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The Economics of Entrepreneurship: Subsidies, Risk and Tax Evasion

Dennis H. Barber III

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**THE ECONOMICS OF ENTREPRENEURSHIP: SUBSIDIES, RISK AND TAX
EVASION**

BY

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B.S., Business Administration, East Carolina University 2004

M.A., Economics, University of New Mexico 2010

DISSERTATION

Submitted in Partial Fulfillment of the
Requirements for the Degree of
Doctor of Philosophy

Economics

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DEDICATION

This dissertation is dedicated to Perseu Fernando dos Santos, Ph.D., my late friend, mentor and father-in-law. Perseu's guidance and support was a driving force behind my completion of this degree. You are loved and truly missed. Saudades, seu amigo Pilúla.

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ABSTRACT

Often times, policymakers develop legislation to increase the levels of entrepreneurial activity. These policies exist at the federal, state and local levels as part of economic development plans. This dissertation aims to offer information to policymakers on the effectiveness of existing policies and to evaluate how entrepreneurial individuals behave. There are three approaches taken in this dissertation. The first chapter presents a natural experiment and utilizes a difference-in-difference-in-difference model to investigate whether state level subsidies increased the health insurance take-up rate among the self-employed. The findings suggest that, in fact, these types of subsidies did increase the probability that a self-employed individual would be self-insured. The second chapter presents a laboratory, economic experiment, conducted in the U.S. and replicated in Brazil, which tests to see if entrepreneurial and non-entrepreneurial differ in their financial risk aversion levels. The results supported that entrepreneurial subjects were less risk averse than non-entrepreneurial subjects. Also, the subjects from the U.S. sessions were more entrepreneurial than those from Brazil. The final chapter presents an extension of the Ramsey model, a theoretical macroeconomic model. The model suggests that higher levels of tax evasion lead to lower levels of capital and consumption in a given economy at all points in time. Also, tax evasion leads to a decrease in government revenue. Finally, the model predicts that tax evasion will have no impact on the long-term economic growth rate, which is only determined by productivity growth.

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INTRODUCTION

Entrepreneurship is a driver of economic growth and is often included with labor, capital and technology as a factor of production when developing models of economic growth. This study will focus its efforts on presenting the implications of public policies on the behavior and choices of entrepreneurs. This dissertation offers analyses of experimental data, large microeconomic data sets and presents a theoretical macroeconomic model. The objective is to show how public policies affect entrepreneurship. Policies are not only important during the start-up phase of a business but also during the growth and development of a venture. Entrepreneurship policies should be all encompassing and should include efficient policies that help stimulate more entrepreneurial activity, support existing entrepreneurial activity and discourage inefficient activity. This dissertation hopes to provide more information for policy makers about how certain policies affect the behavior and choices of entrepreneurs and potential entrepreneurs.

Why is it important to dedicate an entire Economics dissertation to public policy and entrepreneurship from so many different angles? The primary motivation for the study was the often recognized relationship between entrepreneurship and economic growth. The study of the correlation between entrepreneurship and growth dates back to at least the 1930's when Joseph Schumpeter wrote about it and discussed the relationship between entrepreneurship and capitalism, among other subjects (1934). Entrepreneurship is now one of the recognized factors of production and determinants of economic growth. Entrepreneurs create markets, ideas, products, and employment, all of which contribute to growth. They also create new ways to combine labor and capital to produce new or

improved output. New business creation contributes to economic growth in many ways including converting ideas into new economic activities, increasing market competition, and creating a source for new employment and increased productivity (Kantis, Komori and Ishida 2002). Empirically, those countries that have introduced more support for entrepreneurship have experienced additional economic growth (Audretsch and Thorik 2000). It has been argued that entrepreneurship should be included in growth theory because of its ability to incorporate human capital, knowledge externalities and increasing returns to scale (Holcombe 1998).

However, looking at entrepreneurship and its effects on growth and development does not supply sufficient information for policy makers on how to increase national levels of entrepreneurial activity. Using the relationship between entrepreneurship and economic growth as motivation, this dissertation takes the opportunity to look at specific intersections between public policy and entrepreneurial activities.

One area where the federal and state level governments have supported the self-employed and small business owners is by subsidizing health insurance costs and the first chapter of this dissertation takes a closer look at the effects of state health insurance subsidies on the choice of the self-employed to insure. It has been argued that one of the driving factors in the rise of health insurance costs in the United States is the high level of uninsured. Also, the take up rate among the self-employed is suggested to be lower than that of wage-earners. Combining the relationship between uninsured and the cost of health care with the strong effect that the self-employed have on the level of uninsured, it becomes clear that policies effective at increasing the take up rate among the self-employed are important in helping reduce the cost of health care. The federal government

has tried to combat this since the implementation of the Tax Reform Act of 1986, which allowed the self-employed to deduct a percentage of their health insurance costs from their earnings. Subsequent federal policies followed and then around the year 2000, some states began to subsidize the insurance costs for small business owners.

Many studies have been conducted to determine the effects of the federal policies, or a combination of federal and state policies, on the take up rates among self-employed. However, few studies have focused on the effects of only the state policies while controlling for the changes in the federal policies. This information is very important for policy makers to determine if the subsidies, deduction allowances and premium discounts have effectively increased the take up rate, irrespective of the federal government efforts. This is where the first section of this dissertation adds to the existing body of literature. The study method includes a difference-in-difference-in-difference approach that helps isolate the effects of the state subsidies from those of the federal policies. Another important question that could be asked of the data is whether these subsidies encouraged a higher level of self-employment in the states that implemented health insurance subsidy programs, which is also investigated in the first chapter.

Another area where there is a debate about entrepreneurs and their behavior is when addressing the question of whether entrepreneurs have different risk aversion levels than non-entrepreneurs and if this difference in risk aversion is a driving factor in the decision to become an entrepreneur. The discussion about the risk aversion levels of entrepreneurs dates back to the late 1800s. At that time, many believed that a higher propensity for risk taking was a primary characteristic function of an entrepreneur. This discourse continued into the 1900s when Joseph Schumpeter began to question this

proposition. He was not convinced that risk taking, primarily financial risk taking, was necessarily an inherent behavioral characteristic of entrepreneurs. As this discussion continued into the mid to late 1900s, a more formal manner of data collection, storage and analysis became prevalent. Therefore, this principally theoretical discussion could now begin to be tested empirically. Even as empirical methods improved and access to data became easier, the disagreement continues. This discrepancy in the literature has strong public policy implications. If a policy maker decides to subsidize start-up costs, then only the people that are less risk averse will first take advantage of the subsidy. Often times, it is argued that subsidizing this type of behavior will encourage inefficient entry into the market. Only the less risk averse will take advantage of the subsidy and these individuals often times are the ones willing to take further risks in order to ensure their business is a success. If the subsidy is too high then it will certainly create a market flooded with inefficient business owners who thought that the subsidy was high enough to protect them against the risk of his or her business failing.

On the other hand, it could be the case that potential entrepreneurs are no less financially risk averse than those who plan to remain wage-earners. If this scenario holds true then a subsidy that protects potential entrepreneurs from financial risk will not encourage entrepreneurial entry. Therefore, it is an inefficient use of tax dollars. Not only is it important to note whether there are differences in risk preference when deciding to subsidize start-up costs but also when deciding on subsidizing innovative activities for existing businesses. The same argument exists here as before. Information on the risk preferences of entrepreneurs gives legislators the ability to better target subsidies and other support programs for entrepreneurs. If entrepreneurial ventures are not innovating

and the government wants to increase their innovative capacity then information as to whether innovation is not taking place because of the hesitation of entrepreneurs to take financial risk is imperative.

The second chapter of this dissertation examines whether there is a difference in the financial risk taking behaviors among more and less entrepreneurial individuals. This is done so by employing an economic experiment. This is where this paper adds to the literature. As the experimental economic literature is rich with risk studies, very few of these studies focus on determining if there is a difference in the risk preferences of entrepreneurs versus non-entrepreneurs or entrepreneurial people versus non-entrepreneurial. The information on the risk preferences of entrepreneurs is also useful when designing policies to discourage informal economic activities. If an entrepreneur is less risk averse then it may take high penalties and a high probability of being caught to discourage them from participating, at least in part, in the informal sector.

This is where the final chapter of the dissertation comes in and presents a theoretical macroeconomic model that shows the economic impacts of tax evasion. A self-employed individual can more easily evade taxes by underreporting income and falsifying deductions. This ease of tax evasion is one of the often cited reasons why some individuals choose entrepreneurship over wage earning. This chapter also takes some time to present literature on the state of informal economics throughout the world.

This dissertation takes a wide range of approaches in modeling and empirically analyzing the behaviors of entrepreneurs. There are two empirical chapters; one which uses a large household level data set and the other employs an experiment to generate new data. As both of the first two chapters include a brief theoretical explanation of what

is expected to be seen in the results or in the real world, the final chapter employs the Ramsey model to explain the effects of tax evasion. Hopefully, some of the findings in this dissertation can be used to inform policy makers that are either interested in developing new policies to encourage entrepreneurial activity or determine if previously implemented policies have had the intended effects.

CHAPTER 1

STATE HEALTH INSURANCE SUBSIDIES AND THE SELF-EMPLOYED

Abstract

Many of the studies addressing the effectiveness of health insurance subsidies on the take-up rate of the self-employed have focused on either federal policies, such as TRA86 and OECSA, or the federal policies in combination with state policies. We are interested in isolating the effects of the state subsidy programs on take up rates. We are also interested in determining whether state health insurance subsidies have increased the probability that an individual would choose to become self-employed. Using a difference-in-difference-in-difference approach, this natural experiment isolates the effects of the state policies from the federal policy effects by comparing a group of states that subsidize the cost of health insurance with a group of similar states that have not implemented such policies. We find that a self-employed individual in the treatment states was more likely to be covered by private insurance after the state subsidized the cost of health insurance. However, we do not find that the subsidies increased the probability that an individual would choose to become self-employed.

Health insurance concerns

Two of the driving issues in the recent debate over a public health program are the number of uninsured and the high cost of health insurance. In 2009, over 50.6 million people in the U.S. were without health insurance (DeNava-Walt, Proctor and Smith 2009). The average health insurance premium for a family of four in 2009 was \$13,770 and \$5,049 for a single individual, as reported by the Kaiser/HRET (2010) annual survey. These statistics exist in spite of policy changes intended to reduce the number of uninsured over the past 20 years. During the health care debate, tax credits that lowered premiums were proposed as an effective way to increase demand for health insurance. If adverse selection is present then individuals with less health risks choose not to participate in the insurance markets. Lowering the premium would increase the pool of “healthy” purchasers of health insurance. However, some studies have found that adverse selection did not exist in certain health insurance markets (Swartz and Garnick 2000). If this describes current health insurance markets, lower premiums will not attract healthier people into the pool. However, by making insurance more affordable, lower premiums can increase the take up rate even in the absence of adverse selection. Health insurance subsidies have been found to have a significant effect on the take up rate of the uninsured (Heim and Lurie 2009). Hence, before any new subsidies are implemented, it seems appropriate to determine the efficiency of previous policies.

This paper will focus specifically on the impact of state health insurance subsidies on the take up rate for privately insured self-employed. Because the insurance programs used in this analysis offer subsidies for the purchase of private insurance, we did not include total insurance coverage rates, only the effects on the probability of being

privately insured. The self-employed sector of the population is a force in low rates of insurance coverage. In 2004, 77.9% of adults in employed families were covered as opposed to 47.9% of adults in self-employed families (Selden 2009). In Selden's study, a self-employed family includes the self-employed person, his or her spouse and other family members living in the same household. An employed family was defined as a family where the head of the household was employed but not self-employed. It was estimated that, using Schedule C filing as a proxy for self-employment, an increase of 5% in the number of self-employed could translate into a 1% increase in the uninsured population (Cebula 2006).

The Tax Reform Act of 1986 (TRA86) allowed self-employed individuals to deduct 25% of the costs of health insurance from their taxable income on their federal income tax returns. The Omnibus Consolidated and Emergency Supplement Act (OCESA) of 1998 gradually increased this deductibility, until finally in 2003 the self-employed were able to deduct 100% of their health insurance expenditures. Since these changes, some states have followed suit and implemented their own form of health insurance subsidies designed to lower the cost of health insurance for the self-employed and small businesses. Many current health insurance subsidy studies focus on the federal and state policies simultaneously or they consider only the effects of the federal policies. Our approach is distinguished from the standard difference-in-difference approach (DID). By controlling for the effects of the federal policy changes, this paper uses a difference-in-difference-in-difference (DDD) approach. In this way we isolate the effects of state insurance subsidies on the self-employed. The three differences are whether the person is self-employed (1), living in a state that implemented a subsidy (2) after the subsidy was

implemented (3). I test the effectiveness of such state policies by addressing two research questions. First, have the state health insurance subsidies increased the likelihood that a self-employed individual will purchase health insurance? And second, have state health insurance subsidies increased the likelihood that a person will become self-employed?

Health insurance subsidies and take-up rates

As the price of a good decreases (increases) we expect the quantity demanded of that good to increase (decrease) by an amount that depends on the price elasticity of demand. It is important for policy makers to be aware of the price elasticity of demand for health insurance when subsidizing the purchase of this good. Many studies find that the price elasticity for insurance is very low which leads to small increases in take-up rates when insurance premia fall. However, there is no consensus on the true value of the take-up rate.

Evidence for the price elasticity of insurance take-up is mixed. Feldstein and Friedman (1977) found a large impact of the price of insurance on the amount of insurance purchased, using simulations. Holmer (1984) finds a price elasticity of -0.16 and believes that it is important to determine why earlier studies find dramatically different results. Holmer asserts that the previous studies used the expected utility model to explain how people made choices of health insurance plans under uncertainty and they overestimated the price elasticity. He proposes that the theoretical framework for viewing this choice behavior could be Kahneman and Tversky's (1979) prospect theory as opposed to the conventional expected utility model. Prospect theory, as it relates to the purchase of insurance, asserts that insurance is not a way to reduce uncertainty but that people insure from a gain perspective (P. Schneider 2004). Therefore, people may choose

not to purchase insurance because they expect to pay less for their health risk than a deviation from the optimal risk level. Hence, individuals have a risk preference with respect to losses and will only insure if the loss will occur with certainty and not because they are risk averse as predicted by expected utility theory (P. Schneider 2004).

Shoemaker (1982) and Slovic and Lichtenstein (1983) have shown the empirical inadequacy of the expected utility model. More recently, Gruber and Washington (2005) estimated a price elasticity closer to -0.02, which is even lower than Holmer's estimate, suggesting little response to changes in the price of insurance. Their study focused on employee premiums and they concluded that subsidies are not a cost effective way to increase coverage.

These elasticities measure the responsiveness of insurance purchases to changes in the price of insurance. Gruber and Levitt (2000) evaluated a number of different tax policies and their potential impact on the number of uninsured. They conclude that even the most effective tax policy they evaluated would cost about \$40 billion per year and would only cover about 30% of the uninsured. This is similar to Blumberg et al.'s (2001) conclusion that subsidies will have to be very large to induce uninsured workers to purchase insurance. Other studies have actually tried to estimate the effects of specific subsidy programs on the take-up of health insurance. Long and Marquis (2002) found that decreasing insurance premiums to only \$10 would have a small impact and one-third of eligible adults would still remain uninsured. They used a conditional logit model to explain the choice of health insurance status including the existence of subsidies and public health insurance options. It was interesting that over 37% of the individuals below the poverty line were not aware of the public options that were available to them.

Marquis et al. (2004) showed that a 50% subsidy would only reduce the number of uninsured by 4-8%, specifically focusing on the impact of a state subsidy package in California. Auerbach and Ohri (2006) suggested that a 50% subsidy would only increase the purchased coverage by 4.4%. This study specifically focused on non-group health insurance.

