consisting of a dummy equal to one if the employer in period-t had lower than 25 employees, and again an interaction with ability. Finally, I simultaneously control for unemployment and firm size with the following specification.

$$PR(SEL_{i,t+1} = 1 \mid SEL_{i,t} = 0) = \gamma_0 + \gamma_1 X_i + \gamma_2 Y_{i,t} + \gamma_3 L_{i,t} + \gamma_4 S_{i,t} + \varepsilon_{i,t+1} \quad (4)$$

The variables $L_{i,t}$ and $S_{i,t}$ represent U.S local unemployment rates and prior employer's size. This regression is run for each ability group separately, so there are no interaction terms.

4 Interaction terms are used in the regressions as described in Chunrong and Norton (2003).

Results

The tables in this section exhibit results for the critical explanatory variables. Estimates for occupation, industry, and state of residence variables are not reported because they are not the main concern of this chapter. Estimated marginal effects for the first two logistic regressions are given in Table 5 for 1978-1983, and in Table 6 for 1993-1995.

Table 5 provides logistic regression results for the period 1978-1983. Both regressions include age, gender, education, and work experience as independent variables. Results are very similar for these variables in both models. Age and education are positively correlated with probability of becoming self-employed, while men are more likely to become self-employed than women. There is also a positive correlation between work experience and the probability of entering self-employment, but this correlation is statistically insignificant.

The table also provides evidence about the effect of local unemployment rates on the likelihood of entrepreneurship. Column (1) indicates that local unemployment rates and the probability of entry into self-employment are positively correlated. Moreover, a high local unemployment rate is a strong significant predictor of entrepreneurship.

Table 5 : Probability of Becoming Self-Employed, 1978-1983; (Marginal Effects)

Dependent variable = 1 if self-employed in current year, 0 otherwise.		
	(1)	**(2)**
Age	0.0005** (0.0002)	0.0003* (0.0002)
Gender	0.0302*** (0.0037)	0.0297*** (0.0034)
Education	0.0010** (0.0004)	0.0011*** (0.0004)
Work Experience	0.0001 (0.0002)	0.0001 (0.0002)
Local Unemployment Rates	0.0031*** (0.0008)	- 0.0001 (0.0013)
A1	----	0.0459*** (0.0110)
A2	----	0.0091 (0.0119)
A3	----	- 0.0084 (0.0122)
A4	----	Dropped
A5	----	0.0586*** (0.0127)
Local Unemployment Rates-A1	----	0.0025* (0.0013)
Local Unemployment Rates-A2	----	0.0041*** (0.0014)
Local Unemployment Rates-A3	----	0.0052*** (0.0015)
Local Unemployment Rates- A4	----	0.0049*** (0.0016)
Local Unemployment Rates-A5	----	Dropped
Pseudo R^2	0.0838	0.1070
Observations	22,848	22,848

Standard Errors are reported in parentheses.

***Significant at 1 % level; **Significant at 5 % level; *Significant at 10 % level

Column (2) displays results from a deeper examination of the local unemployment effect after considering five ability groups. Consistent with earlier literature, I find a statistically significant positive correlation between local unemployment rates and the probability of becoming self-employed for people at the lower end of the skill distribution. In fact, the correlation between local unemployment rates and the likelihood of being an entrepreneur is positive and statistically significant for individuals in all ability groups except A5. In other words, high local unemployment rates are strong predictors of entry into entrepreneurship for all but the most able individuals.

Consistent with the literature, I was expecting a negative correlation between local unemployment rates and the probability of entry into self-employment for workers at highest end of the skill distribution. Surprisingly, the estimates reveal no correlation between them in A5.

Table 6 repeats results from the second sample. The effects of age, gender, education, and work experience are similar to those found in the first sample.[5] Column (1) of Table 6 shows that local unemployment rates have a positive, but statically insignificant, influence on the transition of workers into self-employment. Estimates for interaction terms between local unemployment rates and the five ability groups are similar for the two samples, except for A4 and A5.

5 Education and work experience are both positively correlated with the probability of self-employment. Estimates for them are statistically significant. Males are more likely to be self-employed than females but, the estimate is statistically insignificant.

Table 6 : Probability of Becoming Self-Employed, 1993-1995; (Marginal Effects)

Dependent variable = 1 if self-employed in current year, 0 otherwise.		
	(1)	**(2)**
Age	- 0.0005 (0.0004)	- 0.0009*** (0.0003)
Gender	0.0071 (0.0064)	0.0063 (0.005)
Education	0.0040*** (0.0012)	0.0028*** (0.0009)
Work Experience	0.0011** (0.0005)	0.0008** (0.0003)
Local Unemployment Rates	0.0007 (0.0076)	- 0.0051 (0.0063)
A1	----	Dropped
A2	----	0.0045 (0.0341)
A3	----	0.0038 (0.0292)
A4	----	0.0354 (0.0299)
A5	----	0.0260 (0.0279)
Local Unemployment Rates-A1	----	0.0050 (0.0043)
Local Unemployment Rates-A2	----	0.0006 (0.0053)
Local Unemployment Rates-A3	----	0.0031 (0.0046)
Local Unemployment Rates-A4	----	Dropped
Local Unemployment Rates-A5	----	- 0.0005 (0.0044)
Pseudo R^2	0.0804	0.0782
Observations	4,187	5,375

Standard Errors are reported in parentheses. ***Significant at 1 % level; **Significant at 5 % level *Significant at 10 % level

That is, lower-ability individuals in A1, A2, and A3 are more likely to be self-employed when local unemployment rates are high. However, the point estimates ones for the second sample are statistically insignificant. There is no correlation between local unemployment rates and the probability of self-employment for individuals in A4, suggesting that this group is not affected by local unemployment in their entrepreneurial decisions. Also contrary to the first sample, local unemployment rates and the probability of transition into self-employment are negatively correlated for people in A5, although these results are insignificant.

The insignificant results in the second sample may be the result of its smaller size. Because, the first sample has six years of data, while the second sample has only has only two years. I reduce demands on data in the second sample by dividing individuals into just two ability groups: L. Group and H. Group. L. Group includes individuals having ability levels up to the 90th percentile of the skill distribution, while H. Group includes individuals in the top 10 percent. Table 7 reports outcomes of the same analysis done before by using these two new ability groups. Unfortunately, this combination of ability groups did not alter the results; There was no statistically significant result.

Table 7 : Probability of Becoming Self-Employed, 1993-1995 (Marginal Effects)

Dependent variable = 1 if self-employed in current year, 0 otherwise.		
	(1)	**(2)**
Age	- 0.0005 (0.0004)	- 0.0009*** (0.0003)
Gender	0.0071 (0.0064)	0.0055 (0.0052)
Education	0.0040*** (0.0012)	0.0030*** (0.0009)
Work Experience	0.0011** (0.0005)	0.0009** (0.0003)
Local Unemployment Rates	0.0007 (0.0076)	- 0.0063 (0.0065)
L.Group (bottom 90%)	----	Dropped
H.Group (top 10%)	----	0.0166 (0.0244)
Local Unemployment Rates-L.Group	----	0.0034 (0.0034)
Local Unemployment Rates-H.Group	----	Dropped
Pseudo R^2	0.0804	0.0657
Observations	4,187	5,375

Standard Errors are reported in parentheses.
***Significant at 1 % level; **Significant at 5 % level; *Significant at 10 % level

The results suggest that local unemployment influences transitions of low-ability individuals into self-employment but has no impact on the most able people. These results may change if firm size is also controlled for in the regressions. Because Elfenbeim, Hamilton, and Zenger (2008) indicate that size of the prior employer also affects self-employment transitions of wage-earners significantly. They show that prior employment in small firms increases the likelihood of self-employment relative to prior

employment in larger firms. In particular, this implication is valid for workers having positions at the lower and the upper tails of the skill distribution. In addition, it is known that employment volatility is inversely related to firm size (Davis and Haltiwanger, 1992; Davis et al., 1996; Rob, 1995; Shaffer, 2006). As shown by Parker (2004) and Robbins, Pantuosco, Parker, and Fuller (2000), large numbers of new jobs are created by small firms[6]. However, these jobs tend to be less permanent than those created by large firms (Davis and Haltiwanger, 1992; Davis et al., 1996; Rob, 1995). Moreover, we also know that employer size and wage rates are positively correlated. That is, individuals having higher residual earnings work for large firms (Abowd et al., 1999; Brown and Medoff, 1989; Acs, 1999). Namely, high-ability people are working for large firms rather than small firms. Consequently, we can infer that low-ability workers are hired by local small firms. Thus, low-ability individuals who are affected significantly from high local unemployment in their self-employment transitions are also more likely to be employees of small firms. Therefore, the observed positive correlation between local unemployment rates and the likelihood of entrepreneurship for low-skilled workers may be the result of a small firm effect.

The possibility of small-firm effect leads me to check the robustness of my results by controlling for firm size. To do so, I first analyze the role of prior employment in small firms in self-employment transitions of wage-earners at various skill levels (Table 8).

6 In fact, their contributions to job creation are greater than those of large firms (Davis and Haltiwanger, 1992).

Table 8 : Probability of Becoming Self-Employed, 1993-1995; (Marginal Effects)

Dependent variable = 1 if self-employed in current year, 0 otherwise.		
	(1)	**(2)**
Age	- 0.0009*** (0.0003)	- 0.0005 (0.0003)
Gender	0.0051 (0.0051)	0.0081 (0.0055)
Education	0.0031*** (0.0009)	0.0036*** (0.0010)
Work Experience	0.0009** (0.0003)	0.0009** (0.0004)
Small-Firm	0.0175*** (0.00473)	- 0.0146 (0.0157)
A1	----	- 0.0177 (0.0109)
A2	----	- 0.0544*** (0.0116)
A3	----	- 0.0138* (0.0082)
A4	----	0.0005 (0.0078)
A5	----	Dropped
Small Firm Employees in A1	----	0.0399** (0.0173)
Small Firm Employees in A2	----	0.0657*** (0.0188)
Small Firm Employees in A3	----	0.0241 (0.0178)
Small Firm Employees in A4	----	0.0074 (0.0185)
Small Firm Employees in A5	----	Dropped
Pseudo R^2	0.0722	0.1152
Observations	5,375	4,187

Standard Errors are reported in parentheses. ***Significant at 1 % level; **Significant at 5 % level; *Significant at 10 % level

Then, I test both the local unemployment effect and the small firm effect simultaneously for each ability group (Table 9). Only one sample, 1993-1995, is used for this analysis.

Effects of personal characteristics like age, gender, education, and work experience are again controlled for in the logistic regressions presented in Table 8.[7] The dummy variable "Small-Firm" identifies prior employment in small firms. The estimate associated with this variable indicates that prior employees of small firms are, on average, more likely to be self-employed. My results are consistent with the findings of Elfenbeim, Hamilton, and Zenger (2008).

To analyze the "small firm" effect in more detail, I add in column (2) of Table 8 interaction terms that allow for separate small firm effects in each ability group. Employees of small firms in A1 and A2 are more likely to be entrepreneurs. Moreover, the associated marginal effects are statistically significant at the 5% and 1% levels for individuals in A1 and A2, respectively. Evidently, prior employment in small firms is a strong predictor of self-employment for individuals in lower ability groups. Although workers in A3 and A4 show the same positive correlation between the probability of entering self-employment and employment in small firms, the coefficients are all

7 Estimates are statistically significant for age, education level, and work experience but insignificant for gender. While education and work experience are positively correlated with the likelihood of self-employment, age is negatively correlated. That is, more work experience and high education level are significant predictors of entrepreneurship.

statistically insignificant.

Table 9 : Probability of Becoming Self-Employed, 1993-1995; (Marginal Effects)

Dependent variable = 1 if self-employed in current year, 0 otherwise.						
		Sub-samples by Ability Groups				
	Full Sample	A1	A2	A3	A4	A
Age	- 0.0004 (0.0004)	- 0.0006 (0.0013)	0.0006 (0.0005)	- 0.0032** (0.0012)	- 0.0003 (0.0014)	- 0.0013*** (0.0004)
Gender	0.0059 (0.0063)	0.0052 (0.0193)	- 0.0015 (0.0090)	- 0.0013 (0.0150)	0.0462** (0.0234)	0.0149* (0.0089)
Education	0.0040*** (0.0012)	0.0076* (0.0041)	0.0019 (0.0020)	0.0065** (0.0032)	0.0035 (0.0036)	0.0019 (0.0014)
Work Experience	0.0010** (0.0005)	0.0004 (0.0016)	- 0.0008 (0.0006)	0.0048*** (0.0014)	0.0014 (0.0015)	0.0005 (0.0005)
Small Firm	0.0174*** (0.0052)	0.0333** (0.0155)	0.0296*** (0.0104)	0.0111 (0.0129)	- 0.0114 (0.0169)	0.0157 (0.0179)
Unemp. Rate	0.0017 (0.0074)	0.0004 (0.0097)	- 0.0038 (0.0037)	- 0.0138** (0.0067)	- 0.0253*** (0.0096)	- 0.0134*** (0.0043)
Pseudo R^2	0.0877	0.1309	0.2636	0.1780	0.2357	0.1526
Observations .	4,187	723	563	715	451	1,108

Standard Errors are reported in parentheses.
***Significant at 1 % level; **Significant at 5 % level; *Significant at 10 % level

Entry into self-employment does not depend on prior employment in local small firms in the A5. The result contrasts with the findings of Elfenbeim, Hamilton, and Zenger (2008) who found that those entering into self-employment from small firms are drawn from both the upper and the lower tails of the skill distribution, and the association is much stronger for those from the upper tail of the distribution.

My findings, however, indicate that those entering into self-employment from small firms are drawn from the lower tail of the skill distribution, and the association is stronger for individuals in A2 than the ones in A1.

A logistic regression model is run for each ability group separately. Explanatory variables representing personal characteristics, prior employment in small firms, and local unemployment rates are included. The associated estimates are displayed in Table 9. [8] Since I control for both local unemployment and small firm effects for each ability group in the last analysis, I can observe relative strengths of these effects at each ability level.

8 Estimates imply that education and work experience are positively correlated with the probability of being self-employed for all individuals from all ability levels. Both high level of education and more work experience are statistically significant predictors of self-employment however significance level of education is greater than that of work experience. Males are more likely to be self-employed than females at all ability levels. Estimates for gender are statistically significant only for individuals in A4 and A5. While high education level is a significant predictor of self-employment for workers in A1 and A3, more work experience is a significant predictors of self-employment only for those in A3. Only significant estimates for age are the ones for people in A3 and A5. These two results show negative correlations between age and probability of entry into entrepreneurship. That is, individuals in A3 and A5 are more likely to be self-employed when they are younger.

Column (1) uses the full sample. Small firm employment raises the likelihood of transition into self-employment. The estimated marginal effect is statistically significant at the 1% level. Therefore, it can be inferred that prior employment in small firms is a strong predictor of self-employment. Local unemployment has no significant effect on the probability of entry into self-employment. These results hold for sub-samples A1 and A2 as indicated by columns (2) and (3). This indicates that local unemployment is not a condition forcing low-ability workers into necessity entrepreneurship. The small firm effect is much stronger for them. Thus, it can be said that previously observed positive correlations between local unemployment rates and probability of being self-employed for low-skilled individuals are mostly due to the small firm effect.

On the other hand, prior employment in small firms has no influence on the likelihood of self-employment for workers in A3, A4, and A5. That is, there is no small firm effect for high-ability people constituting the upper 50 % of the skill distribution. However, these highly-skilled individuals are less likely to be entrepreneurs when local unemployment rates are high. In other words, opportunity entrepreneurship is affected negatively by high local unemployment. Associated significance levels, 5 % for A3 and 1 % for other two groups, point out that these results are strong although sample size is moderate. In fact, it is the strongest for the top 25 % of the skill distribution. Since it is consistent with the literature, this outcome is as expected. It suggests that opportunity entrepreneurs postpone or cancel their self-employment plans when there are high

unemployment rates.

Conclusion

This chapter presents results obtained after investigating the existence of a local unemployment effect on entry into self-employment. Initially, I showed that the probability of entry into self-employment is increasing in the local unemployment rate. Moreover, the correlation between local unemployment rates and the probability of entry into self-employment was found to be positive for all but the top 10 % of the skill distribution. For the top 10 % of the skill distribution, there is no correlation between them. These results for low-ability workers are consistent with the theory of necessity entrepreneurship. The literature indicates that individuals with lower ability levels become necessity entrepreneurs because they are forced into entrepreneurship by some external factors. From the estimates presented in this chapter, high local unemployment appears to be one of these external factors. The literature suggests that high-ability people are more likely to be opportunity entrepreneurs, and I conjectured that they could be discouraged by high local unemployment. The initial results provided no support for this conjecture. However, the initial results may be confounded by the absence of a control for firm size.

Low-ability individuals are more likely to be employees of small firms, prior employment in small firms increases the likelihood of entrepreneurship, and small firms are more sensitive to the economic fluctuations that cause changes in unemployment

rates. Therefore, the observed positive correlation between local unemployment rates and the probability of self-employment for low-skilled workers may be due to a small firm effect. In order to explore this possibility, I checked the robustness of my results by controlling for employment in small firms. Analysis of the small firm effect shows that prior employment in small firms, on average, increases the probability of entry into self-employment. This inference is consistent with the literature. When this effect is tested by considering different skill levels of people, it is observed that prior employment in small firms is positively correlated with the likelihood of self-employment for workers in the first four ability groups, although estimates for A3 and A4 are statistically insignificant. For high-ability individuals, however, there is no correlation between the probability of self-employment and employment in small firms. Thus, my findings are consistent with the earlier literature only for low-skilled workers.

Last, I test the local unemployment effect and small firm effect simultaneously for each ability group. The results are highly significant despite the moderate sample size. While prior employment in small firms increases the likelihood of self-employment significantly, local unemployment rates have almost no effect for low-ability workers in A1 and A2. This means that high unemployment is not one of the factors forcing these low-skilled workers into necessity entrepreneurship. The small firm effect has a greater impact on their self-employment transitions than local unemployment effect. In contrast, these results are not valid for more skilled individuals in A3, A4 and A5. The estimates show that prior employment in small firms has no influence on the probability of

becoming self-employed for them. Instead, their likelihood of entrepreneurship is affected significantly by high local unemployment. Moreover, it is consistent with the literature that this impact is negative. Thus, high-ability workers in A3, A4, and A5 are less likely to be self-employed when local unemployment rates are high. That is, opportunity entrepreneurship is reduced by high unemployment.

III. CHAPTER 2 : ORGANIZATIONAL CAPITAL AND BARRIERS TO FIRM FORMATION

Introduction

This chapter investigates how organizational capital constitutes a barrier to firm formation by individuals at different skill levels over time. As indicated in the literature, entrepreneurial behaviors of people having distinct ability levels are not the same. In particular, individuals at the lower and upper ends of the skill distribution are more likely to be self-employed Elfenbeim, Hamilton, and Zenger,(2008). This means that these low- and high-ability people are the ones who establish firms that are crucial for the economy. Therefore, analyzing factors that cause changes in the occupational decisions over time, and that affect firm formation activities of individuals from various ability groups is an important topic to study.

In this section, organizational capital refers to human capital and physical capital. As indicated by Brynjolfsson, Hitt, and Yang (2002), production requires not only such traditional factors as capital and labor but also skills, organizational structures and processes, culture, and other factors collectively referred to “intangible assets”. These intangible assets are often large in magnitude and have important productivity benefits. In addition, Hubbard and O'Brien (2009) define human capital as the accumulated training and skills that workers possess. Therefore, estimated personal ability or skill level of individuals which is also within the intangible assets is taken as human capital in this

chapter. The amount of organizational capital required for firm formation depends on the type of industry which will be chosen for the new firm. In other words, whether the industry is an ability-intensive industry or a capital-intensive industry is an important criteria for a potential entrepreneur to consider while founding a firm[9]. A capital-intensive industry refers to an industry requiring substantial amount of investments in capital assets, and consequently requires more liquidity for the production of goods. An ability-intensive industry, however, is an industry requiring more human capital instead of monetary capital for the production of goods. Since people have different skill levels[10] and different amounts of initial wealth[11], required organizational capital for the new firm could become an entry barrier for them.

In order to explore the role of organizational capital in firm formation, I first construct a model simulating interactions among a representative utility maximizing agent and his/her profit maximizing firm. Second, I analyze testable implications of my model empirically. Both industry types, capital-intensive and ability-intensive, require funds for investment spending in the model. However, the amount of funds necessary for a capital-based firm is greater than funds necessary for an ability-based firm. Moreover, high human capital is also necessary for an ability-based firm. Thus, high skill requirements induce the most able individuals to found firms in an ability-intensive industry. Firm formation by individuals in distinct places of the skill distribution depend

9 Bates (1990) indicates the importance of human capital as an input in entrepreneurial activities.
10 As indicated by Jovanovic (1994), personal skills affect firm formation activities of individuals.
11 Lack of high initial wealth constitutes a liquidity constraint for people in my study. As implied by Jovanovic and Evans (1989), liquidity constraint affects entrepreneurial choice.

on their initial wealth and saving behavior. That is, if they have high initial wealth, and if the monetary return from a capital-intensive industry is greater than those from an ability-intensive industry and paid-work, then they prefer to found firms in a capital-intensive industry when young. Another option of self-employment for young individuals who do not have high initial wealth but enough liquidity is to form a firm in an ability-intensive industry if their skill levels allow. If the monetary return from an ability-intensive industry is greater than those from a capital-intensive industry and paid-work, then they found new ventures in an ability-intensive industry in the first period of their life even though their initial wealth are limited. Otherwise, they stay at their current jobs and save to accumulate the required funds for investment in a capital-intensive or an ability-intensive industry. These people establish their own firms in the second period of their life by using their savings.

In order to analyze the testable predictions of my theoretical model, observations on a sample of individuals in the PSID are used. A panel is constructed for the period 2003-2007. This time period is selected for the sample because it includes all information needed for the analysis.

A significant empirical challenge is to construct measures of personal ability. For this purpose, I construct an indicator for innate ability from the residuals obtained in a regression of labor earnings on age, gender, education, and work experience (cf. Behrman

and Rosenzweig, 1999). Education is not taken as a part of ability because two people having the same education level can earn different incomes even though they both do identical jobs as a result of their distinct personal abilities. Individuals are placed in four ability groups, denoted by G1 through G4, with G1 representing the lowest ability group. These are not quantiles. Group G1 accounts for the first 25 percent of the observations, G2 accounts for the next thirty five percent, G3 accounts for the next thirty percent, and G5 represents the highest ten percent.

Mixed empirical results about the predictions of the model are observed. That is, high-ability individuals in G4 have the greatest monetary return from their personal ability levels if they found ability-based firms whereas, they have the least monetary return if they become paid-employees. Thus, more personal ability makes them more likely to establish ability-based firms. In contrast, low-ability individuals in G1 have the greatest monetary return from their personal ability levels if they choose to be paid-employees. In other words, their low personal ability constitutes an entry barrier to an ability-intensive industry. However, it is empirically shown that they are more likely to work as wage-earners than to found their own firms when personal ability level increases. Both industry types require investment spending for firm formation although it is less for an ability-intensive industry. This means that liquidity constrained people face entry barriers in both industries. Therefore, high wealth makes individuals more likely to found capital-based and ability-based firms. Since liquidity constraints faced by young individuals can be removed by using savings when old, entry into both industries is

predicted to increase with age. Empirical results indicate that entry into an ability-intensive industry often happens later in life. This result is valid especially for individuals in G1 and G2. Entry into a capital-intensive industry is also more likely to happen later in life for individuals in G1, but not for those in G3 and G4.

This chapter is organized as follows: Section 2 presents theoretical model, section 3 exhibits testable implications of the model, section 4 shows empirical analysis, and the last section offers some concluding remarks.

The Model

The Environment:

I consider an agent that lives for two periods. The agent has two occupational alternatives during his life. He/She can form his/her own firm or be a paid-worker[12]. If the agent decides to establish a firm, he/she has to choose which industry to enter in order to maximize his/her firm's profit Π which is presented in equation (16). There are two types of industries, capital-intensive and ability-intensive, that can be chosen for the new firm. A capital-intensive industry refers to an industry that needs a substantial amount of investment in capital assets. Therefore, it requires more liquidity for the production of goods. An ability-intensive industry, in contrast, is an industry that needs more human capital than physical capital for the production. Since the agent chooses the industry that

12 That is, this representative agent can supply his labor either by as a worker or as an entrepreneur [Kihlstrom and Laffont (1979)].

yields maximum earning for his own firm, profit of his firm becomes earning function of the industry chosen for the firm as shown in the Firm's Problem section. Production in both industries depends on a time-invariant heterogeneous personal ability level, A, which raises entrepreneurial earning f. Their earning functions have the same general form as follows:

$$f_i^j = k_i^j + A\gamma_i^j \tag{5}$$

where

$$i = \begin{Bmatrix} 1 & if & \text{industry type is a capital-intensive industry} \\ 2 & if & \text{industry type is an ability-intensive industry} \end{Bmatrix}$$

$$j = \begin{Bmatrix} 1 & if & \text{current period is the first period} \\ 2 & if & \text{current period is the second period} \end{Bmatrix}$$

In equation (5), γ_i^j and k_i^j denote the marginal product of personal ability and the amount of capital required for industry-i in period-j, respectively.

Assumption 1 : $k_1^j > k_2^j > 0$. That is, both capital-intensive and ability-intensive industries need positive capital for the production. However, a capital-intensive industry requires more capital investment than an ability-intensive industry.

The capital necessary for industry-i is a fixed cost of establishing a firm in industry-i. Therefore, it constitutes an entry condition for that particular industry.

Assumption 2 : $0 < \gamma_1^j < \gamma_2^j$. The marginal product of personal ability is greater for an ability-intensive industry than that for a capital-intensive industry.

If the agent chooses to be a paid-employee, he earns a wage given by equation (6).

$$W = W_0 + A\gamma \tag{6}$$

where W_0 is the base wage, and γ is the marginal contribution of personal ability to the wage. The wage is composed of two parts. The first part is the base wage which is set according to personal characteristics like age, gender, education, and work experience. The second part is directly proportional to the employee's personal ability level A.

Assumption 3 : $\gamma < \gamma_1^j < \gamma_2^j$. That is, the marginal contribution of personal ability level to the wage is less than marginal contributions of personal ability level to entrepreneurial earnings.

Analysis of the Environment:

Graphs of the wage and two production functions are presented in Figure-6. In this figure, k_1^j represents physical capital investment necessary for a capital-intensive industry in period-j whereas, k_2^j represents physical capital investment necessary for an ability-intensive industry in period-j.

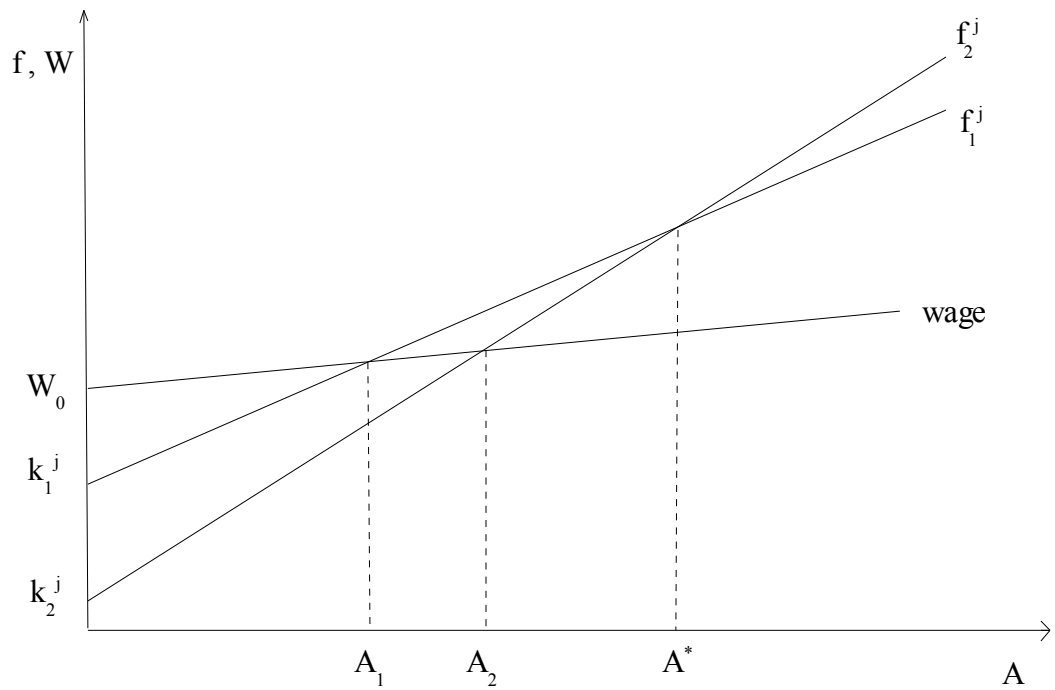

Figure-6: Production functions of two industry types and wage

The variable A^*, given in equation (7), is the critical personal ability level at which two industry types yield the same entrepreneurial earnings after firm formation. It is given by

$$A^* = \frac{k_1^j - k_2^j}{\gamma_2^j - \gamma_1^j} \tag{7}$$

Individuals with personal ability level greater than A^* are classified as high-ability individuals in this chapter. Since A^* is the ability level at which having a capital-based

firm and having an ability-based firm yield identical incomes, future entrepreneurs are indifferent between the two industry alternatives at this point. It is more profitable to have a venture in an ability-intensive industry for people whose personal ability levels are greater than A^* as indicated by Figure-1. The high ability level requirement of an ability-based firm does not constitute a barrier for them because they are already high-ability individuals. This result for high-ability people is presented in Result 1.

Result 1 : $f_2^j > f_1^j$ when $A > A^*$. That is, having a firm in an ability-intensive industry brings greater monetary return than having a firm in a capital-intensive industry for high-ability people whose personal ability levels are greater than A^*.