Approximately 30% of the uninsured in 2009 had a household income of less than \$25,000 (DeNava-Walt, Proctor and Smith 2009). Given this information, the behavior of low income households in response to a subsidy is important. Thomas (1994), using data from the 1977 National Medical Care Expenditure Survey, found that a person's income must rise above 125% of the poverty line before the family is likely to purchase insurance. Thomas concluded that only families above the poverty line would be likely to purchase health insurance. This could be a result of public programs, such as Medicaid, that are available and act as substitutes for private insurance.

In sum, many of the most recent studies suggest that investing tax dollars in subsidizing health insurance would have a very small impact in the likelihood that an individual will decide to purchase insurance. However, policy makers continue to push for tax credit and deductions to cover the cost of insurance at both the federal and state levels.

Health insurance and self-employment

The previous studies reviewed here did not focus specifically on the impact of the health insurance subsidies on the self-employed but on the general effects of health insurance subsidies. Using CPS data and employing a DID approach, Gruber and Poterba (1994) took a closer look at the evidence from the self-employed and conclude that the

self-employed are extremely responsive to changes in the cost of health insurance. Their findings suggest that a 1% increase in the cost of insurance coverage reduces the probability that a self-employed household will insure by 1.8%. An open question is whether the self-employed are as responsive to a price decrease as they are to a price increase. If this is not necessarily the case then it lends support to the prospect theory view for the purchase of health insurance by the self-employed.

Studies are inconclusive regarding the question of the effects of the subsidy on the behavior of the self-employed. Heim and Lurie (2009) find that changing the price of insurance had a moderate effect on the number of self-employed individuals who purchase insurance and the amount of insurance that they purchase, estimating a take-up rate of about -0.3. A much higher elasticity was estimated by Seldon (2009), -1.9, which implies that an increase in tax subsidies will increase the coverage among the self-employed significantly. His simulations of responses to the federal and state increases in subsidies after 1996 found increases of 1.1 million persons in the number of self-employed with private coverage in 2004. Given recent increases in insurance premiums, subsidies have to increase by at least the same amount to be effective in reducing the after tax price of health insurance for the self-employed. On the other hand, Gumus and Regan (2009) concluded that the self-employed respond very little to reductions in the cost of health insurance.

Besides the take-up rate, it is important to identify whether such subsidies will entice potential self-employed individuals to start their own business. After examining the impacts of the TRA86 and the Omnibus Reconciliation Act of 1993 (OBRA93), Moore (2003) found that the reforms (including subsidies) had no significant effect on

the decision to become self-employed. The self-employed have a significant impact on the percentage of persons not covered by health insurance (Cebula 2006). It is important to identify whether the potential self-employed individuals would respond to incentives such as tax deductions, credit or other forms of subsidies by deciding to start their own business. On the margin, these policies reduce the cost of self-employment. The opportunity to obtain lower cost health insurance could tip an uninsured wage earner toward entrepreneurship. Holtz-Eakin et al. (1996) found insured wage-earners to be no less likely to start their own business than their uninsured counterparts.

Why would we want to subsidize health insurance for the self-employed?

Conventional economic theory tells us that when health insurance is subsidized for the self-employed then more self-employed individuals will purchase health insurance. This paper asks whether this is the case and whether state health insurance subsidies have increased the likelihood that workers will choose to become self-employed. The proponents for such subsidies insist that they will decrease the number of self-employed that are uninsured and it will increase the number of potential self-employed individuals that start their own business. Also, if the goal of health policy is to decrease the percentage of uninsured in the population then concentrating part of their effort on the self-employed proves to be valuable due to the large percentage of self-employed which is uninsured.

Besides reducing the percentage of uninsured, why else should we be concerned with supporting the self-employed? The self-employed sector of the population is a driving force for growth and innovation. Many researchers suggest that small and medium-sized businesses have the capacity to be very innovative (Nooteboom 1994;

Rothwell and Dodgson 1994; Van Dijk, et al. 1997; Dahl and Moreau 2002). The self-employed are only one type of entrepreneurs. Individuals which are wage-earners could also behave in an entrepreneurial manner if that type of behavior is supported by the organization. Self-employed are quite often regarded as unemployed as opposed to entrepreneurs. But for the purpose of this chapter, a self-employed individual is aligned with an entrepreneur. The study of the correlation between entrepreneurship and growth dates back to at least when Joseph Schumpeter (1934) wrote about it and discussed the relationship between entrepreneurship and capitalism, among other subjects.

Entrepreneurship is now one of the recognized factors of production and determinants of economic growth. Entrepreneurs create markets, ideas, products, and employment, all of which contribute to growth. New business creation contributes to economic growth in many ways including converting ideas into new economic activities, increasing market competition, and creating a source for new employment and increased productivity (Kantis, Komori and Ishida 2002). Empirically, those countries that have introduced more support for entrepreneurship have experienced additional economic growth (Audretsch and Thorik 2000). It has been argued that entrepreneurship should be included in growth theory because of its ability to incorporate human capital, knowledge externalities and increasing returns to scale (Holcombe 1998). Finally the self-employed (entrepreneurs) are some of the most innovative actors in society and innovation is key for the recovery of certain economic sectors (Bosma and Levie 2009). Therefore, it is in policymakers' best interest to create legislation that encourages growth of start-up businesses.

There are many other barriers, besides the cost of health insurance, to starting your own business including financial risk, start-up costs, capital investment, payroll

taxes, etc. With all of these other factors, lowering the price of health insurance may not play a major role in the decision to become self-employed. If start-up costs are possible barriers to entry then researchers have asked if subsidizing these costs should encourage more self-employment. High start-up costs reduce the rate at which new businesses are started (Fonseca, Lopez-Garcia and Pissarides 2001). But subsidizing entry may reduce the revealed differences between less efficient and more efficient firms, which may lead to inefficient firms entering the market (Kösters 2009).

State health insurance subsidies

Not every state has implemented subsidies of health insurance premiums for small businesses. And no two state policies are exactly alike. Among some of the policy differences are the sizes of small businesses that are eligible to receive the subsidy, employee income restrictions, level of the subsidy, date of implementation, minimum employee participation, and required employer contribution. Table 1 presents some information on the general restrictions and inclusions for each state with subsidies that were included in our analysis.

In the Health Insurance Premium Tax Credit program (Arizona), for a small business to be eligible to receive the subsidy, they must have had between two and 25 full-time employees during the last year, not offered health insurance for the previous six months, and been operating in Arizona for the past year (Health Insurance Premium Tax Credit 2010). Also, small businesses can participate in the program for a maximum of three years and can only change insurance providers on the day of annual renewal. The Insurance Coverage Affordability and Relief to small Employers (ICARE) in Kentucky began in 2007. As of now, they are not accepting new applications but are accepting

renewals. Maine's DirigoChoice plan of 2008 offers programs to small businesses with 2-50 employees and also has an option for sole proprietors. Maine offers three different plans for its enrollees with different deductibles but identical benefits.

The proponents of the Working Families and Small Business Health Coverage Act of Maryland hope that over 100,000 uninsured will gain coverage (Working Families & Small Business Health Coverage Act 2010). To be eligible a small business must have only 2-9 full-time employees, have average wages below \$50,000 and have not offered insurance to their employees for the past 12 months (Working Families & Small Business Health Coverage Act 2010). The self-employed in Massachusetts have to meet certain eligibility requirements to be covered by the Insurance Partnership including but not limited to: be between the age of 19-64, live in Massachusetts, have a family income that is no more than the standard income and, of course, be self-employed (Insurance Partnership for Employees 2010). Insure Montana is a state funded program that can assist small business owners in two ways. One is through the Purchasing Pool Program (for businesses who do not currently offer a group plan) and the other is through the Tax Credit Program (for businesses who do currently offer coverage) (Insure Montana 2010). The State Coverage Insurance program in New Mexico covers small businesses with 50 or less employees, including self-employed sole proprietors. The annual benefits are capped at \$100,000 and are targeted towards the uninsured (State Coverage Insurance Frequently Asked Questions 2010). Finally, CoverTN is a low-cost coverage plan for small businesses and individuals in Tennessee. Employers must: be located in Tennessee, have 50 or fewer full-time employees with 50% of them earning less than \$55,000 per year, pay one third of the premium, and have not offered coverage in the past six months

(CoverTN Eligibility 2010). Thus, most state plans target small firms whose employees do not earn high wages and do not already have access to employer provided health coverage.

Table 1. Health Insurance Subsidy Characteristics by State

State	Name of Program	Size of employer	Year Started	Level of subsidy
Arizona	Health Insurance Premium Tax Credit	2-25 eligible employees	2006	Lesser of: \$1,000 for each employee (single coverage); \$3,000 for each employee (family coverage); or 50% of annual premium
Kentucky	ICARE	2-25 eligible employees	2007	\$3,000 for each employee (family coverage); or 50% of annual premium \$40 per employee/month; Employee with a high-cost condition - \$60/month
Maine	Dirigo Choice	2-50 eligible employees	2008	Premium discounts and cost-sharing reductions
Maryland	Working Families and Small Business Health Coverage Act	2-9 eligible employees	2008	Lesser of: \$2,000 for each employee; or 50% of the premium
Massachusetts	Insurance Partnership	2-50 eligible employees	2008	\$33.33/month (individual); \$66.66/month (couple or one adult/one child); \$83.33/month (family)
Montana	Insure Montana	2-9 eligible employees	2005	Premium assistance
New Mexico	State Coverage Insurance (SCI)	1-50 eligible employees	2005	Employers pay \$75, and enrollees pay up to \$35 depending on income
Tennessee	CoverTN	1-50 eligible employees	2008	Premium discounts

*Source: Henry J. Kaiser Family Foundation. Data as of February 2010 and can be accessed at <http://www.statehealthfacts.org/comparereport.jsp?rep=4&cat=7>

Data and empirical approach

I used data from the 2002 and 2009 Current Population Survey (CPS), with 2002 representing the before policy year and 2009 representing the after policy year. The March Supplement asks Health Insurance related questions and was used for this study.

The data are collected for each individual in the household but the labor data is only collected for those 15 years or older (Technical Documentation Current Population Survey 2009). The disabled and those not between the ages of 19 and 64 were dropped from the sample.

To answer the two questions of interest, we exploit a natural experiment. The treatment group consists of states that have implemented a subsidy for the purchase of health insurance by small businesses or the self-employed. These states are Arizona, Kentucky, Maine, New Mexico, Maryland, Massachusetts, Montana and Tennessee. The control group consists of states that have not implemented such policies but are similar to the treatment states with regards to their median income and industry mix. The control states are Colorado, West Virginia, Ohio, Nevada, New Jersey, Rhode Island, North Dakota and Alabama. Table 1A, in the Appendix, presents some comparative statistics between the treatment and control states.

Table 2 presents variable descriptions and the summary statistics. The income variable was reported as a continuous variable representing the amount of income earned in the previous year. The occupation variable was reported by choosing from one of eleven different categories of occupations. The years of education variable was estimated using the information given in the data. Table 2A, in the Appendix, shows the conversion from the variable reported in the data to the form of the variable used in the analysis. In the sample, an individual was considered married if they reported themselves as married with civilian spouse present or married with armed forces spouse present.

A person in the sample was considered self-employed if they reported themselves as self-employed incorporated or self-employed not incorporated as their class of worker.

Table 2. Variable Descriptions and Summary Statistics

Variable Name	Description	Mean	Std. Dev.
<i>Private Insurance</i>	Indicator Variable for having private insurance	.780	.414
<i>age</i>	Age in years	40.356	11.944
<i>male</i>	male = 1	.472	.499
<i>married</i>	married = 1	.619	.486
<i>White</i>	White, Non-hispanic	.721	.448
<i>Black</i>	Black, Non-hispanic	.100	.300
<i>Native</i>	American Indian or Aleut Eskimo	.010	.102
<i>Asian</i>	Asian or Pacific Islander	.042	.201
<i>Hispanic</i>	Hispanic	.120	.325
<i>income</i>	Annual Income from Previous Year in Dollars	\$39,096	\$49,222
<i>education</i>	Number of years of education	13.615	2.860
<i>kids</i>	Number of children	.914	1.123
<i>self_employed</i>	Indicator variable equal to 1 if self-employed	.083	.275
<i>subsidy</i>	Indicator variable equal to 1 if in subsidy state	.458	.498
<i>after</i>	Indicator variable where before policy (2002) = 0 and after = 1	.462	.499
<i>management</i>	Indicator variable equal to 1 if in management, business or financial occupations	.153	.360
<i>professional</i>	Indicator variable equal to 1 if in professional or related occupations	.198	.399
<i>service</i>	Indicator variable equal to 1 if in service occupations	.073	.261
<i>sales</i>	Indicator variable equal to 1 if in sales and related occupations	.087	.283
<i>administrative</i>	Indicator variable equal to 1 if in office and administrative support occupations	.123	.328
<i>farming, fishing and forestry</i>	Indicator variable equal to 1 if in farming, fishing or forestry occupations	.002	.047
<i>construction</i>	Indicator variable equal to 1 if in construction and extraction occupations	.026	.160
<i>maintenance</i>	Indicator variable equal to 1 if in installation maintenance and repair occupations	.061	.240
<i>production</i>	Indicator variable equal to 1 if in production occupations	.066	.248
<i>transportation</i>	Indicator variable equal to 1 if in transportation and material moving occupations	.040	.197
<i>armed forces</i>	Indicator variable equal to 1 if in Armed Forces occupations	.019	.136

Source: 2002 and 2009 Current Population Survey

The variable representing the number of children only takes into account children that were never married and were under the age of 18 at the time of completing the survey.

The theoretical model that motivated the empirical model to answer the first question of interest is below. The data was available to test most of the theoretical model less the health

$$\begin{aligned} \text{Private Insurance}_t = & \alpha \text{age}_t + \beta \text{gender}_t + \gamma \text{marital status}_t + \\ & \delta \text{ethnicity}_t + \theta \text{occupation}_t + \lambda \text{income}_t + \mu \text{education level}_t + \\ & \rho \text{number of kids}_t + \tau \text{health status}_t \end{aligned}$$

status variable. Based on the consensus in the literature it is assumed that are older, married, with kids and higher incomes would be more likely to purchase private health insurance. Also, it was important to control for the type of occupation because individuals employed in occupations with higher risk of injury would be more likely to purchase health insurance. Missing in the estimation is a measure of health status which was not available in the data. A presence of adverse selection in the health insurance market would imply that less healthy individuals are more likely to purchase health insurance.

I employed a difference-in-difference-in-difference (DDD) approach using a logit model. This type of model is often used for policy analysis, specifically to determine the effectiveness of a policy. Once a policy has been implemented for a number of years and has been given the opportunity to take effect the DD or DDD model is a great candidate for determining the effectiveness of the policies. This type of model is used when a natural experiment can be developed. It was a great model for the data that was used for this study to determine if the subsidies had the intended consequences on the target

population, the self-employed. The dependent variable represents whether the individual purchased health insurance privately or not. The variable of interest for the DDD is the variable that interacts whether an individual is self-employed, whether an individual is from a state with a subsidy program or not and whether we are looking at before or after the policy implementation.

Model (1) below was used to determine whether or not the policy was effective in increasing the probability that a self-employed individual will purchase health insurance. The variable of interest is self-employed, subsidized and after policy year, our DDD variable, which interacts *self_employed*, *subsidy*, and *after* multiplicatively.

$$priv_ins_t = \alpha + \beta X_t + \gamma Z_t + \delta self_sub_after \quad (1)$$

X_t contains the covariates *age*, *male*, *married*, ethnicity variables (*white*, *black*, *Native*, *Asian*, and *Hispanic*), *lninc* (natural log of *income*), occupation type variables¹ and *kids*. These covariates were included because of their impact on the choice to purchase private insurance. Z_t includes dummies (and all of the interaction terms) for self-employed, whether the individual was in a state that offered a subsidy or not and if we are looking at before or after the policy implementation. The coefficient δ is of the most interest. If δ is positive and statistically significant then self-employed individuals in states that have subsidized the purchase of health insurance after the start of the policy are more likely to be covered by private health insurance. The literature, as presented earlier, is undecided as to whether subsidies are effective, therefore, it is assumed that there will be no effect of the subsidy on the likelihood to become self-employed.