The model implies that having a capital-based firm is more profitable for people whose personal ability levels are less than A^*. Since these individuals do not have the high human capital necessary for an ability-based firm, they are constrained by the required high ability level. Therefore, setting up a capital-based firm brings more earning for them. Result 2 presents this result.

Result 2 : $f_2^j < f_1^j$ when $A < A^*$. That is, having a firm in a capital-intensive industry brings greater entrepreneurial income than having a firm in an ability-intensive industry for people having personal ability levels less than A^*.

There are two more break-even personal ability levels as A_1 and A_2. A_1 represents a personal ability level at which wage and earning from a capital-intensive firm are equal after the firm is formed. Similarly, A_2 shows a personal ability level at which the wage and earnings from an ability-intensive firm are same after firm formation. They are as follows:

$$A_1 = \frac{W_0 - k_1^j}{\gamma_1^j - \gamma} \quad \text{and} \quad A_2 = \frac{W_0 - k_2^j}{\gamma_2^j - \gamma} \tag{8}$$

Result 3 : $A_2 > A_1$. That is, cut-off personal ability level between wage and earning from an ability-based firm is greater than cut-off personal ability level between wage and earning from a capital-based firm.

People having personal ability levels less than A_1 are classified to be low-ability individuals in this chapter. Since A_1 is the ability level at which wage and earning from a capital-based firm are the same, people are indifferent between being paid-employees and having firms in a capital-intensive industry at this ability level. However, their decisions change along with the positions of their personal ability levels with respect to A_1. That is, they prefer to have capital-based firms if their personal ability levels are greater than A_1. Since being a firm-owner in a capital-intensive industry yields higher income than being a paid-employee for them, they enter into a capital-intensive industry by founding firms.

This means that having personal ability level less than A_1 constitutes an entry barrier to a capital-intensive industry. In other words, it is not profitable to set up a capital-based firm for the ones whose positions are at the lowest end of the skill distribution because of their lower human capital. Result 4 states this result.

Result 4 : $f_1^j > W$ when $A > A_1$. That is, being a firm-owner in a capital-intensive industry brings greater monetary return than being a paid-employee for people whose personal ability levels are greater than A_1.

Analogous to A_1, A_2 is the personal ability level at which wage and earning from an ability-based firm are identical. This means that people are indifferent between being paid-employees and having firms in an ability-intensive industry at this ability level. However, they decide to have ability-based firms if their personal ability levels are greater than A_2. Since being firm-owners in an ability-intensive industry yields greater earning than being paid-employees for them, they enter into an ability-intensive industry by setting up new firms. This means that having personal ability level less than A_2 constitutes an entry barrier for an ability-intensive industry. This outcome can be seen in Result 5.

Result 5 : $f_2^j > W$ when $A > A_2$. That is, being a firm-owner in an ability-intensive industry brings greater earning than being a paid-employee for people whose personal

ability levels are greater than A_2.

The three critical ability levels, A_1, A_2, and A^*, divide individuals into four ability groups for which the best occupational choices are different. As described earlier, people whose personal ability levels are greater than A^* are classified as high-ability individuals whereas, others whose personal ability levels are less than A_1 are classified as low-ability individuals. Being a paid-employee is the best way of earning more income. Consequently it is the best occupational choice for low-ability people. On the other hand, since having a firm in an ability-intensive industry is the way to earn the greatest income for high-ability individuals, it is the best occupational alternative for them. Results 6 and 7 state these results for low-ability and high-ability individuals, respectively.

Result 6 : $W > f_1^j > f_2^j$ when $A_1 > A$. That is, being a paid-employee brings the greatest monetary return for low-ability people whose personal ability levels are less than A_1.

Result 7 : $f_2^j > f_1^j > W$ when $A > A^* > A_2 > A_1$. That is, having a firm in an ability-intensive industry brings the greatest income for high-ability people whose personal ability levels are greater than A^*.

Having a firm in a capital-intensive industry is the way to earn the highest income for the two groups of people with personal ability levels between A_1 and A^*. However, since

capital-intensive industry requires more spending for physical investment, their occupational choices depend on the amounts of their initial wealth. Results 8 and 9 present results for these two ability groups.

Result 8 : $f_1^j > f_2^j > W$ when $A^* > A > A_2 > A_1$. That is, having a firm in a capital-intensive industry brings the greatest monetary return for people having personal ability levels between A_2 and A^*.

Result 9 : $f_1^j > W > f_2^j$ when $A_2 > A > A_1$. That is, having a firm in a capital-intensive industry brings the greatest earning for people having personal ability levels between A_2 and A_1.

Household's Problem:

The agent lives for two periods. He is born with one unit of labor time. As it can be seen from the objective function, he gets utility from both first-period and second-period consumptions C_1 and C_2. He makes a consumption-saving decision in the first period. That is, he saves some portion of his first period income M_1 whereas, he consumes all of his second period income M_2 as indicated by two budget constraints (10) and (11).

$$Max\, U = \ln(C_1) + \beta\ \ln(C_2) \tag{9}$$

subject to

$$C_1 + S = M_1 \tag{10}$$

$$C_2 = M_2 \tag{11}$$

where

$$M_1 = Max\{\Pi_i^1 + \theta - k_i^1, W + \theta\} \tag{12}$$

$$M_2 = \left\{ \begin{array}{lll} \Pi_1^2 + (1+r)(\theta + S - k_1^1) & if & \text{A Capital-Based Firm-Owner in the First Period} \\ \Pi_2^2 + (1+r)(\theta + S - k_2^1) & if & \text{An Ability-Based Firm-Owner in the First Period} \\ Max\{\Pi_i^2 + (1+r)(\theta + S - k_i^2), W + (1+r)(\theta + S)\} & if & \text{Wage-Earner in the First Period} \end{array} \right\} \tag{13}$$

where θ, S, and r denote initial wealth, saving, and interest rate. There is no borrowing.

Assumption 4 : Initial wealth, θ, is positive at the beginning of the first period.

The agent's incomes in the first and the second periods depend on the decision of setting up a firm or staying as a wage-earner. That is, if he owns a firm, his income will mainly be the profit, Π, of his firm. Profit of his firm depends on the selected industry as shown by equation (20). However, if he works as a paid-employee, his income will mainly be his wage. The decision to found a firm means spending some part of initial wealth for investment. The amount of investment required depends on the industry chosen for the new venture. A capital-intensive industry requires more physical investment,

while an ability-intensive industry requires less physical investment. Thus, the amount of initial wealth must be high enough for the chosen industry.

Assumption 5 : There is no perfect foresight in the model. In other words, the agent does not see or predict the second period cases. Occupational decisions are made at the beginnings of the first and the second periods.

The decision to found a firm or stay in the current job is made by the household at the beginning of each period. In particular, if the household founds his own firm at the beginning of the first period, his first period income will be profit of his firm plus part of his initial wealth left after paying for investment. However, if he decides to stay in his current paid-work, his income will be his wage plus his initial wealth. As shown by equation (12), self-employment decision therefore the first period income level depends on relative magnitudes of entrepreneurial and paid-work earnings. That is, if monetary return from being a firm-owner is greater than that from a paid-work, he founds his own firm. Monetary return from being a firm-owner depends on the industry chosen for the new venture. Earning from an ability-based firm is greater for high-ability individuals even though they have less wealth. On the other hand, monetary return from a capital-based firm is greater for people having lower ability but more wealth.

Assumption 6 : If the agent decides to found a firm in one of the industry types in his first period of life, he continues operating the same firm in the second period. In other

words, there is no switch from one industry to the other industry while becoming self-employed.

As implied by equation (13), the second period income of the agent depends on his occupational decision made in the first period. That is, if he has his own firm when young, he continues operating the same firm when old. In this case, his total income is his profit plus his total wealth which includes some part of his initial wealth left after investment payment and his saving plus interest earning from his total wealth. However, if he does not have his own firm in the first period, he can found it or can stay as a wage-earner in the second period. Since he is old now and worked when young, he has savings that increased his total wealth. That is, if he could not establish his own firm because of limited liquidity when young, he has an opportunity to found it now when old. The decision about up his own firm in the second period also depends on the magnitudes of monetary returns from self-employment and paid-work. If his total income from staying as a wage-earner is greater, then he chooses to continue as an employee. But, if the return from having a firm is greater, he has to decide which industry to enter. Since he has more funds now, he has an opportunity to remove the barriers to founding a firm in a capital-intensive or in an ability-intensive industry. However if he wants his new firm to be in an ability-intensive industry, he has to consider his own ability level in addition to his wealth. That is, his personal ability level can constitute another entry barrier to an ability-intensive-industry. If he has lower personal ability, founding his own firm in a capital-intensive industry brings more monetary return. But, if he is a high-ability person

meaning that he also has high human capital necessary for an ability-based firm, he can choose either the capital-intensive or the ability-intensive industry for the new firm. When the household's problem is solved for C_1, S, and C_2, as shown by Appendix-III, the following results are obtained.

$$C_1 = \left(\frac{1}{1+\beta}\right) M_1 + \left(\frac{1}{(1+\beta)(1+r)}\right) Y_2 \tag{14}$$

$$S = \left(\frac{\beta}{1+\beta}\right) M_1 + \left(\frac{1}{(1+\beta)(1+r)}\right) Y_2 \tag{15}$$

$$C_2 = \left(\frac{\beta(1+r)}{1+\beta}\right) M_1 + \left(\frac{\beta}{1+\beta}\right) Y_2 \tag{16}$$

where

$$M_1 = \left\{ \begin{array}{lll} W+\theta & if & A < A_1 \\ \Pi_1^1 + \theta - k_1^1 & if & A_1 < A < A_2 \ , \ A_2 < A < A^* \ \text{and} \ k_1^1 \leqslant \theta \\ \Pi_2^1 + \theta - k_2^1 & if & A_2 < A < A^* \ \text{and} \ A^* < A \ \text{and} \ k_2^1 \leqslant \theta < k_1^1 \\ W+\theta & if & A_1 < A < A_2 \ \text{and} \ k_1^1 > \theta \\ W+\theta & if & A_2 < A < A^* \ , \ A^* < A \ \text{and} \ k_2^1 > \theta \end{array} \right\} \tag{17}$$

$$Y_2=\begin{cases} W+(1+r)\theta & if \quad A<A_1 \\ \Pi_1^2+(1+r)(\theta-k_1^1) & if \quad A_1<A<A_2 \ , \ A_2<A<A^* \text{ and } k_1^1\leqslant\theta \\ \Pi_2^2+(1+r)(\theta-k_2^1) & if \quad A_2<A<A^* \text{ and } A^*<A \text{ and } k_2^1\leqslant\theta<k_1^1 \\ \Pi_1^2+(1+r)(\theta-k_1^2) & if \quad A_1<A<A_2 \text{ and } k_1^1>\theta \\ \Pi_2^2+(1+r)(\theta-k_2^2) & if \quad A_2<A<A^* \ , \ A^*<A \text{ and } k_2^1>\theta \end{cases} \tag{18}$$

The variables C_1, C_2, and S indicate that the consumption and saving behavior of the agent depends on personal ability and initial wealth. The results for C_1, C_2, and S are calculated in terms of M_1 and Y_2 whose values differ along with personal ability and initial wealth. The variable M_1 denotes the first-period income whereas, Y_2 denotes the second period income without saving. That is, Y_2 includes the wage or profit of the new firm depending on the chosen second-period occupation, and initial wealth or the amount of initial wealth left after investment payment with interest earned from them. However, M_2 given in equation (19) shows total second-period income that also contains saving and interest earning it brings.

$$M_2=\begin{cases} W+(1+r)(\theta+S) & if \quad A<A_1 \ , \ A_2<A<A^* \ , \ A^*<A \ , \ A_1<A<A_2 \text{ and } k_2^2>\theta+S \\ \Pi_1^2+(1+r)(\theta-k_1^1+S) & if \quad A_1<A<A_2 \text{ and } A_2<A<A^* \\ \Pi_2^2+(1+r)(\theta-k_2^1+S) & if \quad A_2<A<A^* \ , \ A^*<A \\ \Pi_1^2+(1+r)(\theta-k_1^2+S) & if \quad A_1<A<A_2 \ , \ A_2<A<A^* \text{ and } \theta+S>k_1^2 \\ \Pi_2^2+(1+r)(\theta-k_2^2+S) & if \quad A_2<A<A^* \ , \ A^*<A \text{ and } k_2^2<\theta+S<k_1^2 \end{cases} \tag{19}$$

Individuals whose personal ability levels are less than A_1 do not change their occupations over time. That is, low-ability people with personal ability levels less than A_1 become wage-earners both in the first and the second periods of their lives. Because, they earn the greatest income by being paid-employees as indicated by Result-6. M_1 shows that low-ability people's income in the first period consists of wage and initial wealth. And their second-period income contains wage, initial wealth, saving, and interest earned from both initial wealth and saving.

Since high-ability individuals whose personal ability levels are greater than A^* have the greatest monetary return from being entrepreneurs in an ability-intensive industry as shown by Result-7, their best choice is to be ability-based firm-owners in both periods of their lives. However, this can be achieved only if initial wealth is greater than k_2^1 which is the capital necessary for ability-based firm formation in the first period. Thus, if they have enough liquidity for an ability-intensive industry, their M_1 includes profit of the ability-based firm and the amount left from initial wealth after investment spending for the new firm. M_2 contains profit of the ability-based firm, amount left from initial wealth after investment spending done in the first period for the new firm, saving, and their interest earnings. If they do not have enough money to create an ability-based firm, they become wage-earners in the first period. After working as paid-employees in the first period, their second-period employment choices depend on their total second-period wealth. Total second-period wealth is composed of initial wealth and saving. If the amount of capital needed for an ability-based firm formation is less than their total

second-period wealth, they become ability-based firm-owners. Therefore, their M_1 is wage plus initial wealth. And their M_2 includes profit of the ability-based firm, amount left from initial wealth and saving after investment spending done in the second period for the new firm, and their interest earnings. On the other hand, if their total second-period wealth is less than k_2^2, they continue working as paid-employees in the second period. In this case, M_1 consists of wage and initial wealth. And M_2 contains wage, initial wealth, saving, and interest earned from both initial wealth and saving.

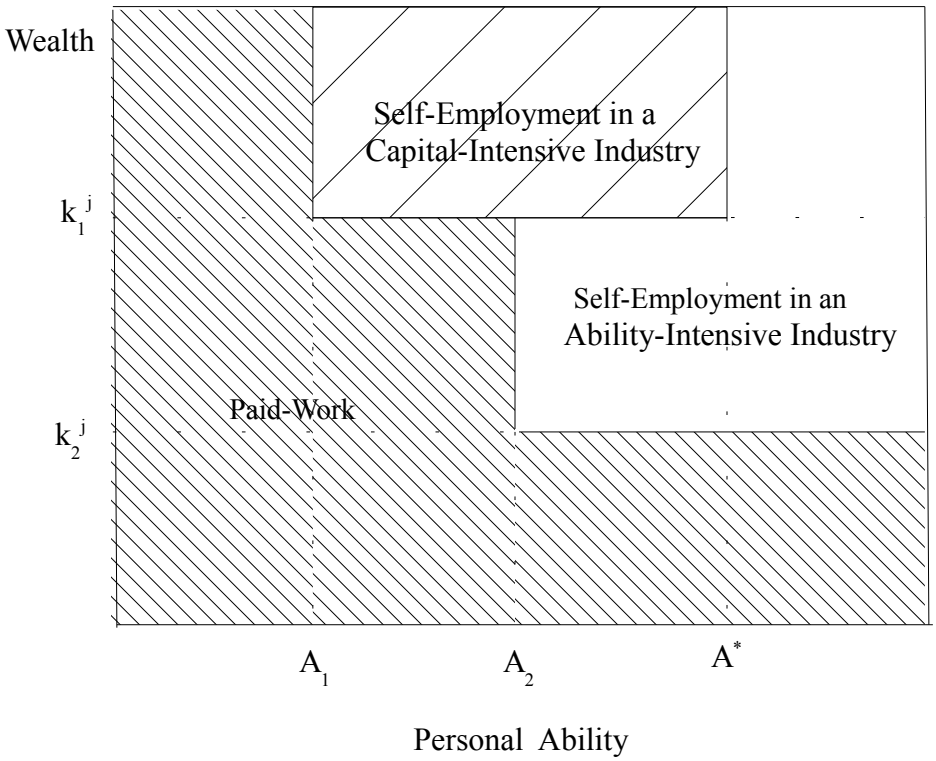

Figure-7: Occupational Choices According to Initial Wealth and Personal Ability

Occupational choices of individuals according to wealth and personal ability are also shown in Figure-7 given above[13]. For people having personal ability levels between A_1 and A_2, there are three optimal solutions. In the first solution, they choose to establish firms in a capital-intensive industry when young and continue operating the same firms when old. They choose to be capital-based firm-owners in both periods of their lives because Result-9 proves that this choice supplies the greatest income for them. M_1 and M_2 have two-period-profits of the capital-based firm and an amount left from initial wealth after investment spending undertaken in the first period together with its interest earning. Saving plus interest is also in M_2. Since a capital-intensive industry requires more investment, a high amount of initial wealth is necessary for this solution. Consequently, liquidity constrained individuals become wage-earners when young, and then they found capital-based firms by using their savings when old in the second solution. They choose to be wage-earners in the first period in this solution because being a wage-earner brings greater monetary return than being an ability-based firm-owner for them as shown by Result-9. Moreover, there is no switch from one industry to the other industry while becoming self-employed as stated in Assumption-6. The first-period income, M_1, for this solution consists of wage and initial wealth. The second-period income, on the other hand, has profit of the capital-based firm plus total wealth which includes an amount of funds left from the initial wealth and saving after investment spending, and interest saving yields. For the second solution to exist, required capital

13 Since occupational decisions are made at the beginnings of the first and second periods, wealth in this figure refers to the amount of funds people have at the beginning of each period. In other words, wealth denotes initial wealth at the beginning of the first period whereas, it denotes initial wealth plus saving at the beginning of the second period.

investment spending for a capital-based firm should be less than saving and initial wealth. Therefore, if this condition does not hold, individuals in this ability interval continue to be paid-employees in the second period. As a result, their M_1 values include wage and initial wealth whereas, their M_2 becomes summation of wage, initial wealth, saving, and interests earned from both initial wealth and saving.

There are five optimal solutions for the last group of people whose personal ability levels are greater than A_2 and less than A^*. They have the same occupations in both periods of their lives in the first and the second solutions. That is, people in this ability interval choose to found capital-based firms when young and continue operating them when old in the first solution. And they set up firms in an ability-intensive industry when young and continue with the same firms when old in the second solution. Not all these individuals choose to set up firms in a capital-intensive industry although Result-8 proofs that it is the most profitable outcome for them. That is, ones with high initial wealth choose to found capital-based firms whereas, others with less wealth but enough liquidity for an ability-intensive industry choose to found ability-based firms. That is, an ability-intensive industry also requires liquidity but it is not as high as the wealth necessary for a capital-intensive industry. Since Assumption-6 states that there is no switch from one industry to the other industry while becoming self-employed, these people whose initial wealth is less for a capital-based firm but enough for an ability-based firm do not choose to form firms in an ability-intensive industry in the first period, and then establish firms in a capital-intensive industry in the second period. In other words, they cannot switch

from an ability-intensive industry to a capital-intensive industry. Moreover, individuals having initial wealth which is not high enough for a capital-intensive industry do not choose to be wage-earners even though they have enough initial wealth for an ability-based firm with the aim of establishing capital-based firms in the second period by using their savings. Because, there is no perfect foresight in the model. In other words, the agent does not see or predict the second-period cases as indicated by Assumption-5. Occupational decisions are made at the beginnings of the first and the second periods without future intentions. M_1 and M_2 of the first solution include two-period-profits of the capital-based firm and amount left from initial wealth after investment spending done in the first period for the new firm. Analogously, M_1 and M_2 of the second solution contain two-period-profits of the ability-based firm and the amount left from initial wealth after investment spending for the new firm. Savings together with interests earned from savings and the amount of wealth left are also in M_2 values of these two solutions. Other three cases show another option for individuals having liquidity less than the one necessary for an ability-based firm formation. They indicate that people in this ability group are wage-earners in the first period. Thus, M_1 for these cases is wage plus initial wealth. However, the second period occupations are different for these last three solutions. That is, people become capital-based firm-owners in the third solution, they become ability-based firm-owners in the fourth solution, and lastly they continue to be paid-employees in the fifth solution. If wage-earners in this ability interval can accumulate high wealth by saving, they become firm-owners in a capital-intensive industry in the second period of their lives. In this case, M_2 is the profit of the capital-

based firm plus amount left from initial wealth and saving after investment spending for the new firm plus interests earned from them. The fourth solution indicates that paid-employees can found ability-based firms in the second period by using their savings if accumulated money is enough to pay the capital investment necessary for that type of firm. M_2 value of this solution is composed of the profit of the ability-based firm, amount left from initial wealth and saving after investment spending for the new firm, and their interest earnings. In the fifth solution, they are paid-employees in both periods of their lives because their initial wealth and the second-period accumulated wealth are not high enough to establish any type of firm. Therefore, M_2 of the fifth solution has wage, saving, initial wealth, and interests earned from saving and initial wealth.

The Firm's Problem:

If the agent chooses to set up a firm, he becomes a potential entrepreneur and has to face the following problem of a profit maximizing firm.

$$\Pi^j = Max[f_1^j, f_2^j] \tag{20}$$

subject to

$$k_i^1 \leqslant \theta \tag{21}$$

$$k_i^2 \leqslant \theta + S \tag{22}$$

$$k_2^j < k_1^j \tag{23}$$

$$\gamma_1^j < \gamma_2^j \tag{24}$$

where Π_i^j is the profit of a firm operating in industry-i in period-j.

As presented by the objective function of the firm, a potential entrepreneur has two industry alternatives from which he will choose maximum-yielding one for his firm. Production functions of these alternative industries are as shown in equation (5). That is, they both have exogenously given personal ability level, A, and a capital k_i^j of industry-i in period-j. Exogenous interest rate, r, also plays an important role in the potential firm owner's decision together with saving and initial wealth. Representative agent chooses the industry that fits his liquidity and personal ability constraints as well as maximizes his firm's profit, Π. In other words, his initial wealth has to be greater than k_i^1 which denotes capital required for industry-i in the first period. Moreover, his second period wealth must be greater than k_i^2 that shows capital invested for industry-i in the second period. As it can be seen from inequality (22), his wealth at the beginning of the second period consists of his initial wealth plus saving. As shown by the third constraint, capital necessary for a capital-intensive industry is greater than that necessary for an ability-intensive industry in the same period. On the other hand, marginal contribution of personal ability is greater in the ability-intensive industry than capital-intensive industry as indicated in the last constraint. Maximized profits for the first and the second periods are

$$\Pi_i^1 = \begin{cases} 0 & if \quad A < A_1 \\ \Pi_1^1 = f_1^1 & if \quad A_1 < A < A_2 \ , \ A_2 < A < A^* \text{ and } k_1^1 \leqslant \theta \\ \Pi_2^1 = f_2^1 & if \quad A_2 < A < A^* \text{ and } A^* < A \text{ and } k_2^1 \leqslant \theta < k_1^1 \\ 0 & if \quad A_1 < A < A_2 \text{ and } k_1^1 > \theta \\ 0 & if \quad A_2 < A < A^* \ , \ A^* < A \text{ and } k_2^1 > \theta \end{cases} \tag{25}$$

$$\Pi_i^2 = \begin{cases} 0 & if \quad A < A_1 \ , \ A_2 < A < A^* \ , \ A^* < A \ , \ A_1 < A < A_2 \text{ and } k_2^2 > \theta + S \\ \Pi_1^2 = f_1^2 & if \quad A_1 < A < A_2 \text{ and } A_2 < A < A^* \\ \Pi_2^2 = f_2^2 & if \quad A_2 < A < A^* \ , \ A^* < A \\ \Pi_1^2 = f_1^2 & if \quad A_1 < A < A_2 \ , \ A_2 < A < A^* \text{ and } \theta + S > k_1^2 \\ \Pi_2^2 = f_2^2 & if \quad A_2 < A < A^* \ , \ A^* < A \text{ and } k_2^2 < \theta + S < k_1^2 \end{cases} \tag{26}$$

Values of maximized profits differ according to ability group. That is, since low-ability individuals (i.e., the ones whose personal ability levels are less than A_1) choose to be paid-employees in both periods of their lives, their maximized profits are zero. Similarly, since high-ability individuals whose personal ability levels are greater than A^* choose to have ventures in an ability-intensive industry in both periods of their lives if they have enough liquidity, their maximized profits in this case are f_2. However, if they do not have liquidity necessary for an ability-intensive industry, they become wage-earners in the first period. Therefore, their first-period profits are zero. Paid-employees in this ability interval become ability-based firm-owners in the second period if they can accumulate required funds for the investment through saving. If they can do it, then their

second-period profits are f_2, otherwise their second-period profits are zero. Because, they continue to work as paid-employees in the second period if their accumulated funds are not high enough for investment.

Individuals having personal ability levels between A_1 and A_2 decide to have firms in a capital-intensive industry if their initial wealth allow in both periods of their lives. In this case, their maximized profits are f_1. However, if they do not have enough initial wealth, they become paid-employees in the first period, and then they establish capital-based firms in the second period by using their savings accumulated during the first period. Consequently, their first period profits are zero and the second period profits are f_1. The third case for these individuals is being paid-employees in both periods of their lives. This last case occurs if they cannot accumulate funds necessary for a capital-intensive industry. Thus, their profits in both periods are zero.

People whose personal ability levels are greater than A_2 and less than A^* establish either capital-based or ability-based firms in the first period, and continue operating the same firms in the second period of their life. Thus, if they decide to set up firms in an ability intensive-industry, their profits are f_2. But, if their choices are to found capital-based firms, their profits become f_1. In addition, they become paid-employees when young, and establish capital-based firms when old if their accumulated wealth enable payments for investment in the third case. Thus, their first-period profits are zero and the second-period profits are f_1.But, if their second-period funds are high enough only for an

ability-intensive industry, they become firm-owners in this types of the industry. Therefore, their first-period profits are zero and the second-period profits are f_2 in the fourth case. The fifth case exists if their second-period total wealth are so low that they cannot found their own firms. Then, their profits in both periods of their lives are zero because their occupational choices are being paid-employees.

Testable Implications of the Model

The model implies four predictions all of which are examined against data. The first prediction is about how wealth affects occupational decisions and firm formation activities of individuals. Even though a capital-intensive industry requires more capital investment than an ability-intensive industry, they both require wealth for the set up. Prediction-1 states the first testable implication of the model as follows:

Prediction 1: Wealthy people are more likely to enter into self-employment by founding firms in both capital-intensive and ability-intensive industries. That is, both industry types require wealth.

The second prediction of the model is related with the timing of establishing firms. Since individuals can save and accumulate wealth necessary for forming firms over time, the model implies that liquidity constrained young people can become firm-owners in

both capital-intensive and ability-intensive industries later in life. That is, they found firms when they get older by using their savings. Prediction-2 presents this implication.

Prediction 2: Entries into both industry types, capital-intensive and ability-intensive, will often happen later in life.

Prediction-3 states the third prediction of the model. This prediction describes the industry preferences of high-ability individuals. Since individuals at the upper end of the skill distribution have high personal ability level required for an ability-intensive industry, they are more likely to found ability-based firms.

Prediction 3: High-ability people are more likely to enter ability-intensive industry.

Last prediction concerns occupational choices of low-ability individuals. Working as a wage-earner is the optimal occupational choice for them due to their lower personal ability levels.

Prediction 4: Low-ability people are more likely to do wage-work.

Empirical Analysis

Data and Empirical Methods:

In order to explore the impact of organizational capital on the firm formation activities of people, I am going to study testable implications of my theoretical model in this empirical part. For this purpose, I use two-year panel data constructed from the Panel Study of Income Dynamics (PSID). My data contain 13,886 individuals in years 2003-2007. I choose this time period for data because it has all information that I need for this study. I use household heads in my sample because they are family members about whom the greatest amount of information is available.

Since people are divided into four categories according to their personal ability levels in theoretical model, I have to measure personal ability level and distinguish individuals in my sample accordingly in this empirical part. Total labor income of individuals depends on individual characteristics like age, gender, education, work experience, and personal ability. We can measure age, gender, education, and work experience but we cannot measure personal ability level directly. There are two ways of measuring ability used in literature. The first, which is used by Elfenbeim, Hamilton, and Zenger (2008) holds the education level constant. They construct a percentile rank in the skill distribution separately for people having the same highest degree. They measure relative ability as the position of a given individual within the pay distribution in a given year

among individuals with the same highest degree. Their method seems logical because we observe large income differences among people having identical observable human capital. However, this method ignores the impacts of work experience, age, and gender on personal labor income. These additional characteristics can also create large differences in labor income. The one with more work experience can earn more than others although all have identical highest degrees.

The second way of measuring personal ability is to use residual income as a proxy. Juhn, Murphy, and Pierce (1993) use this method to determine ability levels of individuals and therefore their relative positions in the skill distribution. This is a more logical way of measuring ability level. It controls for the effects of age, gender, and education level on personal labor income and uses the residual as a measure of ability. As Behrman and Rosenzweig (1999) indicate, ability has been used as the rubric for all unmeasured earnings endowments, which may include genetic endowments of ability, preschool human capital, or motivation.

I also use residual income in this study as a proxy to determine the position of an individual in the skill distribution. Unexplained incomes used in this chapter are residuals from a regression of the logarithm of income on some observable individual variables. These variables are age, gender, education, and work experience. A general form of the wage regression is given below.

$$\text{Ln(income)}_{i,t} = \gamma_0 + \gamma_1 Y_i + \gamma_2 Z_{i,t} + \varepsilon_{i,t} \quad (27)$$

where the vector Y_i represents a set of time-invariant individual characteristics, and the vector $Z_{i,t}$ represents a set of time-varying individual characteristics of person-i in year-t. Since regression of wage on education is biased [Garen (1984) and Weiss (1995)], I used Heckman two-step correction to obtain unbiased parameters. Marital status and the number of children at home are used in the selection equation in addition to the other variables. Table 10 presents wage regression and the first stage estimates. The first stage estimates show that being married and having more education are positively correlated. More educated people tend to have fewer children. Results of the wage regression indicate that more education raises earnings, more work experience induces higher incomes, and males earn more than females. These are all familiar and unsurprising results. The lambda term is significant and negatively signed. This means that the error terms in the selection and primary equations are negatively correlated. Thus, unobserved factors that make participation more likely tend to be associated with lower wages.