¹The occupation categories are as follows: 1) Management, business and financial occupations 2) Professional and related occupations 3) Service occupations 4) Sales and related occupations 5) Office and administrative support occupations 6) Farming, fishing and forestry occupations 7) Construction and extraction occupations 8) Installation, maintenance, and repair occupations 9) Production occupations 10) Transportation and material moving occupations 11) Armed Forces

Model (2), which was used to test whether the policy increased the probability that an individual would choose to become self-employed, was motivated by the following theoretical model. Age has been deemed important in the decision to become an entrepreneur by the job-

$$\begin{aligned} Self\ Employed_t = & \alpha age_t + \beta gender_t + \gamma marital\ status_t + \delta ethnicity_t + \\ & \theta occupation_t + \lambda income_t + \mu education\ level_t + \rho number\ of\ kids_t + \\ & \phi personal\ savings_t + cost\ of\ health\ insurance_t + \eta social\ environment_t \end{aligned}$$

shopping models employed by Miller (1984) despite the fact that Evans and Leighton (1989) find that the decision to become an entrepreneur is independent of age and that men are more likely to be entrepreneurs. Some occupations have more opportunities for entrepreneurship and some industries will have fewer barriers to entry. Meyer (1990) reports that the percentage of black business owners is about one-third that of whites. Therefore, the theoretical model includes a control for ethnicity. Liquidity constraints have been found to be important in the choice to become self-employed, where those with insufficient funds are less likely to become self-employed (Evans and Jovanovic 1989; Branchflower and Oswald 1998) and therefore the theoretical model includes a control for income. Ideally, I would control for personal savings but I did not have this variable in the data and was not able to include this in the empirical analysis.

Theoretically, I would control for the cost of health insurance but that data were not available either. The social environment of an individual including exposure to other family members being self-employed or a close friend deciding to become self-employed have a statistically significant effect on the choice to become self-employed (Djankov, et al. 2008). We were able to control for the demographic information but did not have the

necessary data to see if controlling for the social environment would have changed the results.

The main variable of interest in Model (2) is the DID variable, *subsidy_after*, which interacts *subsidy* and *after* multiplicatively.

$$self_employed_t = \alpha + \beta X_t + \gamma Z_t + \delta subsidy_after \quad (2)$$

Once again, X_t contains the covariates *age*, *male*, *married*, ethnicity variables (*white*, *black*, *native*, *Asian*, and *Hispanic*), *lninc*, occupation type variables and *kids*. Z_t includes dummies (and all of the interaction terms) for whether the individual was in a state that offered a subsidy or not and if we are looking at before or after the policy implementation. The coefficient δ is still of the most interest. If δ positive and statistically significant then the health insurance subsidies increased the probability that an individual will choose to become self-employed.

Results

The results from the logit models (1) and (2) are shown in Table 3. Of the covariates, age, gender, marital status, ethnicity, income, number of children and years of education were all statistically significant. The older the individuals were the more likely to be insured; males were less likely to be insured; married individuals were more likely to be insured; those with higher income and more years of education were more likely to be insured; and the more children you have the less likely you are to be insured. At first glance, it seemed strange that the probability of being insured would decrease with the number of children. But household expenses increase with the number children and therefore, there may be less disposable income to purchase health insurance. Also, the

price of health insurance increases with the size of a family and individuals may no longer be able to afford the health insurance premiums.

Table 3. Logit Regression Results (Marginal Effects)

VARIABLES	(1) <i>priv_ins</i>	(2) <i>self-employed</i>
<i>age</i>	0.0016*** (0.0001)	0.0034*** (0.0001)
<i>male</i>	-0.0067* (0.0038)	0.0384*** (0.0028)
<i>married</i>	0.1580*** (0.0044)	0.0199*** (0.0030)
<i>white</i>	0.0735*** (0.0224)	0.0199*** (0.0111)
<i>native</i>	-0.2630*** (0.0194)	Not significant
<i>hispanic</i>	-0.0543** (0.0085)	Not significant
<i>lninc</i>	0.0131*** (0.0006)	-0.0169*** (0.0006)
<i>educ</i>	0.0250*** (0.0007)	0.0044*** (0.0005)
<i>kids</i>	-0.0081*** (0.0017)	0.0139*** (0.0012)
<i>sub_self_after</i>	0.0401** (0.0192)	
<i>sub_after</i>	-0.0084 (0.0074)	0.0003 (0.0051)
Observations	70320	58217

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

Gruber and Poterba (1994), Hein and Lurie (2009) and Selden (2009) all find that the self-employed health insurance take-up rate increases with a decrease in the price of health insurance, even though their estimated price elasticity differed. Gumus and Regan (2009) find that the self-employed are not responsive to changes in the price of health insurance. In this analysis, price data is not included and actual take-up rates are not calculated. The first question of interest is *have the state health insurance subsidies increased the likelihood that a self-employed individual will purchase health insurance?*

The coefficient of the DDD variable, *sub_self_after*, which interacts *self_employed*, *subsidy* and *after*, had a value of 0.0401 and was significant at the 5% level.

Therefore, the probability that a self-employed individual in a state that had implemented a subsidy would be covered by private insurance increased by about 4 percentage points after the subsidies were implemented when compared to the self-employed in the control states. This finding is consistent with some of the findings in the literature but the debate of the effectiveness of subsidies will continue. We ran model (1) and redefined our dependent variable as having private insurance in your own name. Our results were different. We found no statistically significant impact of the subsidy on take up rates in this case. This lends support to the possibility that the take up rates increased because more people became insured by their spouse's insurance plans but we have no reason to believe this was the case.

Now for the second question, *have state health insurance subsidies increased the likelihood that a person will become self-employed?* The results suggest that the subsidies were not enough to increase the probability that an individual in the treatment states after the policies would decide to become self-employed. This is not surprising and the findings supported those of Moore (2003). The determinants of the choice to become self-employed involve much more than the cost of health insurance. By comparing the theoretical model to the empirical model, we can see that there are many other factors including the cost of insurance, personal savings and the social environment for which I was not able to control.

Conclusion

Many of the studies addressing the effectiveness of health insurance subsidies on the take-up rate of the self-employed have focused on either federal policies, such as TRA86 and OECSA, or the federal policies in combination with state policies. This natural experiment isolates the effects of the state policies from the federal policy effects by looking at a group of states that subsidize the cost of health insurance as a treatment group and a group of similar states that have not implemented such policies as a control group. We were able to do so because there were no changes to the federal policy after 2003 and it applied to all states. We find that a self-employed individual in the treatment states after the state subsidized the cost of health insurance was more likely to be covered by private insurance. This finding adds to the debate as to whether health insurance subsidies are an effective approach to lower the amount of uninsured in the U.S. With the implementation of a public health care option, this body of research will continue to be important.

However, we do not find that the subsidies increased the probability that an individual would choose to become self-employed, which is not surprising due to the number of other factors involved in this decision. Subsidizing entry (e.g. health insurance costs) or start-up costs may cause an increase in the number of inefficient firms to enter the market. This could cause an increase in the failure rate of new businesses. However, it is hard to determine a “healthy” rate of business failure (Holtz-Eakin 2000).

One weakness of this study is that the CPS data is not collected to represent the smaller U.S. states sufficiently and therefore may be underrepresented in our data. Also, this paper does not discuss any of the policy changes brought on by the recent healthcare

reform. The reform increases some of the subsidies by increasing the type of deductions that can be made for health care costs for small businesses. Also, we did not have data on health status. That would have been useful to include in the covariates to account for adverse selection in this market. Further, the natural experiment could be compromised if the control states and the treatment states reacted differently to the recent recession. The after policy year is 2009, which is at the height of the recent recession.

CHAPTER 2

ENTREPRENEURIAL SUBJECTS AND FINANCIAL RISK DECISIONS: AN EXPERIMENTAL EXAMINATION OF AN AMERICAN AND BRAZILIAN SAMPLE

Abstract

There are risks involved when starting a business, but as entrepreneurs take this risk they are creating jobs and supporting local economic development. This paper employs an economic experiment to determine if there is a difference between the risk aversion levels of entrepreneurial and non-entrepreneurial subjects when making a risky financial decision. The experiment was conducted in the United States and replicated in Brazil, therefore, we were able to conduct a cross country comparison. In the U.S., 78 students participated and 54 in Brazil. Using the Entrepreneurial Attitude Orientation, subjects were categorized as either entrepreneurial or not. Entrepreneurial subjects invested into a risky asset at a higher rate than the non-entrepreneurial subjects, although not all tests showed statistical significance. Also, the entrepreneurial subjects from Brazil invested into the risky asset at a higher rate than the U.S. entrepreneurial subjects. First round investment results affected the investment decisions in the second round suggesting the existence of the hot hand and gambler's fallacy phenomena.

Introduction

Frank Knight and Joseph Schumpeter differed greatly in their theories of the risk taking attitudes of entrepreneurs. Knight (1921) asserted that entrepreneurs took financial risks when starting their own enterprise and therefore could be deterred by liquidity constraints. Knight believed that it was part of the basic function of an entrepreneur to bear more financial risk than other actors in an economy. However, Schumpeter (1934) asserted that the entrepreneur and the capitalist were two different actors in the economy and therefore the financial risk was taken on by the capitalist, not the entrepreneur. For Schumpeter, the capitalist is the person responsible for financing entrepreneurial ventures and he believed that this individual was not the entrepreneur himself. Therefore, the capitalist was taking on the majority of the financial risk. The design of the experiment in this chapter does not distinguish between an entrepreneur and a capitalist.

The literature is rich with a theoretical view of the risk aversion levels of entrepreneurs. This paper expands an empirical literature that includes very few experiments. The paper examines if entrepreneurial subjects differ in their financial risk behavior when compared to non-entrepreneurial subjects. This is one of the first economic experiments that tests the differences in risk behaviors between more and less entrepreneurial subjects. One hypothesis that is tested is whether entrepreneurial subjects are less financially risk averse than non-entrepreneurial subjects, following the Knightian view.

For policymakers, it is important to know if a potential entrepreneur is more risk averse when making financial decisions. If liquidity constraints are a barrier to entry for entrepreneurs then public policy can be designed to help cushion some of the risk, for example, subsidizing start-up costs. Manufacturing and hi-tech entrepreneurial ventures

normally require a large amount of start-up capital. If potential entrepreneurs are no less risk averse than their counterparts then subsidizing this capital does not incentivize more entrepreneurial activity. However, even if there is no difference in risk perception between entrepreneurs and non-entrepreneurs, a subsidy would still overcome liquidity constraints. Therefore, it would be difficult to determine which barrier was eased due to the subsidy.

The experimental subjects are categorized as entrepreneurial or not based on the results of the subjects' responses to the Entrepreneurial Attitude Orientation (EAO). This is an attitudinal survey. Over the recent years, there has been a trend in social science experiments to look at personality and behavior scales to try to explain differences in the way subjects perform in experiments (Ben-Ner and Kramer 2011; Boon, Bradander and Witteloostujin 1999; Deck, Lee and Reyes 2010; Ho, Weingart and Rousseau 2004; Swope et al. 2008).

The subjects were students from either the University of New Mexico in Albuquerque, New Mexico or the Universidade Católica de Brasília in Brasília, DF Brazil. The subjects completed a version of the EAO and were then asked to invest all or part of their participation fee in a risky asset. The participation fees were 10 US dollars (US\$) for the sessions held in the U.S. and 10 Brazilian Reals (R\$10) for the sessions held in Brazil. At the time of the experiment the exchange rate was about US\$1 to R\$1.75. If Knight's beliefs hold true then entrepreneurial subjects should invest more than the non-entrepreneurial subjects. If differences do exist between their behaviors then Schumpeter would say that this difference is attributed to something other than their entrepreneurial tendencies. Schumpeter's view is that other structural differences between

the two groups must exist to explain the differences in their behaviors such as gender, age, ethnicity or other demographic variables.

The results show that the subjects that were categorized as entrepreneurial did not invest at higher rates than their counterparts but these results are highly sensitive to varying measures of entrepreneurial attitude. Entrepreneurial subjects from Brazil invested at a higher rate than the entrepreneurial subjects in the U.S. but the non-entrepreneurial subjects from the U.S. invested more than their Brazilian equivalents. The Brazilian responses showed signs of hot hand behavior and the U.S. data showed signs of the gambler's fallacy. The hot hand phenomenon suggests that if you have previously won you perceive a higher chance of winning than the actual probability of winning. The gambler's fallacy exists when someone believes that the probability of winning is now higher because he/she has recently sustained repeated losses. Both types of events are due to individuals' failure to recognize the independent nature of risky events.

This chapter continues with a literature review including the following topics: risk and entrepreneurship; house money effect; the hot hand and the gambler's fallacy; and demographic and cultural differences in risk behavior.

Risk and entrepreneurship

Many entrepreneurship researchers at least mention the concept of risk and it is often assumed that part of an entrepreneur's function is to take on risk (Say 1803; Knight 1921; Mill 1984). The classical view implies that the decision to self-select into entrepreneurial positions is affected by attitudes towards risk. Kihlstrom and Laffont (1979) construct an entrepreneurial model using the theory of competitive equilibrium under uncertainty. Their model suggests that an entrepreneur has relatively low levels of

risk aversion. Research findings are not unanimous as to whether entrepreneurs are less (or more) risk averse than non-entrepreneurs.

Using three different measures of risk aversion (reservation pricing transformation, Arrow-Pratt, and lottery participation), Cramer et al. (2002) suggest that the relationship between risk-aversion and entrepreneurship is negative, indicating that those who self-select into entrepreneurship have lower levels of risk aversion. The propensity to be an entrepreneur was defined as whether, at any time, the individual became self-employed. The fifty year dataset used included responses from the Brabant survey administered in the Netherlands in 1952. The subjects included 5800 schoolchildren at least at the age of 12. All traceable subjects were re-interviewed in 1983 and 1993. The earlier questionnaire provided aptitude scores and parental background data. The later surveying provided data on entrepreneurship, risk attitude and wealth.

A main concern for many researchers is the tool used to extract the risk attitudes of entrepreneurs. The validity of the instrument used to extract risk attitudes is often questioned. Even so, using an experimentally validated survey instrument, Caliendo, Fossen and Kritikos (2009) conclude that people with higher inclination towards risk have a significantly higher probability to become an entrepreneur. In this line of research, the risk attitude of an individual is assumed to be one of the main determinants in becoming an entrepreneur.

On the other hand, Rosen and Willen (2002) suggest that willingness to accept risk is not the dominating factor in the decision to become an entrepreneur or self-employed. They argue that the assumption that risk aversion drives the choice between

self-employment and wage-earning conflicts with empirical data. Others have examined the Knightian view of entrepreneurship, which says that entrepreneurship is a form of risk sharing and profits a return to risk bearing. One such study finds that these Knightian predictions are implausible (Newman 2007). The argument for whether risk is the determining factor in an individual choosing to become an entrepreneur remains extremely difficult to verify. With that being said, there is obviously a relationship between entrepreneurship and risk but determining the causality is an empirical challenge. Besides risk aversion levels, the choice to become an entrepreneur is affected by many other hard to measure factors, for example, previous exposure to entrepreneurship and social/environmental conditions.

House money effect

Imagine that you decide to participate in a lottery and on the way to buy a ticket you find a twenty dollar bill. Would you buy more lottery tickets because you found the money? If the house money (or sometimes called the found money) effect exists then people would be more willing to gamble after a gain. These effects have been explained behaviorally. Thaler (1985) asserts that “mental accounting” takes place and people place windfall gains in a different “mental account” than other money. The various “mental accounts” differ in their marginal propensities to consume. Under the quasi-hedonic editing hypothesis, Thaler and Johnson (1990) suggest that in the case of a gain, losses that are smaller than the original gain can be grouped together with prior gains reducing loss aversion and increasing risk seeking. In essence, a loss stings less when it comes out of winnings and not from someone’s “own” money. When winnings are depleted, the losses hurt more. Thaler and Johnson (1990) set up a one stage and two stage gambling

experiment. The two stage version takes into account prior gains and has an expected value of zero. They used eight different problems, each including a one and two stage gamble. See Table 4 for an example.

Table 4. One- and Two-Stage Lotteries of Thaler and Johnson (1990)

Problem	Initial Outcome	Two-Stage Gambles Choices		Percent Risk Seeking		One-Stage Gambles Choices			
		Payoff	Prob.	two-stage N = 95	one-stage N = 111	Payoff	Prob.		
1	+\$15	\$0	1	77	44	\$15	1		
		\$4.50	0.5					\$19.50	0.5
		-\$4.50	0.5					\$10.50	0.5

In problem 1, the respondents who won more than they lost gamble differently, assumedly because they have not depleted their winnings and are still playing with house money. In problem 1, 77% of the subjects were risk-seeking in the two-stage version opposed to 44% being risk-seeking in the one-stage.

These results are counter to predictions such as the “no memory” prospect theory and the concreteness hypothesis (Slovic 1972). In “no memory” prospect theory, prior outcomes do not alter decisions in the future. The prior outcomes are “encoded, valued and then forgotten” (Thaler and Johnson 1990). Slovic (1972) presents what he calls a general principle in decision making known as concreteness. The concreteness theory supposes that information explicitly displayed in a given object or stimulus will be used only in the form that it is presented. Also, it asserts that information stored in memory, inferred or transformed tends to be discounted or totally ignored. If the house money effect exists then previous events will alter the way a subject gambles.

Weber and Zuchel (2005) conduct a two round sequential decision making experiment but frame the experiment in two different formats: Portfolio vs. Lottery. In

both of the presentation formats the subjects received an endowment. In the portfolio format, the subjects decided how many units to buy (from 1 to 10) in the first round at varying prices. In the second round, subjects could purchase units, sell units or do nothing at all. This format resembles common financial investment decisions. In the lottery format, the same opportunities for risk were presented with the same attainable payoff distributions as in the portfolio format. However, the decisions were made as a sequence of two opportunities to participate in a betting game. See Table 5 for more details about the two presentation formats.

Table 5. Portfolio and Lottery Formats

	Portfolio Format	Lottery Format
Endowment	Subjects receive 6 Deutsche Marks (DM) at the beginning of Period 1	Subjects receive 6 DM in two installments (3 in each period)
Opportunity Set	0 to 10 units in all decisions	0 to 10 units in all decisions
Payoff Profile	A unit generates either a gain of 0.40 DM (price increase) or a loss of 0.30 DM (price decrease in each period. Gains and losses are equally likely	A unit generates either a gain of 0.40 DM (payoff 0.70 DM minus cost of 0.30 DM) or a loss of 0.30 DM (cost of purchase). Gains and losses are equally likely.

*Source Weber and Zuchel (2005)

Subjects had to make two contingent decisions in the second round: One for a gain in the first round and one for a loss. They analyzed the number of units held and more units represented higher risk taking. If prior outcomes affected risk behavior then the number of units held would differ depending on whether the first round was a win or loss. This setup allowed Weber and Zuchel to see if subjects behaved differently in the second round in the case of a gain or loss in the first round. They find conflicting evidence based on the presentation method. In the portfolio decision format risk taking is

greater following losses rather than gains. However, when using a two-stage betting game presentation, they find that risk taking is greater following gains rather than losses.

Clark (2002) asks whether the house money effect drives the observed high levels of voluntary contribution to a public good. Using two treatments of the voluntary contribution mechanism (VCM) design, Clark conducted his experiment with 150 student subjects. 75 had house money and 75 had own money. The design of the experiment followed the VCM designs of Isaac et al. (1984) and Andreoni (1995). In both treatments, each student was told to bring \$8 with them to the experiment and knew that he or she could avoid losing this money *with certainty* through his or her decisions. At the beginning of the own money sessions subjects were asked for their \$8 and the house money group was not. Clark found that the mean contribution was higher in the house money session than in the own money session but this difference was not statistically significant at any relevant level. Therefore, he concludes that the found money effect did not explain the high public good contributions observed in experiments. However, Harrison (2007) reexamines Clark's data with different statistical approaches and found evidence of the house money effect.

Ackert, et al. (2006) searched for the existence of a house money effect in a dynamic setting by conducting a multi-period financial experiment. The experiment consisted of nine sessions; in five, subjects were endowed with \$60 (low endowment) and in four they were endowed with \$75 (high endowment). There were three periods in each session consisting of eight traders. The low endowment sessions had six markets and the high endowment sessions had eight markets. In these markets, subjects had the opportunity to buy stock and receive dividends. They find an average initial price of the

stock was \$17.10 in the low endowment sessions and \$20.37 for the high endowment sessions. The price difference was significant at the 5% level. Therefore, they find evidence of the house money effects in the dynamic, financial setting. Even after truncating the data to alleviate the effects of extreme bids, the results remained significant.

Davis et al. (2010) posit that cash participation fees are commonly used in experiments to incentivize voluntary participation but there is little to no mention of *when* this fee should be paid. The subjects of their experiment were given the option of buying a good at a posted price. The value of the good was determined by drawing a ball from a bingo cage. In the later rounds of the sessions, subjects were given the opportunity to purchase information about the value of the good. The 2 x 2 factorial design experiment included treatments for participation payment and quality of information. In one half of the sessions subjects were paid a lump sum payment at the end of the experiment and the other half were their participation payment in cash upon arrival at the experiment. The second treatment included differentiating between certain and uncertain information. If a subject purchased uncertain information then they received the actual value of the good 80% of the time and a value less than the actual value 20% of the time. They find that paying the participation fee upon arrival, instead of at the end of the experiment, was associated with more frequent information purchase but not necessarily indicative of purchasing the certain information. They suggest these findings support the house money effect.

Hot hand and gambler's fallacy

Two phenomena often found when examining risk behavior are the “hot hand” and the “gambler’s fallacy”. The hot hand phenomenon suggests that you have a higher perceived chance of winning than the actual probability of winning only because you have won previously. For example, if you have ten lottery balls, numbered one through ten, and you correctly guess the number three times in a row you may believe that you have a hot hand and that your chance of guessing the correct number on the fourth occasion is higher than the actual chance, one out of ten.

An example of gambler’s fallacy is if a person believes that since they lost four consecutive times they are due for a win. The gambler believes that he or she is more likely to win after a series of losses than he or she actually is. It can also be described as the belief that an independent event is unlikely to happen if it has happened repeatedly. The probability of the event happening again is assessed as being lower than it actually is. Both of these irrational beliefs are akin to Tversky and Kahneman’s (1971) law of small numbers, which says that a gambler overestimates power, overestimates significance, underestimates confidence intervals and has little opportunity to recognize sampling variation.

The “hot hand” concept originated in the game of basketball. Often times, people believe that if you make a large number of shots in a row then you are more likely to make the next. Even though “hot hand” research is much easier when looking at a coin flip, some researchers have used actual basketball data to test for this phenomenon. Gilovich et al. (1985) present three different studies looking at the hot hand in basketball. One study involved basketball fans who were given questionnaires that examined their

beliefs regarding sequential dependence among shots. The results were overwhelming: 91% of the 50 fans believed that a player has “a better chance of making a shot after having just *made* his last two or three shots than he does after having just *missed* his last two or three shots”. In the second study, they analyzed field goal records from 48 home games of the Philadelphia 76ers and their opponents during the 1980-81 season. The results suggest that the outcome of one shot was largely independent of the outcome of the previous shot. The final study involved a controlled shooting experiment using members of Cornell’s intercollegiate basketball teams. The final study investigated the ability of players to predict their own performance. In the final study, the results were the same as the previous two. The players’ predictions revealed a belief in the hot hand but no correlation between shots was found.

Offerman and Sonnemans (2004) conduct an experiment to test if the hot hand effect explains overreaction better than recency or vice versa. In sports, overreaction is associated with an unfounded belief in a “hot hand.” In financial markets, stocks that performed badly over a period of time are often undervalued and stocks that were doing well are overvalued (De Bondt and Thaler 1984). De Bondt and Thaler assume that the overreaction they measured was due to recency, which assumes that people overweight recent information. Their experiment was completely computerized and involved a coin being drawn from an urn that contained 100 coins. 50 of these coins were fair coins, where heads and tails always have a 50% chance of being tossed, but 50 of the coins were unfair coins, where heads and tails both have a 50% chance of being tossed on the first toss. However, after this initial toss the probability of repeating the outcome of the previous toss is 70%. They received different point values for correctly predicting the

outcome of tossing a fair and unfair coin. To compare the hot hand and the recency explanations, they focused on the fair coin results. They hypothesized that subjects would overestimate the probability of an unfair coin when the coin seems unfair. A Wilcoxon rank test revealed that the hot-hand hypothesis beat all other explanations of the overreaction phenomenon in their study, including recency.

Kahneman and Tversky's (1979) prospect theory suggests "that a person who has not made peace with his losses is likely to accept gambles that would be unacceptable to him otherwise." The gambler's fallacy refers to the tendency for gamblers to believe that, since they have recently sustained repeated losses, the probability of winning is now higher. Clotfelter and Cook (1993) examine data from the Maryland daily numbers game to see if lottery players exhibit gambler's fallacy type behavior. The Maryland Lottery computes a total prize liability for a given number. This liability is a convenient indicator of the intensity of betting on a given number. Looking at the winning numbers drawn during March and April of 1988 and also the frequency of numbers that were recorded during that period, the authors computed the liability of the numbers on which people bet. They then indexed this liability by the total bets placed in a day. The results show that after certain numbers win the amount of people choosing those numbers in the subsequent days falls dramatically, until gradually, the frequency of which the number is chosen rises. They offer two explanations for this finding. One is that when a number hits the people who normally choose that number stop betting. An alternative explanation is that people believe when a number is drawn, the probability of it being drawn over the next few weeks or months is reduced. This would support the existence of the gambler's fallacy in lottery players' behavior.

Similar to Clotfelter and Cook (1993), Terrell (1994) examines state lottery data to determine whether the gambler's fallacy exists. Looking at five years of data from the New Jersey lottery's "Pick 3", Terrell constructs a regression model to test the hypothesis. In this analysis, Terrell includes a cost for choosing a gambler's fallacy strategy, unlike the Maryland study. Even with a more complex analysis, Terrell suggests that the gambler's fallacy does in fact influence the behavior of those who play New Jersey's "Pick 3" lottery game.

The previous studies suggest that the gambler's fallacy may affect the behavior of lottery players but what about casino gamblers? Croson and Sundali (2005) were able to test roulette data from a large casino in Reno, Nevada. The researchers were supplied with video footage from which they compiled their data set. They observed nine hundred and four spins of the roulette wheel by 139 players placing 24,131 bets. They used different lengths of time for the streak period. For example, if the streak period equaled four and black was played on all four turns then a red play on the next turn was counted as a gambler's fallacy bet. For streak lengths of two through four, they found that at least half of the bets were gambler fallacy bets but this difference was not significant. However, at lengths of five and six, there was statistically significant evidence of the gambler's fallacy. At lengths of six or more, 85% of the bets showed support for the gambler's fallacy.

Casinos and lottery play are two very good arenas in which to look for behavior supporting the gambler's fallacy but it is often difficult to gain access to data. Therefore, many researchers conduct laboratory experiments to generate their own data. Huber et al.

(2010) use an economic experiment to investigate the gambler's fallacy. Using a forty-round treatment of random coin tosses they find support for the gambler's fallacy.

Demographic and cultural differences in risk behavior

Differences in levels of risk aversion or risk preference can sometimes be attributed to differences in gender, age, marital status, ethnicity and cultural background. Powell and Ansic's (1997) experiments suggest that risk preferences differ by gender. Iqbal et al. (2006) examine a data set from the 2000 edition of *Standard and Poors ExecuComp* database that consisted of 69,767 person-year observations, (of which 67,004 were from males and 2,763 were from females) spanning from 1992 until 2000. They analyzed changes in executives' shares when new stock options were available and interpreted a decrease in shares as a reduction of risk. Using multiple regression analyses, the authors concluded that female executives were no more risk averse than males. These findings support other studies that suggest that there is no difference between male and female levels of risk aversion (Cecil 1972; Masters and Meier 1988; Schubert et al. 1999).

However, many studies suggest that the opposite is true. For example, Barber and Odean (2001) tested the hypothesis that men are more overconfident when making financial decisions than women. Employing over 35,000 household level trading records, they examine financial transactions, returns from these transactions, transaction turnover and security selection. They find that men are more overconfident and, in turn, women were more risk averse. Their findings were specifically pronounced among single men and women. The literature is rich with studies focused on differences in risk levels and preferences among men and women. A large number of studies support Barber and

Odean's result, finding that men are less risk averse, especially when it comes to financial decisions (Eckel and Grossman 2008; Hudgens and Fatkin 1984; Jianakoplos and Bernasek 1998; Olsen and Cox 2001).

Several studies find that there is a significant relationship between age and risk attitudes (Al-Ajmi 2008; Hallahan, Faff and McKenzie 2004; Harbaugh, Krause and Vesterlund 2002; Jianakoplos and Bernasek 1998). Many researchers find that risk tolerance decreases with age. Yao et al. (2011) examines data from the 1989-2007 versions of the Survey of Consumer Finances (SCF) to analyze age, generation and period effects on risk tolerance. They employed an ordered logit model and developed three risk tolerance categories: substantial risk, high risk and some risk. These were all constructed from one question on the survey asking about how much financial risk the respondent and their spouse/partner are willing to take when saving money or making investments. The results show that willingness to take risk decreased with age. This could be due to less time being available to recoup losses.

Even as the literature suggests a negative relationship between risk tolerance and age, Riley and Chow (1992) suggest that a rise in risk tolerance levels happens after the age of 65. Halek and Eisenhauer (2001) estimated the Arrow-Pratt coefficient of risk aversion using data from the University of Michigan Health and Retirement Study. Using multivariate semi-log regression analysis, they find that a one-year increase in age decreases risk aversion by around 5%. They too found that, after 65, risk tolerance may no longer decrease and may begin to increase.

There may be no difference in the risk behavior or attitude of married versus unmarried individuals (Haliassos and Bertaut 1995; McInish 1982), however, some

researchers have found that married individuals are more risk averse than unmarried individuals. When someone is married they may take into account the risk preferences of their spouse or partner when making decisions. Also, an unmarried individual may have much less to lose than someone who is married, which would lead to the married person being more risk averse. Halek and Eisenhauer (2001) suggest that married heads of households have significantly lower levels of risk-taking when compared to the unmarried.

A large portion of the risk studies look at the relationship between demographic indicators and financial risk attitudes. However, a wealth of literature compares health risk attitudes and age/gender. Health risks include seat belt usage, drinking and driving, smoking habits, drinking habits, etc. For example, West et al. (1996) administered the Health Risk Behavior Survey to students at eight state universities in Florida and obtained 1,150 observations. They cluster the questions relating to different types of personal safety e.g. driving safety, fighting, carrying weapons, suicide, etc. and conducted contingency (or frequency) analysis. They find that: more married individuals wore a seat belt (when riding or driving); fewer married individuals recently rode with a driver who had been drinking; and fewer married drove while drinking. These figures were all compared to the unmarried.

There is also research that suggests that married individuals are less risk averse. Grable (2000) first defines risk tolerance as “the maximum amount of uncertainty that someone is willing to accept when making a financial decision.” He goes on to conduct an analysis of randomly sampled data obtained from 1,075 faculty and staff at a large southeastern university in 1997. He used descriptive discriminant analysis, more

specifically, univariate test statistics and found that married individuals were more risk tolerant. These findings conflicted with most of the research conducted in this area and this analysis may have been too simple to control for other relevant factors.