Since roles of human capital and physical capital in the firm formation decisions are analyzed, there are both wage-earners and self-employed individuals in my sample. Summary statistics of residual income for wage-earners and self-employed individuals are given in Table 11.

Table 10 : Results of Labor Income Regression

Constant	8.6142*** (0.1094)
Age	0.0139*** (0.0009)
Gender	0.4208*** (0.0172)
Education	0.0658*** (0.0032)
Work Experience	0.0072*** (0.0011)
Lambda	- 1.4123*** (0.3168)
R^2	0.2819
First Stage Estimates	
Age	0.0211 (0.1031)
Gender	0.4309** (0.1465)
Married	0.1675* (0.0146)
Number of Children	- 0.5901** (0.0412)
Work Experience	- 0.0184 (0.1040)
R^2	0.2991
Observations	13,886

Standard Errors are reported in parentheses.

***Significant at 1 % level; **Significant at 5 % level; *Significant at 10 % level

Table 11: Summary Statistics of Unexplained Incomes

	Wage-Earners	Self-Employed
Mean	0.023	- 0.089
Std. Dev.	0.725	1.273
25th Percentile	- 0.913	- 1.351
60th Percentile	- 0.006	- 0.009
90th Percentile	0.453	0.489
100th Percentile	1.045	1.334
Observations	12,407	1,479

Table 11 and Figure 8 show that mean residual income for self-employed people is smaller than that for wage-earners. However, the variance of unexplained income for self-employed people is larger. Unexplained income of self-employed individuals is lower than that of wage-earners at the first 60th percentile and higher above the 90th percentile.

Since occupational decisions of people having distinct positions in the skill distribution are not the same, they are divided into four ability groups in the model. Consistent with the model, I also use four ability groups to classify individuals in my sample according to their positions in the skill distribution. People at the first 25th

percentile of the skill distribution are in G1. Since they are at the lowest end, they are called low-ability people in this chapter. Individuals at the highest end of the skill distribution are classified as high-ability people. They constitute the top 10 % of the skill distribution. People in between these two ends are also divided into two additional groups as G2 and G3. Group G2 contains the next thirty five percent of the skill distribution after G1. People in G3 constitute the thirty percent of the skill distribution below those in G4.

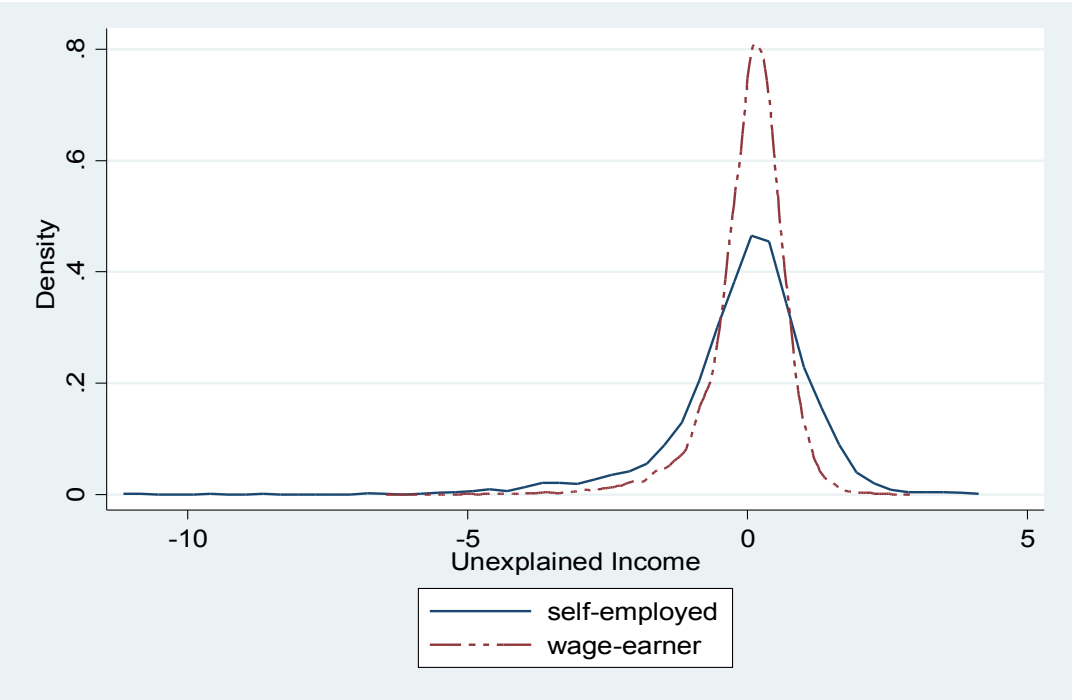

Figure-8: Unexplained Income Distributions for Paid-Employees and Self-Employed

Incomes of wage-earners and self-employed people are not the same. Summary

statistics of annual total labor income for wage-earners and self-employed individuals are given in Table 12. Table 12 and Figure 9 show that mean incomes of self-employed people are greater than those of wage-earners. The same is also true for the variances. That is, variances of incomes for self-employed individuals are larger than those for wage-earners. Incomes of self-employed individuals are lower than those of wage-earners at the first 25th percentile and higher at the 60th percentile. That is, lower-ability individuals are, on average, earning more by being wage-earners than becoming self-employed. Higher-ability individuals, on the other hand, are earning more by becoming self-employed than staying as wage-earners.

Table 12: Mean Annual Total Labor Income for Two Employment Groups (Paid-Workers and Self-Employed Individuals).

	Wage-Earners	Self-Employed
Mean	41,248	52,614
Std. Dev.	44,581	148,564
25th Percentile (G1)	16,423	15,283
60th Percentile (G2)	36,109	39,024
90th Percentile (G3)	51,735	60,683
100th Percentile (G4)	64,289	76,639
Observations	12,407	1,479

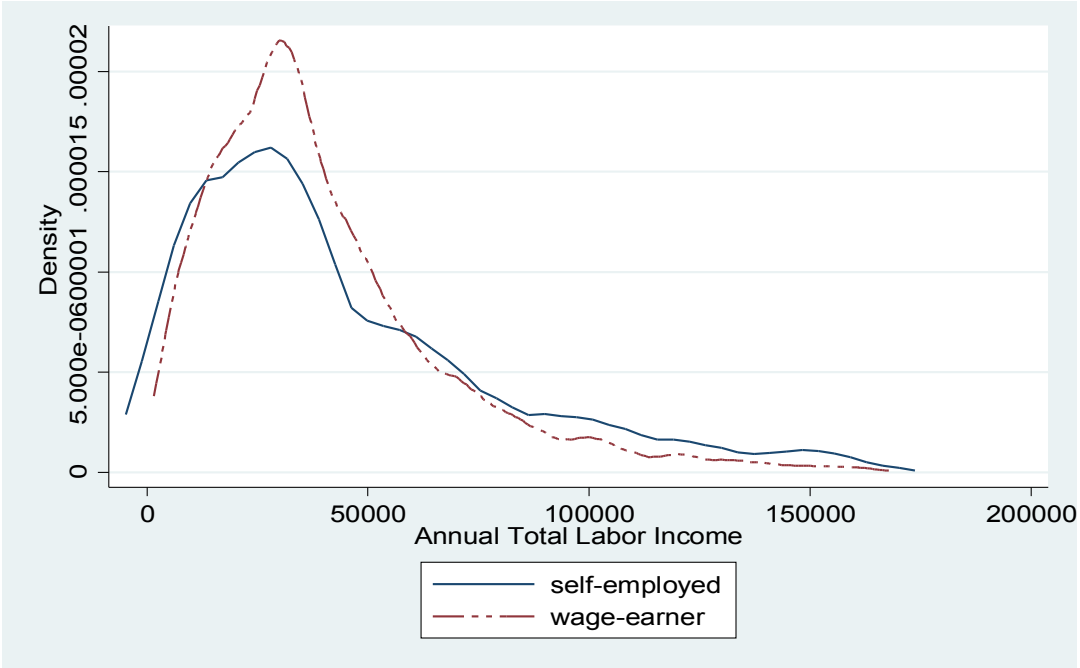

Figure-9: Earning Distributions for Wage-Earners and Self-Employed People

Consistent with theoretical model, I divided industry data into two categories which are capital-intensive industry and ability-intensive industry[14] according to the amount of capital needed to enter. That is, major costs of a capital-intensive industry includes costs coming from investments in equipment, machinery, or other expensive capital goods Kleindorfer and Wu (2003). Mining, utilities, railroads, construction, and heavy manufacturing are capital-intensive industries. Financial services and software development, however, are typically non capital-intensive Schmidt (2004). Capital-intensity is also defined as the asset-intensity Datta and Rajagopalan (1998). In other words, founding a new firm in a capital-intensive industry requires a high investment in

14 Appendix-IV shows the lists of Capital-Intensive and Ability-Intensive Industries in PSID

fixed assets Ghemawat (1991); Harrigan (1981). Thus, amount of fixed assets required for production creates the distinction between a capital-intensive industry and an ability-intensive industry. A new firm needs more funds for its fixed asset investments if its industry is capital-intensive, whereas it needs less money for its fixed asset investments if its industry is ability-intensive. Because the PSID does not include data for fixed asset investment costs or capital asset requirements of the industries, industry classification in this paper is done according to the definitions and classifications provided by the related literature as stated previously. Since abilities or skills of the individuals who found and operate the firms are within the human capital, estimated ability level of the individual is used as a proxy to reflect his human capital in this study. Entrepreneurial earnings of individuals differ along with the industry which is chosen for the new firm.

Summary statistics of entrepreneurial incomes according to industry preferences are given in Table 13. It shows that mean earning of entrepreneurs in an ability-intensive industry is greater than that of entrepreneurs in a capital-intensive industry. That is, founding a firm in an ability-based industry brings, on average, higher income than founding a firm in a capital-intensive industry. For the variances, it is observed that variances of incomes for self-employed individuals in an ability-intensive industry are greater than those for self-employed individuals in a capital-intensive industry.

Table 13: Mean Entrepreneurial Incomes of People in Ability-Intensive and Capital-Intensive Industries.

	Ability-Intensive Industry	Capital-Intensive Industry
Mean	64,319	52,025
Std. Dev.	175,007	163,426
G1	16,139	17,214
G2	44,201	37,319
G3	68,151	61,178
G4	95,740	73,950
Observations	586	893

Entrepreneurial income from an ability-intensive industry is lower than that from a capital-intensive industry for firm-owners at the 25th percentile. Therefore, founding a firm in a capital-intensive industry brings more profit than founding the firm in an ability-intensive industry for these low-ability individuals in G1. In contrast, firm-owners at the top 10th percentile earn more by having the firm in an ability-intensive industry than having it in a capital-intensive industry. In other words, high-ability entrepreneurs in G4 are getting higher profits from having ability-based firms than having capital-based firms. For firm-owners in G2 and G3, mean earnings in a capital-intensive industry are less than those in an ability-intensive industry.

I used multinomial logit[15] to analyze my panel data. Three main forms of my

15 Multinomial Logit, used by Schmidt and Strauss (1975), is utilized in my empirical analysis in order to observe relative probabilities.

regressions are given in equations (24), (25), and (26) which are run for each ability group separately. In the specifications, P_1 shows probability of choosing to stay in paid-work, P_2 shows probability of choosing to enter high-ability self-employment, and finally P_3 shows probability of choosing to enter high-capital self-employment for individual-i. I used age, wealth, and personal ability level as independent variables in all regressions to test the predictions of my theoretical model. Dependent variable in equation (28) shows relative probabilities of choosing to enter high-ability self-employment and to stay in paid-work.

$$\text{Log}_e\,(P_2 / P_1)_i = \alpha_0 + \alpha_1\,(\text{Age})_i + \alpha_2\,(\text{Wealth})_i + \alpha_3\,(\text{Ability})_i + \varepsilon_i \qquad (28)$$

Similarly, dependent variable in regression (29) shows relative probabilities of choosing to enter high-capital self-employment and to stay in paid-work.

$$\text{Log}_e\,(P_3 / P_1)_i = \mu_0 + \mu_1\,(\text{Age})_i + \mu_2\,(\text{Wealth})_i + \mu_3\,(\text{Ability})_i + \varepsilon_i \qquad (29)$$

Dependent variable of the last specification given below shows relative probabilities of choosing to enter high-capital self-employment and high-ability self-employment.

$$\text{Log}_e\,(P_3 / P_2)_i = \delta_0 + \delta_1\,(\text{Age})_i + \delta_2\,(\text{Wealth})_i + \delta_3\,(\text{Ability})_i + \varepsilon_i \qquad (30)$$

Empirical Results :

Table-14 exhibits results obtained from the empirical analysis. Results from Part A indicate that greater ability makes it more likely to enter high-ability self-employment than does wage work for G3 and G4 individuals. This result is as expected because the model implies that founding ability-based firms brings more monetary return than doing wage work for the ones in G3 and G4. Moreover, Part B shows that more ability makes it more likely to enter high-capital self-employment than to do wage work for people in G2, G3, and G4. These results are statistically significant only for those in G3 and G4. Since establishing capital-based firms is more profitable than working as wage-earners for them, this implication is also consistent with the model. It can be seen from Part C that more ability makes it more likely to enter high-ability self-employment than to enter high-capital self-employment for those in G3 and G4 even though these results are not significant. Thus, we can conclude that more ability makes it the most likely outcome to enter high-ability self-employment for high-ability people in G4. The conclusion is consistent with Prediction-3 which states that high-ability people are more likely to enter ability-intensive industry.

On the other hand, Part A implies that more ability makes it less likely to enter high-ability self-employment than to do wage work for individuals in G1 and G2. In addition, Part B shows that more ability makes it less likely to enter high-capital self-employment than to do wage work for people in G1. That is, outcomes for low-ability people indicate

that working as wage-earners becomes more likely outcome than founding own firms when personal ability level increases. Thus, this is not consistent with the model. Results presented in Part C show that more ability makes it less likely to enter high-capital self-employment than to enter high-ability self-employment for individuals in G1. And more ability makes it more likely to enter high-capital self-employment than to enter high-ability self-employment for individuals in G2. But, these results are not significant. Since the last prediction of the model shown by Prediction-4 indicates that low-ability people are more likely to do wage-work, these empirical results for individuals in G1 are inconsistent with it. If we look at the empirical results related with wealth in Part A, we observe that more wealth makes it more likely to enter high-ability self-employment than to do wage work for all individuals in four ability groups.

Similarly, Part B shows that more wealth makes it more likely to enter high-capital self-employment than to do wage work for all people but especially for the ones in G2, G3, and G4. These results are as expected according to the model because both capital-intensive and ability-intensive industries require wealth for firm formation although amount of wealth necessary for an ability-based firm is less than that necessary for a capital-based firm. Outcomes in Part C imply that more wealth makes it less likely to enter high-capital self-employment than to enter high-ability self-employment for individuals in G1, G2, and G3. Greater wealth makes it more likely to enter high-capital self-employment than to enter high-ability self-employment for people in G4.