Race and ethnicity have a significant relationship with levels of risk aversion but the direction of this relationship remains an open question. Halek and Eisenhaur (2001) find that Hispanics and Blacks are consistently less risk averse than Whites and other races. Conversely, Sung and Hanna (1996) use the 1992 Survey of Consumer Finance to investigate risk tolerance among different demographic groups. Using expected utility as their theoretical model, they find Hispanics to be less risk tolerant than whites. Other studies also suggest that race/ethnicity plays an important role in risk attitude (Jianakoplos and Bernasek 1998; Leigh 1986).

Finally, cross-cultural differences in risk perception have been observed. However, these studies are rare due to their high administrative cost. Locating funding, having contacts in other countries, recruiting foreign subjects, and getting approval to conduct these international studies deter researchers from pursuing these types of studies. Two studies that have considered cross-cultural differences in risk attitudes are Bontempo et al. (1997) and Weber and Hsee (1988). Bontempo et al. includes students from large universities in Hong Kong, Taiwan, the Netherlands and the U.S. as subjects. Their subject pool also includes a group of Taiwanese security analysts. They presented the subjects with thirty different monetary lotteries. These were constructed by taking a basic lottery and transforming which changed the expected value, variance and skewness. The subjects were shown each option three times in random order. The subjects were asked to rate the riskiness of each gamble on a scale of 0-100. They used a repeated-

measures analysis of variance of the risk ratings offered by the subjects and included nationality as an explanatory variable. They did not find a systematic difference in the way subjects from different nationalities rated the gambles. However, they did find that different elements of the gambles were weighted differently, meaning, subjects from different nationalities came to the same risk rating but did so in systematically different manners.

Weber and Hsee (1998) also used students as subjects and gathered a sample from the U.S., China, Poland and Germany. Subjects responded to questions about their perception and reaction to financial investment options that yielded three possible outcomes. At least one outcome was a gain and at least one was a loss. They had graphical and numerical illustrations of the probabilities of obtaining each of the three outcomes. Each question was asked twice but in different orders and they were told to assume that they were investing with their own money. By looking at WTP as mean judgment and through regression analysis, the authors conclude that cultural differences exist in the pricing of the risky options and that these differences were attributed to the way the subjects from different cultures perceived the risk. In addition to differences in risk behaviors, the theoretical motivation for this experiment hinges on the perceived (or actual) existence of wage differentials.

Wage differentials

Many studies find a wage gap between races, genders and different age groups. Using a reduced form model, Hotchkiss and Shiferaw (2011) use supply and demand factors to explain wage gaps among workers. As they expected, older, more experienced and more educated individuals earn higher wages. In our data, we have age, gender, and

ethnicity data and we assume that older, white males would have higher wage expectations.

Researchers also observe a wage gap between equally productive men and women. The wage gap has not only been observed empirically in the United States (Weinberger 1998) but also in Brazil (Lovell 2000), Italy (Favaro and Magrini 2008) and Israel (Miki and Yuval 2011). The wage gap between genders could be due to discrimination or differences in productivity. Others suggest that this gap exists because women do not pursue college degrees in remunerative technical fields (Paglin and Rufulo 1990) and that women choose degrees that are more associated with anticipated family responsibilities (Blakemore and Low 1984). For a meta-analysis of the gender wage gap, please see Weichselbaumer and Winter-Ebmer (2005).

Ethnicity and race wage differentials have also been found. Studies show that black workers receive lower wages than white workers and that the actual process for determining their wages is different (Baffoe-Bonnie 2011). While investigating Brazil, Lovell (2000) suggests wage discrimination in the labor market. Lovell finds that Afro-Brazilians of the same education level receive lower wages than whites. Some of the most important factors of the wage gap between races and ethnicities are the employment category (Idson and Price 1992), education quality (Weinberger 1998), education level (Hotchkiss and Shiferaw 2011) and experience/tenure (Favaro and Magrini 2008). If individuals believe that they are going to receive lower wages in the labor market then becoming an entrepreneur may be a method of overcoming these wage gaps.

Experimental design

Subjects were recruited from the University of New Mexico (UNM) and the Universidade Católica de Brasília (UCB). At UNM, subjects were recruited from undergraduate economics courses. At UCB, students were recruited from various undergraduate courses. Exhibit 1 in the Appendix provides the script used during recruitment. There has been discussion in the experimental literature as to whether students were representative of the general population. The studies were conducted using subjects in experiments drawn from many academic areas, including Political Science (Mintz, Redd and Vedlitz 2006), Marketing (Enis, Cox and Stafford 1972) and Economics (Depositario, et al. 2009; Potters and van Winden 1996; Dyer, Kagel and Levin 1996). Most of the economic studies used auctions to test for a difference in behavior and most do not find significant difference between students and professionals in the experiments. Exhibit 2 in the Appendix shows the experiment script that was used for each session. This information was translated into Portuguese for the experiment in Brazil. To try to avoid any miscommunication, a native Brazilian read through the dialogue during the experiment in Brazil. The narrator is a Brazilian and American citizen and is completely bilingual. This allowed for clear explanation of the point of the experiment and assurance that the narrator followed the script. All questions were addressed by solely repeating the relevant information on the script.

Four sessions were held at UNM during a one week span. Three sessions were held at UCB over a two week span. As students entered the classrooms, they were given the consent form and asked to have a seat at a desk on which a study packet had been placed. Once the door for the classroom was closed, no students were allowed to enter

and the consent form was then explained in detail. The students were then given the time to read and sign the consent form with the opportunity to ask for clarification.

After all of the consent forms were collected, the students were told about the experiment packet on his or her desk. The packet contained a 21-question survey (described in greater detail in the next section), an envelope containing 10 one dollar bills (or 10 one *real* coins) and an empty envelope. The 10 Brazilian *reias* or 10 US dollars will be represented as \$10 for the rest of this discussion to avoid confusion. The subjects were informed that the \$10 was their payment for participating in the experiment. It was phrased this way to try to correct for the found money effect. The subjects were then asked to complete the survey. It took about 15 minutes on average across all sessions to complete the survey. They were informed that all questions needed to be completed. The survey did not mention “entrepreneurship” but did make attitudinal statements about business behavior in which the subjects were instructed to rank. There was no reason to believe that giving the survey before having the subjects participate in the financial risk game would alter their strategy during the game.

Once all of the surveys were collected, the students were informed that they now had the opportunity to invest all or part (in increments of one) of their \$10 participation fee in a risky asset with a 60% percent chance of gaining from their investment and a 40% chance of losing. If they gained from the investment then they would gain an amount equal to their initial investment and if they lost then they would only lose the amount they chose to invest. The 60-40 chance was represented by each subject choosing a card from a stack of 10 playing cards, with replacement. The stack was comprised of the ace through 10 of spades. The subjects were shown the stack of cards and were told

that if they drew an ace through six then their investment would be doubled but if they drew a seven through ten then they would lose their investment. They were then informed that the empty envelope was for them to place the amount that they choose to invest. Once everyone made their decisions and placed the amount of their investment into the envelope, each subject was approached individually with the stack of cards. For each subject, their investment envelope was collected and they were asked to draw a card from the deck. As the subjects drew their cards, a W was recorded for a gain, if they drew an ace through six, and an L was recorded for a loss if they drew a seven through ten. This exercise was repeated until all of the subjects' investments were collected and they had drawn a card. Participants were asked to keep the results private but often times it was obvious what the results were because of the reaction of the participants to his/her draw.

All the data from the first round were then recorded. Subjects who drew a losing card received an empty envelope. If the subject gained from their investment then the amount of money in the envelope was matched. For example, if the envelope was from a subject that gained and it contained three dollars then the envelope containing six dollars was returned to them.

An experimental ID was assigned to each subject and was used to identify which envelope belonged to which subject. The subjects were also given an empty envelope². They were now informed that they had the chance to invest in the same risky asset again with the same chance of gaining and losing their investment. The second round investment was given as another method to control for the found money effect and to

² When we returned the second round investments to the subjects at UCB, we did not return an empty envelope. They used the same envelope from the first round for their second round investment. During the experiments at UNM, the second envelope was a small source of confusion and did not add anything to the experiment.

create an opportunity to look for the hot hand or gambler's fallacy phenomena. They were given time to place their second round investment into the empty envelope. The same criteria applied to the second round investment and the same process was followed as before with the cards and recording of the results. The results from the second round were returned along with a receipt. Subjects were asked to verify the data on the receipt and were asked to sign the receipt. The receipts were then collected and the session ended. At this point, all subjects were free to leave.

Survey tool

The survey tool was a short version of the EAO which was developed and tested in 1991, and is shown on Exhibit 3 in the Appendix. A subset of the original 79 question version was used. The authors of the paper (Robinson, et al. 1991) that first introduced the EAO tested its discriminate validity. By having a group of entrepreneurs and non-entrepreneurs complete the survey, they were able to distinguish whether the two groups scored differently on each of the four subscales (achievement, personal control, innovation, self-esteem) of the tool. By using an F-test, they found significant (at the 1% level) differences between the subscale scores of the two groups. For each subscale, the mean of the scores for the group of entrepreneurs was higher than the non-entrepreneurs (Robinson, et al. 1991). Table 6 shows the group means for the entrepreneur vs. non-entrepreneur groups and describes the subscale scores.

Cronbach's alpha³ was used to assess the internal consistency of the EAO's subscales. The authors wanted to ensure that each of the four different scale scores

³ A commonly used tool in statistics, especially in psychometric analysis, that measures the internal consistency and reliability of a score. It is a special case of the Kuder-Richardson coefficient of equivalence. More about this alpha can be seen in the cited work (Cronbach 1951).

represented a uni-dimensional construct. Along with showing that this tool was able to discriminate between entrepreneurs and non-entrepreneurs, they also tested the predictive ability of the tool. They conducted a discriminate analysis using Wilks' lambda⁴ to predict whether individuals were entrepreneurs or not using each of the four subscales. All but one of the subscales (achievement) contributed significantly to the discriminate function used for prediction. Using, the function classification coefficients, they were able to predict group membership with 77% accuracy.

Table 6. Subscale Description and Group Means

Subscale	Description	Group Means	
		Non-Ent.	Entrep.
Achievement	Refers to concrete results associated with the start-up and growth of a business venture.	6.457	7.278
Self-Esteem	Relates to perceiving and acting upon business activities in new and unique ways.	6.274	7.06
Personal Control	Concerns the individual's perception of control and influence over his or her business.	5.244	6.583
Innovation	Pertains to the self-confidence and perceived competency of an individual in conjunction with his or her business affairs.	5.293	6.639

*Source (Robinson, et al. 1991).

Theoretical model

In this model, when an agent decides whether to be a wage-earner or an entrepreneur he/she weighs the probabilities below.

$$Prob(p\theta_l l_i^* \alpha k_i^{*\beta} - p_l l_i^* - p_k k_i^*) \leq Prob(\phi_i x_i z_i) \quad (1)$$

⁴ Wilks' lambda is a test statistic used in multivariate analysis of variance (MANOVA) to test whether there are differences between the means of identified groups of subjects on a combination of dependent variables. It performs, in the multivariate setting, with a combination of dependent variables, the same role as the F-test performs in one-way analysis of variance. Wilks' lambda is a direct measure of the proportion of variance in the combination of dependent variables that is unaccounted for by the independent variable (the grouping variable or factor). More can be found about this test statistic by looking at (Everitt and Dunn 1991).

The left side of the inequality represents the expected wages as an entrepreneur and is equal to maximized profit. p is the price an entrepreneur will receive for his or her output. θ_i is entrepreneurial ability. l_i^* and k_i^* are the optimal levels of labor and capital chosen by the entrepreneur, respectively. α and β are the returns to labor and capital respectively. p_l is the price of labor and p_k is the price of capital. Entrepreneurial ability differs between entrepreneurs and is known but not chosen. As entrepreneurial ability increases expected wages increase.

The right side represents the wage expectations as a wage-earner. ϕ_i is a vector of individual characteristics that affects wage expectations. We assume wage expectations increase in ϕ_i . x_i and z_i are the education and amount of relevant experience of agent i respectively. Wage expectations as a wage earner are increasing in education and relevant experience. Therefore, if an agent has low wage expectations but high entrepreneurial ability then he/she would be more likely to be an entrepreneur. On the other hand, if an agent has low entrepreneurial ability but high wage expectations then he/she would be more likely to be a wage-earner.

Hypotheses, results and discussion

Based on previous literature and findings, the following hypotheses are tested using only the data from the experiments.

H1: There will be no difference in risk aversion between U.S. and Brazil subjects.

H2: Women will be more risk averse.

H3: Older subjects will be more risk averse.

H4: Married subjects will be more risk averse.

- H5: There will be no difference in the entrepreneurial values between countries.
- H6: More entrepreneurial subjects will be less risk averse.
- H7: Subjects that won in the first round will wager more in the second round than those who lost.

Table 7 shows the summary statistics of the participant characteristics and the variable descriptions with means and standard deviations. The “other” category for the ethnic breakdown of participants at UNM included the following responses: Middle Eastern, Hawaiian and no response. The “other” category had a blank beside the choice to fill in ethnicity. One participant chose “other” but did not fill in the blank. Moreno was not given as a choice for ethnicity at UNM. One of the Brazilian participants did not complete the ethnicity question and the participant that chose “other” did not fill in the blank. Hispanic and Native American were not given as choices for ethnicity at UCB.

The average total winnings of the pooled data were \$12.14. In the U.S. the average was US\$12.85 and R\$11.13 for Brazil. The minimum total winnings were zero in both the U.S. and Brazil and the maximum was R\$27 in Brazil and US\$40 in U.S. All of the data used was generated from the survey and the experiments and no outside data were introduced.

The *investment percentage* variable was calculated by summing the amounts invested in rounds 1 and 2 and dividing it by the sum of the first and second round starting values. Round 1 starting value for everyone was R\$/US\$10. The starting value for Round 2 was calculated by summing the results (gains or losses) from Round 1 and the amount of the Round 1 starting value

Table 7. Variable Descriptions and Summary Statistics by Country

Experiment Variables	Description	Mean			Standard Deviation		
		Brazil	US	Pooled	Brazil	US	Pooled
<i>investment percentage</i>	Total investment as a percentage of lab money	45.660	47.870	46.966	19.729	22.759	21.520
<i>round1percent</i>	Round 1 investment as a percentage of lab money	50.185	49.743	49.924	23.592	24.599	24.102
<i>winround1</i>	Indicator variable for a gain in the first round	0.574	0.654	0.621	0.499	0.479	0.487
<i>round2percent</i>	Round 2 investment as a percentage of lab money	37.523	42.939	40.724	19.729	26.597	24.741
Survey Variables		Brazil	US	Pooled	Brazil	US	Pooled
<i>innovation</i>	Subscale score representing innovation in business	6.190	6.662	6.469	1.372	1.300	1.345
<i>achievement</i>	Subscale score representing achievement in business	7.944	7.521	7.694	1.351	1.048	1.195
<i>control</i>	Subscale score representing perceived personal control of business outcomes	5.985	7.038	6.608	1.635	1.499	1.635
<i>esteem</i>	Subscale score representing perceived self-esteem in business	4.419	4.603	4.527	0.995	0.710	0.840
<i>entrepreneurial</i>	Indicator variable for entrepreneurial = 1	0.333	0.526	0.447	0.476	0.503	0.499
Demographic Variables		Brazil	US	Pooled	Brazil	US	Pooled
<i>married</i>	Indicator variable for married = 1	0.167	0.064	0.106	0.376	0.247	0.309
<i>age</i>	Age in years	25.944	21.641	23.402	8.588	5.122	7.055
<i>male</i>	Indicator variable for male	0.481	0.590	0.545	0.504	0.495	0.500
<i>Black</i>	Indicator variable for black	0.092	0.013	0.045	0.113	0.293	0.209
<i>White</i>	Indicator variable for white	0.463	0.474	0.470	0.503	0.503	0.501
<i>Hispanic*</i>	Indicator variable for Hispanic	N/A	0.256	0.256	N/A	0.439	0.439
<i>Asian</i>	Indicator variable for Asian	0.019	0.115	0.076	0.136	0.322	0.266
<i>Moreno**</i>	Indicator variable for Moreno	0.389	N/A	0.389	0.492	N/A	0.492
<i>Native*</i>	Indicator variable for native	N/A	0.077	0.077	N/A	0.268	0.268
<i>Other</i>	Indicator variable for other ethnicity	0.019	0.064	0.045	0.136	0.247	0.209
<i>Brazil</i>	Indicator variable for Brazilian participant			0.409			0.494

*The values only include the US sample

**The values only include the Brazil sample

that was not invested. The Round 2 starting value ranged from 0 to 20, the lowest and highest possible values. The two investment percentages for each round, *round1perc* and *round2perc*, were calculated by dividing the amount invested in each round by their respective starting values. The subscale scores, *innovation*, *achievement*, *control* and *esteem* were calculated by taking the average response to the associated survey questions. Exhibit 3 in the Appendix gives more details about the determination of the value of each subscale. To determine the cutoff for *entrepreneurial*, all of the subscales were averaged and the comparative norm, 6.5, was used to set the cutoff value. The comparative norm value came from Robinson, et al. (1991). If a subject scored higher than 6.5 then he or she was deemed entrepreneurial and received a 1 for the *entrepreneurial* value. If a subject scored less than or equal to 6.5 then he or she received a 0 for *entrepreneurial*. All of the other variables can be understood by looking at Table 7. A sensitivity analysis is shown later that provides how sensitive the results are to this cutoff value.

The investment percentages in the first round were higher than the investment percentages in the second round. Subjects' behavior in the second round depended on the results from the first round investment and the results differed depending on country of the sessions. Table 8 shows these differences. In the pooled data, if a subject lost in the first round then the percent invested in the second round was 39.671 as opposed to 41.365 if they gained in the first round. Overall, it appears that losing made participants willing to risk less in the second round. However, these differences are not statistically significant. In Brazil, subjects who gained in the first round invested a higher percentage of their money in the second round. This is possible support for the hot hand phenomenon. US subjects invested at a higher rate in the second round if they lost in the

first round than if they gained. A reasonable explanation for this behavior is that the subjects who lost in the first round were trying to recoup some of their losses by investing a higher percentage of their money in the second round. This could also be a case of gambler's fallacy, as the subjects could have believed that since they lost in the first round they were less likely to lose again. Therefore, they were willing to invest at a higher rate. Also, those

Table 8. Round 2 Investments by Round 1 Result

Round 1 Result	Mean	Standard Deviation	Number of Observations
United States			
Gain	42.224	22.381	51
Loss	44.290	33.597	27
Brazil			
Gain	39.952	15.886	31
Loss	34.249	27.619	23
Overall			
Gain	41.365	20.098	82
Loss	39.671	31.096	50

None of these differences were significant at the 90% level

who won in the first round may not have wanted to push the odds too much and decided that they would hold more of their first round gains rather than gamble it again in the second round. As a note, *round2percent* was included as a continuous dependent variable with *round1percent* as the explanatory variable using the same controls as seen in the regression below but the result was not statistically significant. The regression was also estimated using the amount invested in round 2 (not percentage invested) as the dependent variable using the amount gained or lost as a control. The amount gained or lost had a significant (at the 1% level) positive effect on the amount invested in the second round with a value of 0.473.

The summary statistics and averages of the subjects' overall investment behavior help determine if there were differences between entrepreneurial and non-entrepreneurial subjects. Table 9 shows the differences in the percent invested by country and entrepreneurial status. In Brazil, one-third of the subjects were classified as entrepreneurial compared to over half in the U.S. In both countries, subjects that were classified as entrepreneurial invested a higher

Table 9. Average Investment Decisions by Country and Entrepreneurial Status

	Percent Invested	Std. Dev.	Number of Observations
United States	47.87%	22.759	78
Entrepreneurial	49.44%	26.372	41
Non-Entrepreneurial	46.14%	18.145	37
Brazil	45.66%	19.729	54
Entrepreneurial*	52.68%	26.830	18
Non-Entrepreneurial*	42.15%	14.205	36
Overall	46.97%	21.520	132
Entrepreneurial*	50.42%	26.323	59
Non-Entrepreneurial*	44.17%	16.332	73

Statistically significant difference in means at the 80% level

percentage into the asset during the experiment. However, none of these differences were statistically significant at the 90% level. This could be due in part to the small sample size. However, the difference in the means of the overall entrepreneurial and the non-entrepreneurial are significant at the 80% level. This is evidence that individuals that are identified as being more entrepreneurial by way of the EAO are willing to take more financial risks. This would lend support to the Knightian view of entrepreneurship which asserts that it is the role of the entrepreneur to assume more financial risk than the non-entrepreneur.

Furthermore, a regression analysis was employed to determine if there was a difference in the behavior between the subjects that were coded as entrepreneurial and those not. In this analysis, controls for marital status, ethnicity, age, gender and location of sessions were included. The model below was estimated using OLS with robust standard errors. Due to collinearity, the data could not be analyzed as a panel because the only variable that varied between rounds was *investment percentage*.

$$investperc_i = \alpha + \beta X_i + \delta L_i + \gamma Z_i + e_i$$

X_i is a vector comprised of the following covariates: *married, age, male, Black, Asian, Moreno, Native, Other* and *Hispanic*. The ethnicity variable *white* was excluded and used as the base. L_i is the indicator variable for location of the sessions, *Brazil*. Finally, Z_i was different in each of the five different regressions presented in Table 10. For regression 1, Z_i was the indicator variable of the most interest in the study, *entrepreneurial*. For regressions 2 through 5, Z_i included one of the four subscales *innovation, achievement, control* or *esteem*.

The primary regression of interest is regression 1. After including the covariates in the regression, the estimated coefficient for *entrepreneurial* was not statistically significant. However, see the sensitivity analysis discussion below for a closer look at the cutoff value used to categorize the subjects as entrepreneurial or non-entrepreneurial. The sign is in the expected direction as predicted from the statistics in Table 6. The results were not statistically significant but see the sensitivity analysis below which shows that this result may not be robust. The only variables that were significant in all regressions were *Native* and *Asian*.

Table 10. Regression Results

VARIABLES	(1) <i>Investment Percentage</i>	(2) <i>Investment Percentage</i>	(3) <i>Investment Percentage</i>	(4) <i>Investment Percentage</i>	(5) <i>Investment Percentage</i>
<i>married</i>	-8.236 (7.545)	-9.465 (7.750)	-10.03 (7.936)	-8.206 (7.755)	-8.844 (7.479)
<i>age</i>	0.353 (0.362)	0.396 (0.338)	0.416 (0.366)	0.363 (0.347)	0.373 (0.384)
<i>entrepreneurial</i>	4.746 (3.969)				
<i>male</i>	2.069 (3.971)	1.599 (3.896)	2.335 (4.005)	1.626 (3.929)	3.072 (4.089)
<i>black</i>	-7.319 (7.902)	-4.886 (7.296)	-7.746 (7.836)	-6.269 (7.717)	-7.250 (7.041)
<i>Asian</i>	-14.64** (5.720)	-11.20** (5.432)	-15.18*** (5.756)	-13.57** (5.651)	-14.93*** (5.438)
<i>other</i>	-8.217 (11.72)	-6.298 (11.02)	-9.039 (11.62)	-7.964 (11.78)	-8.114 (11.99)
<i>Moreno</i>	-0.808 (6.031)	1.799 (6.033)	-0.939 (6.114)	-0.00935 (6.048)	-1.047 (6.130)
<i>native</i>	-22.10*** (5.049)	-16.83*** (4.898)	-24.31*** (5.131)	-22.39*** (5.098)	-23.96*** (5.063)
<i>Hispanic</i>	-4.338 (6.521)	-1.969 (6.204)	-4.890 (6.643)	-3.966 (6.512)	-3.596 (6.681)
<i>Brazil</i>	-5.225 (6.127)	-3.913 (6.133)	-7.068 (6.150)	-4.149 (6.170)	-5.439 (6.079)
<i>innovation</i>		4.621*** (1.476)			
<i>achievement</i>			1.336 (1.580)		
<i>control</i>				2.206* (1.138)	
<i>esteem</i>					2.748 (2.285)
Constant	42.08*** (8.460)	11.67 (13.23)	33.53** (15.51)	28.86** (12.32)	30.92** (12.43)
Observations	132	132	132	132	132
R-squared	0.101	0.163	0.094	0.114	0.100

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Male subjects and older subjects invested at a higher percentage than their counterparts. Male subjects may be more accustomed to making financially risky decisions. This supports the previous literature that states males are less risk averse. However, in this sample, older individuals were also less risk averse. These results of age cannot be compared to the other studies cited here because there was low variance in the ages of the subjects. Married subjects and the subjects from Brazil invested less, on

average, than their counterparts. Married individuals may have more to lose when taking financial risks and that could have led to the lower investment rate. These results are consistent with the bulk of the literature examining marital status and risk aversion, suggesting married individuals are more risk averse.

Regressions 2 through 5 did not include the *entrepreneurial* variable. Here it was more interesting to look at the effects the subscale scores would have on subjects' investment decisions. Of the four scores, the only two that were significant at at least the 10% level were *innovation* and *control*. All four of the scores were associated with higher investment percentages. The *innovation* score questions related to perceiving and acting upon business activities in new and unique ways. To be innovative, one must take risks. It is not always the case that these are financial risks but in this experiment higher *innovation* was associated with higher investments in the risky asset. The *control* score questions were concerning the individual's perception of control and influence over his or her business. This perception of control could have not only been seen in their business decisions but may also have been obvious in their control of other decisions. The subjects with higher *control* scores may have felt that they had more control of the outcomes and invested at a higher rate.

Finally, Table 11 gives a simple look at the differences of means of the entrepreneurial score between the US and Brazil subjects. The table below shows that this difference is significant at the 5% level.

Table 11. Differences in Entrepreneurial Score

	Mean	Std. Dev	Number of Observations
Brazil	0.333*	0.476	54
US	0.526*	0.503	78

Statistically significant difference in means at the 80% level

For a sensitivity analysis, the cutoff for *entrepreneurial* was varied by one standard deviation above the comparative norm and one standard deviation below and found that the sign for the coefficient of percent invested stayed the same. Importantly, using this definition of entrepreneurial attitude, the coefficient on the variable became statistically significant. Sign is not sensitive but the difference is measured with greater precision and thus the null that the two groups are the same is rejected. This lends more support to the results that were previewed earlier, in which the subjects that were more entrepreneurial were more likely to invest in the risky asset at a higher percentage. Table 12 shows the value of the cutoff at one standard deviation above and below with the coefficient and summary statistics.

Table 12. Sensitivity Analysis of Entrepreneurial Indicator

	Value	Coefficient of Percentage Invested	Mean	Std. Dev.
Comparative Norm	6.5	4.746	0.447	0.499
One σ above	7.3	17.010*	0.106	0.309
One σ below	5.7	8.972**	0.765	0.426

** $p < 0.05$, * $p < 0.1$

As a final method of looking at the data, a Wald test helped determine if *entrepreneurial* and *Brazil* were statistically different from zero. The null that *entrepreneurial* and *Brazil* were significantly different from zero at the 1% level could not be rejected. Therefore, the results, which suggest that the entrepreneurial subjects did not invest differently in the risky asset relative to the non-entrepreneurial subjects, are highly sensitive to the value used to categorize a participant as entrepreneurial or not. This test does not give us a sign value; it simply indicates whether the variables of interest have a significant impact in the model. Referring to the summary statistics and sensitivity analysis allows for the inference that the more entrepreneurial subjects

invested at a higher rate relative to the non-entrepreneurial participants, even though the initial regression results did not support this hypothesis.

Given the results above, the hypotheses are revisited and the findings summarizes.

H1: There will be no difference in risk aversion between U.S. and Brazil subjects.

U.S. subjects invested an average of 47.87% of their lab money and the subjects from Brazil invested an average of 45.66%. However, this relationship did not hold once the differences between entrepreneurial and non-entrepreneurial subjects in the two countries were examined. The entrepreneurial subjects in Brazil invested an average of 52.68% as opposed to 49.44% average investment for the U.S. subjects. But the non-entrepreneurial subjects in the U.S. invested, on average, more than the Brazilian subjects: 46.14% compared to 42.15%. However, bear in mind that even though these differences in average investment exist, they were not significantly different from each other.

H2: Women will be more risk averse.

No significant differences between genders were found, however, the coefficient on *male* was positive, pointing to the possibility that males invested at a higher percentage, therefore were less risk averse.

H3: Older subjects will be more risk averse.

No support for this hypothesis was evident. This could be due to such a low variance in the age variable.

H4: Married subjects will be more risk averse.

Even though the sign on the *married* variable was negative throughout all the regression results, this was not statistically significant. Therefore, no support for the hypothesis that married individuals are more risk averse was found.

H5: There will be no difference in the entrepreneurial values between countries.

A significance test for the differences in the mean of the U.S. entrepreneurial score and the Brazil entrepreneurial score showed that the difference is significant at the 95% level. However, a lower percentage of the Brazilian subjects were categorized as entrepreneurial. This does not support the Global Entrepreneurship Monitor survey results which suggest that Brazilians are more entrepreneurial than Americans.

H6: More entrepreneurial subjects will be less risk averse.

The difference in the means of the percentage invested was statistically significant at the 80% level. In the regression, the *entrepreneurial* variable carried no statistical significance. However, adjusting how subjects were categorized as entrepreneurial led to a different conclusion because adjusting how subjects were categorized as entrepreneurial led to a different conclusion. If the cutoff value for the *entrepreneurial* variable was changed by one standard deviation above or below the comparative norm then there is support for this hypothesis. Within one standard deviation above the comparative norm, entrepreneurial subjects were less risk averse at the 90% significance level. Within one standard deviation below, entrepreneurial subjects were less risk averse at the 95% significance level.

H7: Subjects that won in the first round will wager a higher percentage in the second round

This hypothesis was developed to test for the existence of the hot hand or house money phenomena. Possible evidence of this phenomenon existed in the Brazilian sample. In the Brazilian sample, subjects that won in the first round were willing to invest at a higher percentage in the second round than those who lost. However, these differences were not statistically significant and this could be due to such a low sample size in the Brazil data. The opposite was true among the U.S. subjects. Those who lost in the first round invested at a higher rate in the second round. This lends support to the gambler's fallacy. It is possible that the subjects that lost in the first round thought that it could not happen again. However, once again, these differences were not statistically significant at the 90% level.

Conclusion

Experiments conducted in the United States and Brazil suggest differences in the financial risk taking behavior between entrepreneurial and non-entrepreneurial subjects. Subjects who were identified as entrepreneurial were likely to invest more of their money from the experiment into a risky asset. Entrepreneurial subjects in Brazil invested a higher percentage of his or her money than entrepreneurial subjects in the U.S. Another interesting finding is that the behavior of subjects who gained or lost from their first round investment in Brazil behaved differently in the second round of play when compared to their correspondents in the U.S. In Brazil, subjects that gained in their first round investment were willing to invest at a higher percentage in the second round compared to those that lost. This lends support to either the hot hand phenomenon or the house money phenomenon because they were betting with won money. This design did not allow us to distinguish between the two. In the U.S., subjects that lost in the first

round invested at an even higher rate in the second round, suggesting the existence of the gambler's fallacy. This could also simply be a result of subjects trying to recoup some of the money lost in the first round by investing even more in the second. These results support Knight's belief that there is a difference in the financial risk taking behavior between entrepreneurial and non-entrepreneurial subjects. Therefore, subsidizing start-up costs may stimulate entrepreneurial entry.