Table 14: Relative Probabilities of Three Occupational Choices

	G1	G2	G3	G4
	A. Dependent Variable: Log_e (P_2 / P_1)			
Constant	- 4.6162***	- 5.0979***	- 5.1964***	- 5.4541***
	(0.2454)	(0.3685)	(0.5410)	(0.6403)
Age	0.0286***	0.0307***	0.0102	0.0212*
	(0.0049)	(0.0081)	(0.0098)	(0.0118)
Wealth	2.97e-07**	8.08e-07***	7.63e-07***	4.56e-07***
	(1.21e-07)	(1.51e-07)	(1.38e-07)	(1.40e-07)
Ability	- 0.5141***	- 0.7935	1.7852**	1.5622***
	(0.0709)	(0.6314)	(0.7131)	(0.2873)
	B. Dependent Variable: Log_e (P_3 / P_1)			
Constant	- 3.9957***	- 3.5851***	- 3.3427***	- 2.2499***
	(0.2489)	(0.3610)	(0.4896)	(0.5878)
Age	0.0098*	- 0.0084	- 0.0259***	- 0.0435***
	(0.0053)	(0.0090)	(0.0097)	(0.0124)
Wealth	1.46e-08	5.32e-07**	3.98e-07*	4.74e-07***
	(2.46e-07)	(2.36e-07)	(2.32e-07)	(1.43e-07)
Ability	- 0.5894***	0.1633	1.3221*	1.0488***
	(0.0719)	(0.6893)	(0.6835)	(0.3543)
	C. Dependent Variable: Log_e (P_3 / P_2)			
Constant	0.6196*	1.5279***	1.8426**	3.1939***
	(0.3289)	(0.5067)	(0.7200)	(0.7852)
Age	- 0.0186***	- 0.0389***	- 0.0360***	- 0.0654***
	(0.0067)	(0.0118)	(0.0136)	(0.0164)
Wealth	- 2.84e-07	- 2.77e-07	- 3.65e-07	1.79e-08
	(2.52e-07)	(2.31e-07)	(2.37e-07)	(5.39e-08)
Ability	- 0.0753	0.9578	- 0.4633	- 0.5084
	(0.0822)	(0.9307)	(0.9739)	(0.3620)
Pseudo R^2	0.06	0.03	0.0298	0.08
Observations	3,809	4,903	3,759	1,414

Standard Errors are reported in parentheses

***Significant at 1 % level; **Significant at 5 % level; *Significant at 10 % level

However, results in Part C are statistically insignificant. Consequently, it can be said that these empirical results about wealth are consistent with Prediction-1 which says that wealthy people are more likely to enter into self-employment by founding firms in both capital-intensive and ability-intensive industries. That is, both industry types require wealth.

In order to test Prediction-2, I use age as an independent variable in the regressions. Associated results in Part A show that it is more likely to enter high-ability self-employment than to do wage work for all individuals in four ability groups when they get older. The results are statistically significant for the ones in G1, G2, and G4. Moreover, Part B indicates that it is more likely to enter high-capital self-employment than to do wage work for individuals in G1 when they get older. These empirical results support Prediction-2 that entries into both industry types, capital-intensive and ability-intensive, will often happen later in life. Because, liquidity constrained young individuals can found firms in both industry types when they get older by using their savings. The model implies that saving money to accumulate wealth necessary for the new firms takes time. However, empirical results shown in Part B also point out that it is less likely to enter high-capital self-employment than to do wage work for individuals in G2, G3, and G4 when they get older. Since these results are statistically significant only for the ones in G3 and G4, it can be said that empirical results for G3 and G4 people contradict with Prediction-2.

Conclusion

This chapter explores the role of organizational capital, human capital and physical capital, in the firm formation activities of people at different skill levels by constructing a theoretical model and analyzing its testable implications empirically. Existing industries are categorized as a capital-intensive industry or an ability-intensive industry so that they can be distinguished according to main organizational capital required. A capital-intensive industry requires more physical capital consequently more funds for investment whereas, an ability-intensive industry requires more human capital. Human capital refers to personal ability level in this chapter. Individuals are also divided into four groups according their personal ability levels in order to observe occupational differences among them.

It is shown that occupational choices and firm formation actions of people in distinct ability groups differ. That is, more ability makes the most able individuals at the top 10 % of the skill distribution more likely to set up firms in an ability-intensive industry because, they earn the greatest income from it. The required high-ability level for an ability-intensive industry does not constitute a barrier for them, instead it stimulates these individuals' ability-based firm formation activities. On the other hand, the model implies that low-ability people at the lowest 25 % of the skill distribution earn the least income if they establish ability-based firms because of their limited personal ability levels. In other words, their low personal ability levels constitute an entry barrier to an ability-intensive

industry. Since being wage-earners brings the greatest monetary return for these low-ability individuals, they become paid-employees. However, this implication for low-ability individuals is not supported empirically. Results indicate that they are more likely to work as wage-earners than to found their own firms when personal ability level increases.

The model indicates that firm formation actions of other individuals in between low-ability and high-ability people also depend on their initial wealth, savings, and personal ability levels. The ones in G2 choose to found firms in a capital-intensive industry because it brings the greatest monetary return for them. However, this can be achieved if they have enough initial wealth for the investment. Thus, wealthier G2 people become capital-based firm-owners when young and continue operating the same firms when old. Liquidity constrained G2 people, on the other hand, become wage-earners when young and establish their own capital-based firms when old by using their accumulated savings. If their savings are not high enough, they continue to work as paid-employees in the second period. This means that required high funds for a capital-intensive industry constitute an entry barrier for them. And having an ability-based firm does not bring the greatest return for them due to the lack of necessary high human capital. The last group of people in G3 also have the greatest earning from establishing a capital-based firm. But, some of them choose to set up ability-based firms which bring the second greatest earning due to not having high amount of wealth. Since place of these people in G3 is between 60 % and 90 % of the skill distribution, they have relatively higher personal

ability levels. Thus, required high human capital is not a big barrier for them. Remaining G3 individuals become paid-employees in the first period, then they establish their own firms in the second period of their life. Their second-period firms can be capital-based or ability-based depending on the amount of savings. In other words, G3 people with high accumulated wealth set up their own capital-based firms whereas, others with less accumulated wealth found their ability-based firms. If their accumulated wealth is lower than the amount of funds necessary for an ability-based firm, they continue to be wage-earners in the second period.

Additional two predictions of the model are also tested against data to observe the implications of theoretical cases. Prediction-1 is supported by the empirical results. That is, since both industry types require wealth even though the amount of funds necessary for them are different, wealthy people are more likely to found both capital-based and ability-based firms. On the other hand, Prediction-2 is partly supported by empirical results. Namely, it is empirically proofed that entries into an ability-intensive industry often happen later in life. This results is true especially for the ones in G1 and G2. Moreover, entries into a capital-intensive industry also happen later in life for individuals in G1. However, entries into a capital-intensive industry do not happen later in life for people in G3 and G4. And this last result for G3 and G4 people contradicts with Prediction-2.

IV. CHAPTER 3 : WHO EARNS MORE? FUTURE ENTREPRENEURS OR THEIR NON-ENTREPRENEURIAL COLLEAGUES

Introduction

This chapter investigates earning differentials between future entrepreneurs and their non-entrepreneurial colleagues by considering the chosen industries of the new firms.

Earning differentials in self-employment and paid-employment were investigated by Hamilton (2000). He found that the median hourly wages of future entrepreneurs are higher than the wages of employees remaining on the job, and as a result he concluded that there must be significant nonpecuniary benefits to owning a business. However, this result may change if industry preferences of future entrepreneurs are taken into consideration. Thus, I explore the determinants of self-employment by studying incomes of employees remaining on the job, future entrepreneurs whose preference is a capital-intensive industry, and future entrepreneurs whose preference is an ability-intensive industry. A capital-intensive industry refers to an industry requiring substantial investment in capital assets, and consequently requiring more liquidity for the production of goods. An ability-intensive industry is an industry requiring more human capital instead of monetary capital for the production of goods. I hypothesize that individuals that form new firms in an ability-intensive industry were earning more than others remaining in wage-work. Since an ability-intensive industry requires a relatively high skill level, they are more likely to have higher abilities. On the other hand, people who

found new firms in a capital-intensive industry were earning less than employees remaining on the job.

Observations on a sample of individuals in the PSID are used in this chapter. A panel is constructed for the period 2003-2007. This time period is selected for the sample because it includes all information needed for the analysis. Since entrepreneurial behaviors of people having distinct ability levels are not the same [Elfenbeim, Hamilton, and Zenger, (2008)], individuals are divided into four groups according to their personal skills.

In order to measure personal skill level, I construct an indicator for innate ability from the residuals obtained in a regression of labor earnings on age, gender, education, and work experience (cf. Behrman and Rosenzweig, 1999). Education is not taken as a part of ability because two people having the same education level can earn different incomes even though they both do identical jobs, because of their distinct personal abilities. Individuals are placed in four ability groups, denoted by G1 through G4, with G1 representing the lowest ability group. These are not quantiles. Group G1 accounts for the first 25 percent of the observations, G2 accounts for the next thirty five percent, G3 accounts for the next thirty percent, and G4 represents the top ten percent.

The empirical results agree with prior research. That is, high-ability individuals that

form new firms in an ability-intensive industry were earning more than others remaining in paid-work. Since a high-ability industry requires more skills but less capital, this result for G3 and G4 people supports my hypothesis. Moreover, estimates indicate that low-ability people that found firms in a capital-intensive industry were earning less than others remaining in wage-work. This is also consistent with my expectation because industry preferences of G1 and G2 individuals for new firms are capital-intensive. Since a high-capital industry requires more capital but less skill, this result for low-ability people also supports my hypothesis.

This chapter is organized as follows: Section 2 presents the data and empirical methods, section 3 provides the empirical results, and the last section concludes.

Data and Empirical Methods

In order to analyze earning differentials between future entrepreneurs and their non-entrepreneurial colleagues, I use two-year panel data constructed from the Panel Study of Income Dynamics (PSID). My data contain 13,860 individuals in years 2003-2007. I choose this time period for data because it has all information that I need for this study. I use household heads in my sample because they are family members about whom the greatest amount of information is available.

Since personal ability level is the key element that creates earning differentials

among people having similar human capital, I have to measure personal ability level and distinguish individuals in my sample accordingly. Total labor income of people depends on individual characteristics like age, gender, education, work experience, and personal ability. We can measure age, gender, education, and work experience but we cannot measure personal ability level directly. There are two ways of measuring ability used in literature. The first, which is used by Elfenbeim, Hamilton, and Zenger (2008) holds the education level constant. They construct a percentile rank in the skill distribution separately for people having the same highest degree. They measure relative ability as the position of a given individual within the pay distribution in a given year among individuals with the same highest degree. This method seems logical because we observe large income differences among people having identical observable human capital. However, this method ignores the impacts of work experience, age, and gender on personal labor income. These additional characteristics can also create large differences in labor income. For instance, the one with more work experience and/or older can earn more than others although all have identical highest degrees. Thus, the effects of personal characteristics like age, gender, and work experience should also be controlled so that innate personal ability which creates the difference can be measured.

The second way of measuring personal ability is to use residual income as a proxy Juhn, Murphy, and Pierce (1993). This is a more logical way of measuring skill level. It controls for the effects of age, gender, and education on personal labor income and uses the residual as a measure of ability. As Behrman and Rosenzweig (1999) indicate, ability

has been used as the rubric for all unmeasured earnings endowments, which may include genetic endowments of ability, preschool human capital, or motivation.

I also use residual income in this study as a proxy to determine the position of an individual in the skill distribution. Unexplained incomes used in this chapter are residuals from a regression of the logarithm of income on some observable individual variables. These variables are age, gender, work experience, and education. A general form of the wage regression is given below.

$$\text{Ln(income)}_{i,t} = \gamma_0 + \gamma_1 Y_i + \gamma_2 Z_{i,t} + \varepsilon_{i,t} \tag{31}$$

where the vector Y_i represents a set of time-invariant individual characteristics, and the vector $Z_{i,t}$ represents a set of time-varying individual characteristics of person-i in year-t. As indicated by Garen (1984) and Weiss (1995), regression of wage on education is biased. Thus, I used Heckman two-step correction to obtain unbiased parameters in my labor income regression. Marital status and number of children at home are used in the selection equation in addition to other variables. OLS estimates of wage regression and the first-stage results are presented in Table 15. The first stage estimates show that being married and having more education are positively correlated. And more educated people have fewer children. This result is consistent with the indications of Kenny, Lee, Maddala, and Trost (1979). That is, married people specialize in the labor market more than singles, and accordingly have a greater intensive to invest in human capital.

Table 15: Labor Income Regression Estimates

Constant	8.7121*** (0.1106)
Age	0.0150*** (0.0011)
Gender	0.4325*** (0.0176)
Education	0.3703*** (0.0052)
Work Experience	0.0094*** (0.0014)
Lambda	- 1.4369*** (0.3289)
R^2	0.3893
First Stage Estimates	
Age	0.0211 (0.1031)
Gender	0.4309** (0.1465)
Married	0.1676* (0.0162)
Number of Children	- 0.5901** (0.0405)
Work Experience	- 0.0183 (0.1042)
R^2	0.2984
Observations	14,860

Standard Errors are reported in parentheses. ***Significant at 1 % level; **Significant at 5 % level; *Significant at 10 % level

Familiar results of the wage regression indicate that having more education raises earnings, more work experience induces higher incomes, and males earn more than

females. The lambda term is significant and negatively signed. This means that the error terms in the selection and primary equations are negatively correlated. Thus, unobserved factors that make participation more likely tend to be associated with lower wages.

Since earning differentials between future entrepreneurs and their non-entrepreneurial colleagues are analyzed, there are both wage-earners and self-employed people in my sample. Summary statistics of residual income for wage-earners and self-employed individuals are given in Table 16. Table 16 and Figure 10 show that mean residual income for self-employed people is smaller than that for wage-earners. However, the variance of unexplained income for self-employed people is larger. Unexplained incomes of self-employed individuals are lower than those of wage-earners at the 25th percentile and higher above the 90th percentile.