One of the main weaknesses of this study, which leads to a possible extension of the study in the future, is that we only categorized individuals as entrepreneurial or not. The experiment was not conducted on actual entrepreneurs and non-entrepreneurs, which could give a more clear indication as to whether a difference in their financial risk taking behavior exists. It can also be argued that the EAO is not a valid tool for categorizing the subjects, regardless of its previously found validity and reliability.

CHAPTER 3

TAX EVASION: A MACROECONOMIC THEORETICAL EXAMINATION

Abstract

Informal activities are looked upon by most governments as a loss in potential revenue. This chapter presents a variety of literature about the state of the informal sector from around the world and how many researchers attempt to measure and define this sector. An extension of the Ramsey model is presented that includes an income tax and a parameter that allows for the evasion of part or all of those taxes. The model shows the decrease in government revenue and long term levels of consumption and capital. However, the growth rate of capital and consumption remains unaffected by informal activities. The model does not include any assumptions about how individuals will choose to spend the money they save by evading taxes.

Introduction

Entrepreneurship is known to be a driver of economic growth and innovation within an economy. At the heart of entrepreneurial ventures is the entrepreneur. Entrepreneurs have many difficult decisions to make as they decide to start their own venture and the decision making continues as they begin operating the firm. This chapter focuses on one of those decisions, which is, do I participate in the formal or the informal sector of the economy? An entrepreneur can participate in informal activities in a variety of manners, for example, hiring informal labor, buying informal inputs, selling in informal markets, evading taxes, etc. Governments have tried over time to discourage these types of activities, even though there may be a degree of informal activity that contributes significantly to economic growth.

A major argument as to why individuals decide to become self-employed, or entrepreneurs, is because of the ease at which they can avoid paying taxes. Falsifying income and botching deductions are just a couple of the ways in which it may be easier to evade taxes as a self-employed individual. Often times, small businesses may receive payments in cash and this income is difficult to trace, therefore it is difficult to prove that tax evasion is taking place. One way to check this is to see if the reported income is lower or higher than the expenses the business has. If the reported income is lower but all of the expenses are being paid then the extra income to cover the difference is assumed to be unreported. The model in this chapter uses the basic Ramsey model for income taxes and adds a parameter that allow for different levels of tax evasion. The model shows that tax evasion decreases government revenue, levels of capital and consumption but does not affect the long term growth rate in the economy.

The literature review in this chapter does not directly focus on tax evasion as the sole informal economic activity. The point was to cover the landscape of informal economic activities throughout the world and use the theoretical model to show one example of how a certain informal activity can affect the macroeconomic indicators in an economy. The chapter continues with a broad overview of topics relating to informal economic activities and how these activities have been measured, debated and possibly supported. Even as this is not an empirical chapter, the literature review begins with a presentation and review of some of the studies that have attempted to measure and define informal activities. It continues by looking at the multiple intersections between public policy and the informal economy. As this chapter primarily focuses on the behavior of entrepreneurs, a discussion of informal entrepreneurship is presented. The debate as to whether informal entrepreneurship is healthy for an economy is briefly discussed in that section as well. The review then continues to give a broad overview of the state and size of informal economies from all over the world, including papers on Italy, the U.S., Nigeria, Brazil, just to name a few. The review concludes with a look at tax evasion among the self-employed and entrepreneurs.

Defining and estimating the informal sector

Finding the data to measure the informal sector is extremely difficult because, by definition, formal data do not exist. Participants in the informal sector are working outside of the formal measurable employment sectors. There have been three major avenues taken to measure the size of the informal economy: using cash demand time-series analysis; difference between aggregate total incomes and total expenditures; and differences between micro-level income and expenditure (Albu, Kim, & Duchene, 2002).

Another issue in measuring this sector arises from the inconsistent definitions of informal economic activity. Does this include illegal transactions? What is the difference between *informal employment* and *employment in the informal sector*? How do you measure something that is not well defined? There has been a progression of the “official” definition of the informal economy. This progression was briefly presented in Hussmanns’ (2004) working paper. A fact finding study, published by Sida, reports three different discourses for defining the informal economy (Becker, 2004). They include: the dualists’ approach that defines the informal economy as separate from the formal economy and is not directly linked to it and it provides a safety net for lower income people; the structuralists’ approach views the informal economy as subordinate to the formal; and the legalists’ discourse discusses the informal economy as informal work arrangements made by entrepreneurs in response to bureaucracy.

In 1993, a statistical definition of the informal economy was included in the System of National Accounts. The informal sector, as quoted in British English, was “broadly characterised as comprising production units that operate on a small scale and at a low level of organisation, with little or no division between labour and capital as factors of production, and with the primary objective of generating income and employment for the persons concerned” (Informal Sector - SNA). This was defined under the context that

“the [informal] sector is defined on a country specific basis as the set of unincorporated enterprises owned by households which produce at least some products for the market but which either have less than a specified number of employees and/or are not registered under national legislation referring, for example, to tax or social security obligations, or regulatory acts” (Informal Sector - SNA).

This definition allowed researchers to more accurately estimate the contribution of the informal sector to GDP across countries. However, there were many criticisms offered to

this definition as outlined by Hussmanns (2004). For example, casual self-employment or persons involved with small-scale activities may not report self-employment and therefore they are not considered as part of the formal sector as they should be. This would lead to overestimation of informal activities. Another criticism is that persons existing in the borderlands between self-employment and wage employment may also cause an error in estimation. A third criticism is that the enterprise-based definition does not capture all aspects of informal employment. As a result, the International Labour Office began to differentiate between the employment in the formal sector and informal employment. For a more rich discussion on this process of definition development see the International Labour Office's (2002) report.

With all the difficulties of defining what exactly is the informal sector and if that is different from the informal economy, measuring informal activity remains just as illusive. Schneider (2004) presents different methods to estimating the size of the informal economy. He presents the direct approach and many variations of an indirect approach. The direct approach is a micro approach that utilizes surveys and samples. This approach is widely used in many European countries and is useful because of the detailed information that can be extracted about the structure of the informal economy. However, as with most survey data, the results are highly sensitive to the design of the surveys. Another direct approach that Schneider mentions is based on the inconsistencies between tax returns and actual checks received. Auditing can catch these inconsistencies and this undeclared income is often assumed to be received through conducting informal economic activities. These direct approaches, however detailed the data, are unlikely to

capture all informal activities because cash transactions are not accounted for in this approach if the cash transactions are not claimed on individual tax returns.

Schneider also outlines five macroeconomic indicator, or indirect, approaches. First are the inconsistencies between National Expenditure and Income Statistics. Theoretically, the income measure of GNP and the expenditure measure of GNP should be equal. If they are not then national accounts statisticians use this gap as an indicator of the size of the informal economy. The second is the differences in the sizes of the “official” and the “actual” labor force, where, often times, a decrease in labor force participation in the formal economy can be attributed to an increase in informal labor force participation. This is valid if the total labor force participation rate remains constant. Of course, unemployment could also be a viable explanation for the decrease in formal labor participation rates. Thirdly, he presents an approach utilized and described by Feige (1996), the transactions approach. The main assumption of this approach is a constant relation between volume of transaction and official GNP over time. Mathematically, the velocity of money times the amount of money must be equal to prices times total transactions. To extract the size of the informal economy using this approach there has to be a base year with no informal economy. Then subtracting the official GNP from the total nominal GNP will give an estimate for the size of the informal economy. One obvious weakness of this approach is assuming a base year with no informal economy and the normalization of the ratio of transactions to nominal GNP. The fourth approach he describes is the currency demand approach. This approach was originally used by Cagan (1958) and further developed by Tanzi (1980). The currency demand function, a correlation of currency demand and tax pressure, is estimated to

calculate the size of the informal economy. This approach assumes that informal activities are cash payment transactions. To estimate the currency demand function, controls are added for government regulation, tax system complexity and federal tax burden. The dependent variable used by Tanzi (1983) is the log of the ratio of cash holding to current and deposit accounts. This is a very commonly used estimation approach but is criticized because not all informal transactions are cash payments and that the velocity of money is assumed to be the same in the formal and informal economies. The fifth and final indirect approach presented by Schneider (2004) is the physical input approach. There are two variations of this method; one is used and further developed by Kaufmann & Kaliberda (1996) and the other was developed, as an improvement to Kaufmann & Kaliberda's method, by Lackó (1998). Kaufmann & Kaliberda use electric power consumption as the best indicator of economic activity, whether it is formal or informal. By using the growth of electricity consumption as a proxy for GDP growth and subtracting measured GDP growth then they have a measurement of the growth and size of the informal economy. Finally Lackó (1998) also assumes that a certain part of electricity consumption can be attributed to informal economy activities. These methods have been criticized because not all informal activities require a considerable amount of electricity and that informal activities also take place outside of the household sector.

Studies use a wide variety of terms to represent informal activity including informal employment, informal sector, informal economy, underground economy, the illegal economy, unreported economy, unrecorded economy, the black market etc. Feige (1990) presents a clear definition of many of these concepts. This review will focus more

broadly on presenting the papers that attempted measure informal activity, however it may be defined.

As stated earlier, one often used approach for measuring the size of the informal economy is using household level data. Albu, Kim & Duchene (2002) analyzed data from a supplemental survey⁵ to the Integrated Household Survey in Romania by computing a composite coefficient for all households in the sample. Their sample size was 288 and they characterized two different types of activity, main and secondary. This categorization was based on a specific question in the survey that asked about the ratio of main activity to secondary activity. They used this information to create an absolute measure of households' income that resulted from secondary activity. Then they took the difference between the incomes earned from the two different types of activities to measure informal activity. They estimated that households' participation in informal activities ranged between 20.4% and 30.6%.

Other approaches include a cross country analysis where countries are divided into categories such as developed, developing and underdeveloped. In an IZA Discussion Paper, Schneider (2004) does just that by categorizing countries into developing, transition, highly-developed OECD, southwest Pacific Islands and communist countries. Schneider used the DYMIMIC (Dynamic Multiple-Indicators Multiple-Causes) approach, which he developed, to estimate the size of the informal economy in 145 countries. He admits that one major disadvantage of this approach is that you can only estimate *relative* sizes of the shadow economy not the *absolute* size. One motivation for this approach is that he does not assume that informal activities show up in only one sector of the

⁵ This supplemental survey was called the Supplemental Survey on Household Informal Economic Activities with a sample size of 2,600 households.

economy and can be seen in production, labor and money markets. The approach is based on the statistical theory of unobserved variables and the informal economy is estimated using a factor-analytic approach. He includes indicators for the money, labor and production markets. This method has been further utilized by Giles & Tedds (2002). Table 13 shows a summary of his results using the DYMIMIC and currency demand method. Ruge (2010) also takes a cross country perspective and is more focused on the determinants of the informal economy but also estimates the size. Using a structural equation model, he examined panel data from 38 countries over a 17 year period spanning the years 1991-2007. The dataset included around 470 variables. The model is similar to a multiple regressions model that describes a linear relationship between latent variables, bivariate correlations and errors. The determinants of the informal economy were placed into three categories: Overall state, tax system and labor system. The overall state included three wealth and development indicators, fourteen administrative indicators and eleven constitutional trust and value indicators. He assumes that as a better “overall state” reduces the size of the informal sector. The tax system variables included seven tax and social security payments indicators, six tax complexity and surveillance indicators and two tax moral indicators. The final group, the labor system, included four labor market indicator variables, one unemployment indicator, three participation right indicators and two wage indicators. The results suggest that a higher wealth and development level, a better administrative system, lower taxes and social security payments, higher tax complexity and surveillance and more regulated labor markets reduce the size of the informal economy. New Zealand was found to have the smallest

informal economy, Romania the largest and the U.S. ranked 12 out of the 35 countries⁶ analyzed.

Table 13. Size of Informal Economy as a Percentage of Official GDP

Region/Category	Years		
	1999-2000	2001-2002	2002-2003
Central and South America ⁷	41.1	42.2	43.4
Asia ⁸	28.9	29.9	30.8
Africa ⁹	41.3	42.3	43.2
Europe and Former Soviet ¹⁰	38.1	39.1	40.1
OECD ¹¹	16.8	16.7	16.3
Pacific Islands ¹²	31.7	32.6	33.4
Communist Countries ¹³	19.4	20.7	21.8

Figures reported are unweighted averages

Source: (Schneider F. , 2004)

⁶ New Zealand, Finland, Denmark, Australia, United Kingdom, Canada, Switzerland, Norway, Sweden, Japan, United States, Ireland, France, Austria, Germany, Belgium, Slovenia, Spain, Portugal, Cyprus, Republic of Korea, Estonia, Slovak Republic, Czech Republic, Italy, Hungary, Greece, Poland, Lithuania, Turkey, Mexico, Bulgaria, Latvia and Romania. This list is ordered from smallest to largest according to Ruge (2010).

⁷ Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Puerto Rico, Uruguay and Venezuela

⁸ Bangladesh, Bhutan, Cambodia, Hong Kong (China), India, Indonesia, Iran, Israel, Jordan, Republic of Korea, Kuwait, Lebanon, Malaysia, Nepal, Oman, Pakistan, Papua New Guinea, Philippines, Saudi Arabia, Singapore, Sri Lanka, Syrian Arab Republic, Taiwan, Thailand, Turkey, United Arab Emirates and Yemen.

⁹ Algeria, Angola, Benin Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Democratic Republic of Congo, Republic of Congo, Cote d'Ivoire, Egypt, Ethiopia, Ghana, Kenya, Lesotho, Madagascar, Malawi, Mali, Mauritania, Morocco, Mozambique, Namibia, Niger, Rwanda, Senegal, Sierra Leone, South Africa, Tanzania, Togo, Uganda, Zambia and Zimbabwe.

¹⁰ Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovinian, Bulgaria, Croatia, Czech Republic, Estonia, Georgia, Hungary Kazakhstan, Kyrgyz Republic, Latvia, Lithuania, Macedonia, Moldova, Poland, Romania, Russian Federation, Serbia and Montenegro, Slovak Republic, Slovenia, Ukraine and Uzbekistan.

¹¹ Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, United Kingdom and United States.

¹² Fiji, Kiribati, Maldives, Marshall Islands, Micronesia, Palau, Samoa, Solomon Islands, Tonga and Vanuatu

¹³ China, Lao, Mongolia and Vietnam

Public policy and the informal economy

One common belief is that governments should strive to reduce the size of the informal economy. When many entrepreneurs and laborers operate in the informal economy, the government is losing out on tax revenue because most of the earnings and revenues generated in this sector are not reported on tax returns. This potential loss of revenue could stifle the economy and inhibit growth rates. Therefore, many governments strive to reduce the size of the informal economy. Also, production in the informal economy could be an inefficient use of resources where market forces are not strong enough to incentivize efficient resource allocation. Peattie (1987) appropriately notes that we should be careful in our stigmatizing perception of the informal economy. There are quite successful informal entrepreneurs and there are underpaid formal wage earners.

Roger Smith (2002) suggests that

“in a world of minimum wages, high payroll taxes, immigration and employment controls, limits on hours worked, and clawbacks of social transfers, the underground economy may enable some individuals to be employed who would otherwise not be employed, enable other individuals to increase their incomes by holding second jobs, and provide services that would otherwise be unavailable.”

As it is, the interaction between public policy and the informal economy is complex and researchers have approached the topic from a wide variety of angles.

The U.S. government has increased the IRS penalties on unpaid tax liabilities and has increased their audit rates in order to deter informal economic activities. Cebula (1997) uses data on the size of the informal economy, generated by Dr. Edgar Feige, combined with official IRS tax data to determine if audit rates, tax rates and tax penalties are associated with the size of the informal economy in the U.S. In his ordinary least squares model, the Feige estimate for the size of the underground economy is as a

percentage of annual adjusted gross income against: the maximum marginal federal personal income tax rate from the previous year, the average effective federal corporate income tax rate from the previous year, the percentage of income tax returns that was subjected to an audit from the previous year and the expected average penalty from underreporting income from the previous two years. He also included a simple linear trend variable. In all specifications of the model, the results show that the higher the maximum federal personal income tax rate, the larger the relative size of the informal economy. He also finds that the higher the IRS audit rate, the smaller the relative size of the informal economy. Finally, he finds that the greater the expected penalty for underreporting, the smaller the relative size of the informal economy.