Table 16: Unexplained Income Statistics

	Wage-Earners	Self-Employed
Mean	0.011	- 0.089
Std. Dev.	0.713	1.272
25th Percentile	- 0.914	- 1.350
60th Percentile	- 0.007	- 0.009
90th Percentile	0.455	0.469
100th Percentile	1.041	1.315
Observations	12,392	1,468

As Elfenbeim, Hamilton, and Zenger (2008) show entrepreneurial behaviors of individuals having distinct places in the skill distribution are different. That is, low-ability and high-ability individuals are more likely to be self-employed. Moreover, two industry types, capital-intensive and ability-intensive, utilized in this chapter differs according to the main input required for the production. Namely, personal skill level is the main input for an ability-intensive industry, whereas a large amount of capital investment is the main input for a capital-intensive industry. Thus, individual skill level is expected to be an important criteria in the industry selection of a potential entrepreneur in this study. Since my aim is to analyze previous earnings and subsequent self-employment choices of people having different skill levels by considering their industry choices for the new firms, individuals are divided into four groups according to their personal abilities. People at the first 25th percentile of the skill distribution are in G1. Since they are at the lowest end, they are called low-ability people in this chapter. Individuals at the highest end of the skill distribution are classified as high-ability people. They constitute the top 10 % of the skill distribution. People in between these two ends are also divided into two additional groups as G2 and G3. Group G2 contains the next thirty five percent of the skill distribution after G1. People in G3 constitute the thirty percent of the skill distribution below those in G4. Incomes of wage-earners and self-employed people are not the same. Summary statistics of annual total labor income for wage-earners and self-employed individuals are given in Table 17.

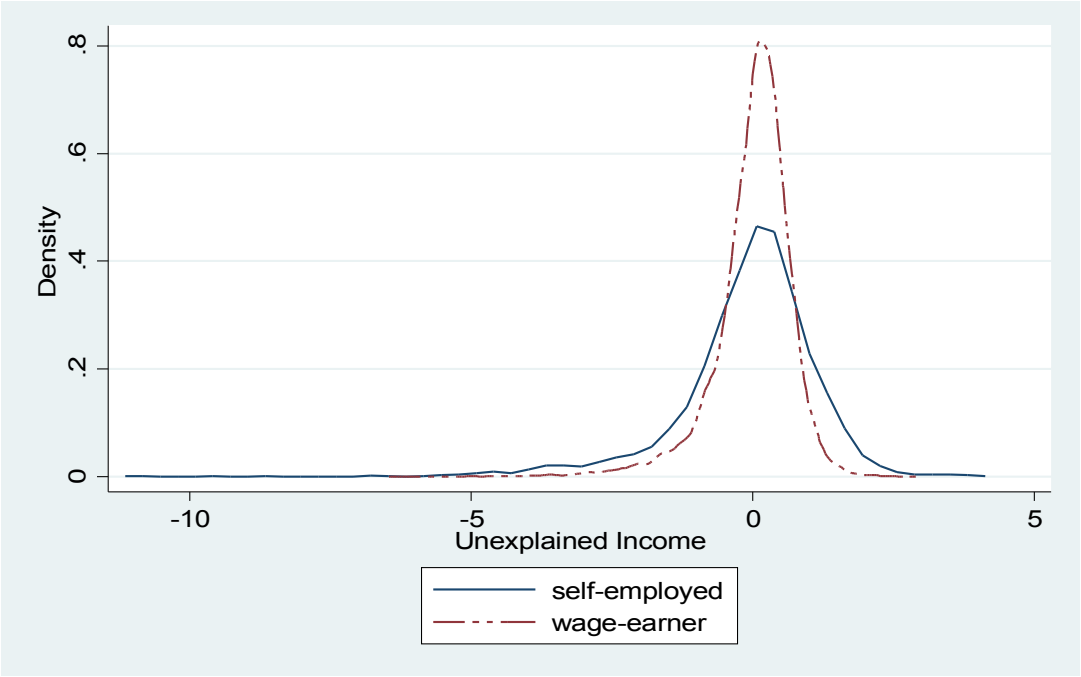

Figure-10: Unexplained Income Distributions (Wage-Earners and Self-employed Individuals)

Table 17: Mean Annual Total Labor Income for Wage-Earners and Self-Employed People

	Wage-Earners	Self-Employed
Mean	41,252	52,539
Std. Dev.	43,581	148,266
25th Percentile (G1)	16,316	15,176
60th Percentile (G2)	36,009	39,025
90th Percentile (G3)	51,741	60,670
100th Percentile (G4)	64,279	76,538
Observations	12,392	1,468

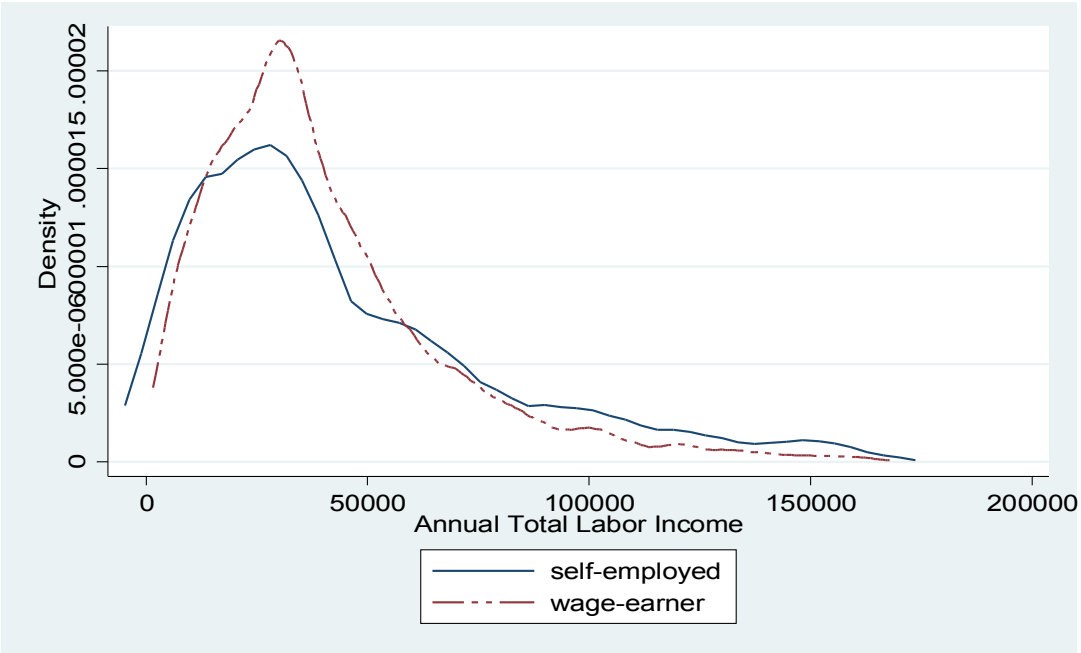

Figure-11: Income Distributions for Paid-Workers and Entrepreneurs

Table 17 and Figure 11 show that mean and variance of income for self-employed people are greater than those for wage-earners. Incomes of self-employed people are lower than those of wage-earners at the first 25th percentile and higher at the 60th percentile. That is, lower-ability individuals, on average, are earning more by being wage-earners than becoming self-employed. Higher-ability people, on the other hand, are earning more by becoming self-employed than staying as wage-earners.

Since two industry types, capital-intensive and ability-intensive, are utilized as the industry choices of future entrepreneurs, industry classification done in previous chapter is also used in this chapter. Similar to the second chapter, estimated ability level of an

individual is used as a proxy to reflect his human capital in this chapter. Earnings of firm-owners differ according to the industry chosen for the new firms. Summary statistics of entrepreneurial incomes according to the industry types are given in Table 18.

Table 18: Summary of Entrepreneurial Incomes in Ability-Intensive and Capital-Intensive Industries

	Ability-Intensive Industry	Capital-Intensive Industry
Mean	64,319	52,011
Std. Dev.	175,007	163,430
G1	16,139	17,209
G2	44,201	37,099
G3	68,151	61,138
G4	95,740	73,941
Observations	585	883

Table 18 shows that mean earnings of entrepreneurs in an ability-intensive industry is greater than that of entrepreneurs in a capital-intensive industry. This means that founding a firm in an ability-based industry brings, on average, higher income than founding a firm in a capital-intensive industry. For the variances, it is observed that variance of incomes for self-employed individuals in an ability-intensive industry is greater than that for self-employed people in a capital-intensive industry.

Entrepreneurial income from an ability-intensive industry is lower than that from a capital-intensive industry for firm-owners at the 25th percentile. Therefore, founding a firm in a capital-intensive industry yields, on average, more earnings than founding the firm in an ability-intensive industry for these low-ability people in G1. In contrast, firm-owners at the 10th percentile earn more by having the firm in an ability-intensive industry than having it in a capital-intensive industry. In other words, high-ability entrepreneurs in G4 are getting higher profits from having an ability-based firm than having a capital-based firm. For firm-owners in G2 and G3, mean earning in a capital-intensive industry is less than that in an ability-intensive industry.

Tables 19 and 20 show employment patterns in my data. Table 19 shows that 10.6 % of paid-employees became self-employed while, 89.4 % of them stayed as paid-employees.

Table 19: Employment Patterns: Number and Fraction of Workers by Mobility Group

	Self-Employed in year t+2	Paid-Employee in year t+2	Total
Paid-Employee in year t	1,468	12,392	13,860
(Number & Fraction)	0.106	0.894	1.00

Table 20 shows that 18.1 % of self-employed people whose choices are ability-intensive industries are in G1 whereas, 24.8 % of them are in G4. Ability groups G2 and

G3 contain 23.1 % and 34 % of ability-based firm-owners, respectively. Similarly, 28.5 % of people who are self-employed in a capital-intensive industry are in G1 while, 10.3 % of them are in G4. Moreover, 36.6 % and 24.6 % of capital-based firm-owners are in G2 and G3, respectively.

Table 20: Employment Patterns: Number and Fraction of Workers by Industry Types

	Self-employed in year t+2				Total
	G1	G2	G3	G4	
	A. Ability-Intensive Industry				
Paid-Employee in year t	106	135	199	145	585
(Number & Fraction)	0.181	0.231	0.340	0.248	1.00
	B. Capital-Intensive Industry				
Paid-Employee in year t	252	323	217	91	883
(Number & Fraction)	0.285	0.366	0.246	0.103	1.00

I use year-pairs in my regressions because my aim is to explore earning differences between people who become self-employed and their colleagues who stay as wage-earners two years later. The regression used for this purpose is given in equation (32). Since there are two industries that can be chosen for the new firms, this regression is run separately for each industry type.

$$LI_{i,t} = \mu_0 + \mu_1 Y_i + \mu_2 Z_{i,t} + \mu_3 SE_{i,t+2} + \varepsilon_{i,t} \tag{32}$$

where $LI_{i,t}$ is employee labor income and $SE_{i,t+2}$ is a dummy variable that equals one if individual-i enters self-employment in year t+2. The terms Y_i and $Z_{i,t}$ are two vectors used in all equations to test the impacts of individual characteristics. The vector Y_i represents a set of time-invariant individual characteristics and the vector $Z_{i,t}$ represents a set of time-variant individual characteristics of person-i in year-t. Specifications (32) is run for each ability group separately.

Empirical Results

Tables 22 and 23 present resulting estimates of the regressions used to investigate earning differences between people who become self-employed and their colleagues who stay as wage-earners two years later. Since entry into self-employment two years later is endogenous, family size is used as an IV variable. In order to justify the usage of family size as an IV variable, firstly, its correlation with the disturbances in regression (32) is tested. This testing is done by re-estimating regression (32) with family size being added as an explanatory variable for each industry type. Estimated coefficients[16] on family size, presented in Table 21, are not significantly different from zero. That is, family size is not an omitted variable. This result supports the validity of family size as an IV variable. Secondly, relevance of family size as an IV variable is investigated by the first stage regressions presented in Part-B sections of Tables 22 and 23 for each industry type.

16 Estimates for the other explanatory variables are as expected. That is, more work experience increases income. Individuals earn more when they get older. And males earn more than females. [Borjas and Bronars (1989), Jovanovic and Moffitt (1990)]

Table 21: Validity of IV Variable (Testing for Omitted Variables)

	G1	G2	G3	G4
	A. Dependent Variable: Employee Labor Income (Wage)			
Constant	8.5697*** (0.0750)	9.5305*** (0.0279)	9.8641*** (0.0314)	9.5850*** (0.0812)
Family Size	0.0107 (0.0237)	- 0.0184 (0.0349)	- 0.0219 (0.0452)	0.0184 (0.0231)
Age	0.0089*** (0.0016)	0.0172*** (0.0008)	0.0207*** (0.0007)	0.0293*** (0.0018)
Gender	0.6983*** (0.0339)	0.4965*** (0.0123)	0.4237*** (0.0130)	0.5937*** (0.0335)
Work Experience	0.0086*** (0.0021)	0.0148*** (0.0009)	0.0175*** (0.0008)	0.0179*** (0.0021)
Self-Employment Dummy for an Ability-Intensive Industry	0.2102 (0.3706)	0.1762 (0.2363)	0.2893*** (0.0419)	0.5726*** (0.0721)
R^2	0.3205	0.2070	0.2404	0.2612
Observations	3,079	4,613	4,082	1,205
	B. Dependent Variable: Employee Labor Income (Wage)			
Constant	8.6071*** (0.0731)	9.5313*** (0.0278)	9.8719*** (0.0313)	9.5836*** (0.0815)
Family Size	0.0130 (0.0236)	- 0.0185 (0.0649)	- 0.0213 (0.0751)	0.0194 (0.0431)
Age	0.0085*** (0.0016)	0.0172*** (0.0006)	0.0206*** (0.0007)	0.0298*** (0.0018)
Gender	0.6857*** (0.0332)	0.4991*** (0.0130)	0.4312*** (0.0129)	0.6048*** (0.0341)
Work Experience	0.0079*** (0.0024)	0.0148*** (0.0008)	0.0172*** (0.0019)	0.0179*** (0.0020)
Self-Employment Dummy for a Capital-Intensive Industry	- 0.8618*** (0.0746)	- 0.3604*** (0.0394)	- 0.2857 (0.3411)	- 0.1941 (0.3802)
R^2	0.2906	0.3710	0.2729	0.2802
Observations	3,225	4,801	4,100	1,151

Standard Errors are reported in parentheses. ***Significant at 1 % level; **Significant at 5 % level; *Significant at 10 % level

Corresponding results on family size are positive and statistically significant. Namely, individuals having larger families are more likely to be self-employed in both ability-intensive and capital-intensive industries. Thus, family size is a valid and relevant IV variable.

Estimates about personal characteristics shown in Tables 22 and 23 imply that people earn more when they get older. Males earn more than females. And more work experience increases income. Results in part-A of Table 22 indicate that individuals that form new firms in an ability-intensive industry were earning more than others remaining on the job. The implication is valid for people in four ability groups, but estimates are statistically significant only for those in G3 and G4. Since individuals in G3 and G4 constitute the top 40 % of the skill distribution, they are high-ability people. These results indicate that high-ability people who become self-employed were earning more than their non-entrepreneurial colleagues. Their industry preferences for new firms are high-ability industries. Since a high-ability industry requires more skills but less capital, this result for high-ability people is reasonable.

Estimates in Part-A of Table 23 imply that people that form new firms in a capital-intensive industry were earning less than others remaining in wage-work. This is true for all individuals in four ability groups. However, the results are statistically significant only for those in G1 and G2. Since individuals in G1 and G2 are at the lowest tail of the skill distribution, they are low-ability people. These estimates indicate that low-ability

Table 22: Estimated Mobility Coefficients for Transitions from Paid-Work to Self-Employment in an Ability-Intensive Industry

	G1	G2	G3	G4
	A. Dependent Variable: Employee Labor Income (Wage)			
Constant	6.1654 (15.0057)	10.2690*** (0.0431)	10.3470*** (0.5496)	11.5464*** (0.7728)
Age	0.0174*** (0.0096)	0.0105** (0.0029)	0.0169*** (0.0022)	0.0182*** (0.0075)
Gender	0.5726*** (0.0239)	0.3698** (0.1105)	0.4790*** (0.0392)	0.3793*** (0.1065)
Work Experience	0.0056* (0.0018)	0.0095*** (0.0042)	0.0117*** (0.0023)	0.0198** (0.0059)
Self-Employment Dummy for an Ability-Intensive Industry	4.1214 (6.8965)	5.6652 (1.8624)	3.8412** (1.8544)	1.7769*** (0.1579)
R^2	0.2933	0.1025	0.3011	0.2621
Observations	3,079	4,613	4,082	1,205
	B. The First Stage IV Regressions			
Family Size	0.2061*** (0.0306)	0.1974*** (0.0268)	0.4168*** (0.0375)	0.5648*** (0.1195)
Age	0.0201*** (0.0052)	0.0269** (0.0113)	- 0.0029 (0.0142)	0.0022 (0.0139)
Gender	0.3027** (0.1425)	0.3509** (0.1741)	0.8135*** (0.2437)	0.5109** (0.2275)
Work Experience	- 0.0027 (0.0120)	0.0123 (0.0195)	0.1248** (0.0107)	0.0213 (0.0179)
Pseudo R^2	0.1405	0.0974	0.1429	0.0797
Observations	3,079	4,613	4,082	1,205

Standard Errors are reported in parentheses.
***Significant at 1 % level; **Significant at 5 % level; *Significant at 10 % level

people who become self-employed were earning less than their non-entrepreneurial colleagues. Their industry preferences for new firms are high-capital industries.

Table 23: Estimated Mobility Coefficients for Transitions from Paid-Work to Self-Employment in a Capital-Intensive Industry

	G1	G2	G3	G4
	A. Dependent Variable: Employee Labor Income (Wage)			
Constant	9.4957*** (0.1461)	11.3628*** (2.6203)	10.8686*** (0.0353)	11.6154*** (0.8180)
Age	0.0076** (0.0028)	0.0242*** (0.0010)	0.0189*** (0.0032)	0.0264*** (0.0058)
Gender	0.7325** (0.1838)	0.4690*** (0.0165)	0.4701** (0.1092)	0.3695*** (0.0368)
Work Experience	0.0146** (0.0025)	0.0074** (0.0046)	0.0173*** (0.0029)	0.0103** (0.0064)
Self-Employment Dummy for a Capital-Intensive Industry	- 3.4079*** (0.5453)	- 4.6318*** (1.7986)	- 5.2235 (1.5612)	- 1.0111 (1.5097)
R^2	0.2933	0.1026	0.3012	0.2611
Observations	3,225	4,801	4,100	1,151
	B. The First Stage IV Regressions			
Family Size	0.6731** (0.0502)	0.7195*** (0.0369)	0.2786** (0.0134)	0.8439*** (0.1306)
Age	0.0156** (0.0081)	0.0321*** (0.0098)	- 0.0007 (0.0123)	- 0.0012 (0.0154)
Gender	0.2104 (0.2271)	0.1654 (0.2509)	5.0766 (7.1203)	0.1705 (0.3120)
Work Experience	0.0003 (0.0089)	0.0089 (0.0110)	0.0215 (0.0179)	0.2111** (0.0169)
Pseudo R^2	0.0672	0.0187	0.0492	0.1209
Observations	3,225	4,801	4,100	1,151

Standard Errors are reported in parentheses.
***Significant at 1 % level; **Significant at 5 % level; *Significant at 10 % level

Since a high-capital industry requires more capital but less skill, this result for low-ability

people is also reasonable.

Conclusion

This chapter analyzes earning differentials between future entrepreneurs and their non-entrepreneurial colleagues. Future entrepreneurs are categorized according to their industry choices, capital-intensive or ability-intensive, for the new firms. A capital-intensive industry requires more physical capital investment, while an ability-intensive industry requires more personal skill. Implications of the empirical results support my hypotheses. Namely, high-ability individuals that establish new firms in an ability-intensive industry were earning more than others remaining in wage-work. And low-ability G1 and G2 people that found new firms in a high-capital industry were earning less than others remaining in paid-work.

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APPENDICES

I. Writing M_2 in terms of M_1 and C_1 for different ability groups :

<u>For $A_1 < A < A_2$ and $k_1^1 > \theta$:</u>

We know that $M_2 = \Pi_1^2 + (1+r)(\theta - k_1^2 + S)$ and $S = M_1 - C_1$

We can rewrite M_2 as $M_2 = \Pi_1^2 + (1+r)(\theta - k_1^2) + (1+r)S$

Plug S into M_2,

$$M_2 = \Pi_1^2 + (1+r)(\theta - k_1^2) + (1+r)(M_1 - C_1)$$

$$M_2 = \underbrace{\Pi_1^2 + (1+r)(\theta - k_1^2)}_{Y_2} + (1+r)(M_1 - C_1)$$

Thus, $M_2 = Y_2 + (1+r)(M_1 - C_1)$

<u>For $A^* < A$, $A_2 < A < A^*$ and $k_2^1 \leq \theta < k_1^1$:</u>

We know that $M_2 = \Pi_2^2 + (1+r)(\theta - k_2^1 + S)$ and $S = M_1 - C_1$

We can rewrite M_2 as $M_2 = \Pi_2^2 + (1+r)(\theta - k_2^1) + (1+r)S$

Plug S into M_2,

$$M_2 = \Pi_2^2 + (1+r)(\theta - k_2^1) + (1+r)(M_1 - C_1)$$

$$M_2 = \underbrace{\Pi_2^2 + (1+r)(\theta - k_2^1)}_{Y_2} + (1+r)(M_1 - C_1)$$

Thus, $M_2 = Y_2 + (1+r)(M_1 - C_1)$

For $A < A_1$:

We know that $M_2 = W + (1+r)(\theta + S)$ and $S = M_1 - C_1$

We can rewrite M_2 as $M_2 = W + (1+r)\theta + (1+r)S$

Plug S into M_2,

$$M_2 = W + (1+r)\theta + (1+r)(M_1 - C_1)$$

$$M_2 = \underbrace{W + (1+r)\theta}_{Y_2} + (1+r)(M_1 - C_1)$$

Thus, $M_2 = M_1 + (1+r)(M_1 - C_1)$

For $A_1 < A < A_2$ and $A_2 < A < A^*$ and $k_1^1 \leq \theta$:

We know that $M_2 = \Pi_1^2 + (1+r)(\theta - k_1^1 + S)$ and $S = M_1 - C_1$

We can rewrite M_2 as $M_2 = \Pi_1^2 + (1+r)(\theta - k_1^1) + (1+r)S$

Plug S into M_2,

$$M_2 = \Pi_1^2 + (1+r)(\theta - k_1^1) + (1+r)(M_1 - C_1)$$

Then,

$$M_2 = \underbrace{\Pi_1^2 + (1+r)(\theta - k_1^1)}_{Y_2} + (1+r)(M_1 - C_1)$$

Thus, $M_2 = Y_2 + (1+r)(M_1 - C_1)$

<u>For $A^* < A$ and $A_2 < A < A^*$ and $k_2^1 > \theta$:</u>

We know that $M_2 = \Pi_2^2 + (1+r)(\theta - k_2^2 + S)$ and $S = M_1 - C_1$

We can rewrite M_2 as $M_2 = \Pi_2^2 + (1+r)(\theta - k_2^2) + (1+r)S$

Plug S into M_2,

$$M_2 = \Pi_2^2 + (1+r)(\theta - k_2^2) + (1+r)(M_1 - C_1)$$

Then,

$$M_2 = \underbrace{\Pi_2^2 + (1+r)(\theta - k_2^2)}_{Y_2} + (1+r)(M_1 - C_1)$$

Thus, $M_2 = Y_2 + (1+r)(M_1 - C_1)$

As a result, $M_2 = Y_2 + (1+r)(M_1 - C_1)$ for all ability groups.

where

$$Y_2 = \left\{ \begin{array}{lll} W + (1+r)\theta & if & A < A_1 \\ \Pi_1^2 + (1+r)(\theta - k_1^1) & if & A_1 < A < A_2 \ , \ A_2 < A < A^* \text{ and } k_1^1 \leqslant \theta \\ \Pi_2^2 + (1+r)(\theta - k_2^1) & if & A_2 < A < A^* \text{ and } A^* < A \text{ and } k_2^1 \leqslant \theta < k_1^1 \\ \Pi_1^2 + (1+r)(\theta - k_1^2) & if & A_1 < A < A_2 \text{ and } k_1^1 > \theta \\ \Pi_2^2 + (1+r)(\theta - k_2^2) & if & A_2 < A < A^* \ , \ A^* < A \text{ and } k_2^1 > \theta \end{array} \right\}$$

II. Solving Household's Problem :

We know from Appendix-I that $M_2 = Y_2 + (1+r)(M_1 - C_1)$

Since $M_2 = C_2$, we have $M_2 = Y_2 + (1+r)(M_1 - C_1) = C_2$

Therefore,

$$L = \ln(C_1) + \beta \ln(C_2) + \lambda[Y_2 + (1+r)(M_1 - C_1) - C_2]$$

First order conditions are,

$$\frac{\partial L}{\partial C_1} = \frac{1}{C_1} - \lambda(1+r) = 0$$

$$\frac{\partial L}{\partial C_2} = \frac{\beta}{C_2} - \lambda = 0$$

Thus, $\frac{1}{C_1} = \lambda(1+r) \quad \rightarrow \quad \lambda = \frac{1}{C_1(1+r)}$ and $\lambda = \frac{\beta}{C_2}$

then, $\frac{1}{(1+r)C_1} = \frac{\beta}{C_2} \quad \rightarrow \quad C_2 = \beta(1+r)C_1$

We know that $C_2 = M_2$

$$\rightarrow M_2 = \beta(1+r)C_1$$

$$\rightarrow C_1 = \frac{M_2}{\beta(1+r)}$$

We know from Appendix-I that $M_2 = Y_2 + (1+r)(M_1 - C_1)$

$$\rightarrow C_1 = \frac{Y_2 + (1+r)(M_1 - C_1)}{\beta(1+r)}$$

$$\rightarrow \beta(1+r)C_1 = Y_2 + (1+r)(M_1 - C_1)$$

$$\rightarrow \beta(1+r)C_1 + (1+r)C_1 = Y_2 + (1+r)M_1$$

$$\rightarrow (1+\beta)(1+r)C_1 = Y_2 + (1+r)M_1$$

Therefore, consumption in the first period is $C_1 = \left(\frac{1}{(1+\beta)(1+r)}\right)Y_2 + \left(\frac{1}{1+\beta}\right)M_1$

Saving is $S = M_1 - C_1$

$$\rightarrow S = M_1 - \left(\frac{1}{(1+\beta)(1+r)}\right)Y_2 - \left(\frac{1}{1+\beta}\right)M_1$$

Thus, saving is $S = \left(\frac{\beta}{1+\beta}\right)M_1 + \left(\frac{1}{(1+\beta)(1+r)}\right)Y_2$

We know that $C_2 = \beta(1+r)C_1$

Therefore, consumption in the second period is

$$C_2 = \left(\frac{\beta(1+r)}{1+\beta}\right)M_1 + \left(\frac{\beta}{1+\beta}\right)Y_2$$

As a result, the first period consumption, saving, and the second period consumption are as the followings:

$$C_1 = \left(\frac{1}{1+\beta}\right)M_1 + \left(\frac{1}{(1+\beta)(1+r)}\right)Y_2$$

$$S=\left(\frac{\beta}{1+\beta}\right)M_1+\left(\frac{1}{(1+\beta)(1+r)}\right)Y_2$$

$$C_2=\left(\frac{\beta(1+r)}{1+\beta}\right)M_1+\left(\frac{\beta}{1+\beta}\right)Y_2$$

where

$$M_1=\left\{\begin{array}{lll} W+\theta & if & A<A_1 \\ \Pi_1^1+\theta-k_1^1 & if & A_1<A<A_2 \ , \ A_2<A<A^* \text{ and } k_1^1\leqslant\theta \\ \Pi_2^1+\theta-k_2^1 & if & A_2<A<A^* \text{ and } A^*<A \text{ and } k_2^1\leqslant\theta<k_1^1 \\ W+\theta & if & A_1<A<A_2 \text{ and } k_1^1>\theta \\ W+\theta & if & A_2<A<A^* \ , \ A^*<A \text{ and } k_2^1>\theta \end{array}\right\}$$

$$M_2=\left\{\begin{array}{lll} W+(1+r)(\theta+S) & if & A<A_1 \ , \ A_2<A<A^* \ , \ A^*<A \ , \ A_1<A<A_2 \text{ and } k_2^2>\theta+S \\ \Pi_1^2+(1+r)(\theta-k_1^1+S) & if & A_1<A<A_2 \text{ and } A_2<A<A^* \\ \Pi_2^2+(1+r)(\theta-k_2^1+S) & if & A_2<A<A^* \ , \ A^*<A \\ \Pi_1^2+(1+r)(\theta-k_1^2+S) & if & A_1<A<A_2 \ , \ A_2<A<A^* \text{ and } \theta+S>k_1^2 \\ \Pi_2^2+(1+r)(\theta-k_2^2+S) & if & A_2<A<A^* \ , \ A^*<A \text{ and } k_2^2<\theta+S<k_1^2 \end{array}\right\}$$

$$Y_2=\left\{\begin{array}{lll} W+(1+r)\theta & if & A<A_1 \\ \Pi_1^2+(1+r)(\theta-k_1^1) & if & A_1<A<A_2 \ , \ A_2<A<A^* \text{ and } k_1^1\leqslant\theta \\ \Pi_2^2+(1+r)(\theta-k_2^1) & if & A_2<A<A^* \text{ and } A^*<A \text{ and } k_2^1\leqslant\theta<k_1^1 \\ \Pi_1^2+(1+r)(\theta-k_1^2) & if & A_1<A<A_2 \text{ and } k_1^1>\theta \\ \Pi_2^2+(1+r)(\theta-k_2^2) & if & A_2<A<A^* \ , \ A^*<A \text{ and } k_2^1>\theta \end{array}\right\}$$

$$\Pi_1^1 = f_1^1 = k_1^1 + A\gamma_1^1$$

$$\Pi_2^1 = f_2^1 = k_2^1 + A\gamma_2^1$$

$$\Pi_1^2 = f_1^2 = k_1^2 + A\gamma_1^2$$

$$\Pi_2^2 = f_2^2 = k_2^2 + A\gamma_2^2$$

III. Lists of Capital-Intensive and Ability-Intensive Industries in PSID :

Capital-Intensive Industries are

- Mining
- Utilities
- Construction
- Manufacturing
- Wholesale Trade
- Transportation and Warehousing
- Accommodations and Food Services

Ability-Intensive Industries are

- Information
- Finance and Insurance
- Professional, Scientific, and Technical Services

- Management, Administrative and Support, and Waste Management Services
- Educational Services
- Health Care and Social Assistance
- Arts, Entertainment, and Recreation

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