Ihrig and Moe (2004) set up a dynamic theoretical model to more closely examine how the informal economy evolves over time, particularly in response to policy changes. An agent is endowed with an initial capital stock and accumulates capital over time. The agent can choose to participate in the formal or informal economy. Formal production is always taxed by the government but the informal is only taxed when the authorities become aware of this production. One of the main differences in the production process is that formal producers employ labor and capital but informal only employ labor. The two-way causality between real GDP per capita and the size of the informal economy analysis suggests that reducing the tax rate can increase standard of living and help move people out of the informal sector into the formal sector. The authors believe that more resources in the economy does not reduce informal participation as much as decreasing the tax rate or increasing the tax penalty.

One theory is that heavy bureaucracy and high tax burden forces producers to partake in informal economic activities. Azuma and Grossman (2008) study this possibility by looking at producer endowments and the quality of public services and their effects on the informal economic participation. One of their theoretical models contains well-endowed producers, poorly endowed producers, and private substitutes for public services. They assume a Cobb-Douglas combination of resources and the marginal rate of substitution for the production function in the informal section is equal to the marginal rate of substitution for the aggregate production function in the formal sector. They also allow producers, both well and poorly endowed, to work in the informal economy by offering private substitutes for public services. One example would be worker compensation. The model also allows the State to extract from production, however imposing the restriction that the amount extracted in the formal economy cannot be easily altered. Two different assumptions are made about producers' endowments, from the State's perspective: observable and non-observable. Non-observable endowments include knowledge, skills, etc. They find that if well-endowed producer endowments are relatively large enough or if the quality of public services is low enough then the State will extract large amounts from the formal producers. This leads poorly endowed producers to participate in the informal economy. This result is also based on the assumption that the State maximizes its own revenue. This result can be important when examining why the informal economy tends to be larger in poorer countries. This study suggests that it could be due to the large information asymmetry between the State and producers in developing and underdeveloped countries.

Dijkstra (2011) presents a theoretical model which tests to see if an economy can have a “good” and a “bad” equilibrium. A bad equilibrium was characterized by a small formal sector with high taxes as opposed to the good equilibrium, small informal sector and low taxes. The theoretical model includes a continuum of workers that sum to one: Workers in the formal sector, workers in the informal sector and workers in the public sector. It is assumed that each worker is full-time in only one sector at any given moment; however a worker can switch sectors over time. It could be argued that someone could be a full-time worker in the formal sector, and at the same time, participate in the informal sector. The public sector produces a good and the formal sector produces a good which is consumed by everyone. These two goods are equal. However, the informal sector produces a fraction of this good because they are not able to reap the benefits of all public goods, for example, informal producers cannot benefit from the legal system, social insurance and medical insurance enjoyed by the formal sector participants. The government levies a tax on production of the formal sector and uses this to pay the public sector workers. The author assumes an implicit tax rate in the informal economy. The rate at which the informal economy increases over time is proportional to the difference between the informal sector and average payoffs. When the economy is in equilibrium, no worker wants to switch sectors. The government maximizes an objective function that combines the welfare of formal and informal workers and the rate at which the informal economy decreases. The author goes on to present situations of multiple equilibria. The model suggests that when the informal sector is large, the government implements a low tax rate which intends to increase the attractiveness of the formal sector. However, as the government raises taxes to discourage workers from entering the informal economy, the

opposite happens. More workers are led to the informal economy and this makes all workers in the economy worse off. Therefore, a tension exists between short run and long run worker welfare.

Another intersection of policy and the informal sector is government corruption and inequality reduction. Dobson and Ramlogan-Dobson (2012) compiled inequality data from the United Nations Worlds Income Inequality Database, corruption measures from the International Country Risk Guide index and corruption perception index, and informal economic measures previously presented in the literature. The informal sector variable is measured as a percentage of GDP. They also included data from the Penn World tables and the World Bank. Their regression includes inequality as the dependent variable and the explanatory variables of interest are the two estimates for inequality, estimates of the size of the informal economy and the two corruption indexes. The regression also includes controls for per capita real output, secondary school enrollment, domestic private sector credit, openness measures, agricultural production and inflation. The results show a link between inequality, the formal sector and corruption. Their findings imply that in an economy with a large informal sector, anti-corruption policies are unlikely to reduce inequality. They suggest that allowing corruption to grow in countries with weak institutions and large informal sectors may be beneficial, however, this should not be the first option explored.

Informal entrepreneurship

Schumpeter believed that the entrepreneur should be considered a major factor in economic development. He does not distinguish between formal and informal entrepreneurs. The consequences (or benefits) from informal entrepreneurship is a

debatable topic. On the one hand, informal entrepreneurs avoid paying formal taxes on their earnings and therefore the government is losing out on revenue that could be used for infrastructure improvements, education and public services. Also, informal entrepreneurs have less market forces and may be operating at an inefficient level and the market does not incentivize more efficient operations. This leads to a misuse of resources that could be more favorably employed in the formal sector. On the other hand, some suggest that informal entrepreneurship, especially in Central and South America, is a source of accelerated economic development (Pisani & Patrick, 2002). Informal entrepreneurs are often very dynamic and have high innovative capabilities that are not supported or may even be hampered in the formal economic sector. These informal enterprises also offer employment options and income to those that may not have access to formal options. Many enterprises that operate in the formal sector do so by exploiting workers by overworking and underpaying them. This has often been the perception of the informal sector but that trend is changing and many researchers and policymakers are beginning to recognize the informal economy as “a hidden enterprise culture” (De Soto, 1989).

Before going too much further, it should be emphasized that it is difficult to define the concept of an informal entrepreneur. Firstly, there are many definitions of an entrepreneur used in the literature. For example, an entrepreneur has been defined as someone who innovates and introduces new goods or methods of production (Schumpeter, 1934), someone who discovers previously unnoticed opportunities to make a profit (Kirzner, 1973), someone that is actively involved in starting a business or is the owner of a business that has been operating less than 42 months (Harding, et al., 2006);

someone that organizes labor, land and capital (Bade & Parkin, 2009) and “an individual who creates new economic enterprises” (Frank & Bernanke, 2001). It is important to note that all of the definitions above, and most that are presented in other literature, view the entrepreneur in a positive light.

An entrepreneur is presented as an important factor in the economy that adds to economic growth, increases employment opportunities and creatively combines factors of production. However, this is counter to the view of the informal economy, in general. Therefore, is an informal entrepreneur a useful agent in the economy that should be supported? Since, the informal economy itself is hard to identify and define, it is unclear how to define and/or recognize an informal entrepreneur. Williams & Nadin (2010) review some of the literature that attempts to define an informal entrepreneur. The definition that they use is an informal entrepreneur is “somebody actively engaged in starting a business or is the owner/manager of a business that is less than 42 months old who participates in the paid production and sale of goods and services that are legitimate in all respects besides the fact that they are unregistered by, or hidden from the state for tax and/or benefit purposes”. Schneider & Enste (2002) presented results from an international survey which surprised many believers that informal sectors are a sign of economic weakness. They suggested that, even in OECD countries, the informal sector generates up to 20% of their GDP. Bureau (2011) suggests that informal entrepreneurship can create value and that equilibrium-based understandings of this sector do not allow us to understand the complexity of this type of entrepreneurship. Webb et al. (2009) set out to integrate entrepreneurship theory, institutional frameworks and collective identity to examine informal entrepreneurship. The study was needed because the literature lacks a

theoretical look at informal entrepreneurship combining macro, micro and meso level theory. In their multidisciplinary study, they suggested that at the macro level, the incongruence between the formal and informal institutions, created by the regulation of market activity, creates the opportunity for informal transactions and these transactions may be illegal but should not be considered unbeneficial

On the other hand, not all researchers have the positive view of entrepreneurship as *Fortune* magazine. For example, drug dealers (Bouchard & Dion, 2009), pimps and prostitutes (Smith & Christou, 2009) all show characteristics and ways of doing business that is similar to how an entrepreneur operates and behaves. Rehn & Taalas (2004) examine a communist economy, the Soviet Union, and infers that this is an entrepreneurial economy if you accept a wider definition of an entrepreneur. They assert that if an entrepreneur is viewed as someone that searches “for opportunities and beneficial outcomes in economic transactions” then nearly “every citizen of the Soviet Union” can be classified as an entrepreneur. They also imply that this type of entrepreneurship can be “subversive and anti-systematic” and the conventional capitalist view that entrepreneurs are “bucking the system” does not have to be viewed as a positive trait. Actually, studies are rare that categorize this entrepreneurial behavior as “against the prevailing social order”.

Williams & Nadin (2011) summarize four theoretical views of informal entrepreneurship. Without going into great detail, here are the basic premises for each perspective. The *leftover perspective* posits that informal entrepreneurship is leftover from earlier production modes and is now disappearing. This perspective implies that informal entrepreneurship is representative of underdevelopment and that formal level

entrepreneurship shows economic progress. The *survivalist perspective* positions informal entrepreneurship as a new mode of production comprised of unregulated employment, particularly in situations where workers are exploited and have dangerous work environments. The informal entrepreneurs, under this perspective, were marginalized by and/or excluded from the formal economy and are nothing but pawns being exploited by the global economic system. The *alternative perspective* suggests that informal entrepreneurship is nothing more than a substitute for formal economic participation where a potential entrepreneur has the choice to join the formal or informal economy. Neo-liberals suggested that informal entrepreneurship, as viewed through this lens, is a choice of resistance against heavy regulation of the formal economy. However, there are modern hypothesis that support this perspective but believe the motivation of the entrepreneurs could be due to social resistance against corruption. Finally, the *complementary perspective* views informal entrepreneurship and formal economic participation as complementary, where the two sectors expand and contract together at both the macro and micro levels. The macro argument is that earnings from the informal sector are spent in the formal sector. At the micro level, those who benefit from one sector are also the ones who reap benefit from the other. The idea here is that informal entrepreneurs' informal activities are a direct result of the formal economy and the informal sector helps alleviate the disparities of the formal economy. Williams & Nadin took these four perspectives and wanted to determine which one best explains informal entrepreneurship in rural England. After surveying 350 households, they determined that neither of the perspectives could adequately explain informal entrepreneurship as a whole. Each participant had varying motivations for their informal activities and the

results showed the complexity involved in developing a theory of informal entrepreneurship.

There is extensive literature on necessity versus opportunity driven entrepreneurship (Acs, Arenius, Hay, & Minniti, 2005); (Jörn & Sandner, 2009); (Maritz, 2004). The basic difference between these two types of entrepreneurs is their motivations for choosing entrepreneurship over wage earning. A necessity based entrepreneur believes they have no options available in the employment market and decide to start their own business. Many of these types of entrepreneurs are thought to be small service providers or offer inexpensive goods for resale. An opportunity based entrepreneur chooses to start their own business because they see an opportunity in the market to offer something new and innovative that is not currently readily available. It is thought that these types of entrepreneurs offer more to the market in terms of employment opportunities and innovation. Necessity versus opportunity driven is also thought of as pushed versus pulled entrepreneurs. Necessity driven entrepreneurs are pushed into entrepreneurship because of the lack of satisfactory formal labor market work and the opportunity driven are pulled into the entrepreneurship in hopes of exploiting a gap in the market.

Are the entrepreneurs operating in the informal economy doing so out of necessity or because of an opportunity? It is often assumed that informal entrepreneurs, especially in emerging economies, are choosing to participate, wholly or partly, in informal activities out of necessity (Valliere & Peterson, 2009). However, Williams (2007) investigates this question and finds that necessity is not the principal motivation for informal entrepreneurs in the UK. He suggests that the ratio of opportunity to necessity

driven entrepreneurs is not much different in the informal sector than it is in the formal sector. Williams admits that this dualism is an oversimplification of informal entrepreneurs' motives. Many of the entrepreneurs who participated in his survey were *both* pushed and pulled into participating in informal entrepreneurial activities. Temkin (2009) conducted a study to determine whether informal self-employment in Mexico was a symptom of inequality and poverty or, instead, a space that flourishes with economic initiative and business potential. He analyzed data from the 2005 edition of the Mexican Version of the World Value Survey, an attitudinal survey. As a background for Mexico, informal employment has been estimated as high as 60% of the total employment. Temkin isolated the 796 respondents that reported themselves as employed at the time of the survey and were at least 18 years of age. The survey questions allowed for different levels of informality to be assessed. The level of informality was estimated based on whether the individual had a formal employment contract, had social security or worked in economic units that did not issue official receipts. He divided the informal participants into either workers or self-employed. His findings suggest that informal entrepreneurs in Mexico choose to be so out of necessity and are characterized by "precariousness, vulnerability and insecurity" (Temkin, 2009). Therefore, he concludes that informal entrepreneurs in Mexico are not drivers of economic growth and he suggests that policymakers in Mexico should not set their hopes "on the possibility of economic growth and alleviation of poverty based on the entrepreneurship and initiative of the informal participants of the economy" (Temkin, 2009). Gurtoo (2009) asks whether the informal economy in India happens in the form of a hidden enterprise culture or out of necessity. The data included results from a survey conducted over a seven month span in

2006-07, which intended to investigate India's informal sector. The questionnaire was administered face-to-face to approximately 1,500 workers. They found that informal entrepreneurs were happy in their work and did not choose to be informally employed because of lack of formal employment options. The author suggests that India should support informal entrepreneurs with sound policy structures by helping them with "skills and strategy development, financial support through easy credit and cooperative programs for welfare" (Gurtoo, 2009). Morris & Pitt (1995) suggest something similar about informal entrepreneurship in South Africa. They believe that these entrepreneurs are dynamic, create employment opportunities and are opportunity driven.

Günther and Launov (2012) also visit the topic of whether informal employment happens because the informal sector is attractive or if participation in this sector is of last resort. This is very similar to the ideas of "push" versus "pull" entrepreneurship. Günther and Launov constructed an empirical model that included a wage equation, a Heckman selection bias correction, a distribution of observed wages and a probabilistic distribution of individuals across competitive market sectors. The sectorial distribution allowed them to apply probabilities to show whether a given individual chose to engage in informal activities as a result of market segmentation or as a result of comparative advantage considerations. Using household data from a 1998 survey, the *Enquête de Niveau de vie*, administered in Côte d'Ivoire, the authors found that many of the informal workers would be better off if they participated in a different segment of the labor market. However, they also find that many informal workers have a comparative advantage in the informal sector. Therefore, they conclude that it is not beneficial to look at this labor choice through the dual choice lens. It may be advantageous for some workers to

participate in the informal sector because market segmentation and for others because this segment offers a comparative advantage.

Williams & Round (2007) aim to determine the rate at which formal business ventures in the Ukraine participated in the informal economy when they were start-ups. The data from a direct survey, 600 face-to-face interviews, conducted in 2005 and 2006, showed that 331 of the individuals surveyed started an enterprise within the last three years. This was a surprisingly high rate of entrepreneurial activities. Of these 331 respondents, only about ten percent of the individuals reported that all of their activities operated in the formal sector. Hence, ninety percent of the entrepreneurs admitted a high dependence on the informal sector for support when starting their operations. Nearly two-thirds admitted to not properly registering their venture, not applying for the appropriate licenses, etc. Of these 298 informal entrepreneurs, fifty-one percent operated completely off the books; they had no license and were unregistered. This leads to a discrepancy in the formal data for estimating the entrepreneurial activity taking place in Ukraine. From this survey, over half of all start-ups operate wholly in the informal sector and eighty percent operate at least partly in the informal sector.

Informal economies around the world

As described above, the informal economy is often associated with underdevelopment, a lack of formal employment options and corruption. If this were the case then informal economic activities would be isolated to regions such as certain areas of Latin America and Africa. However, that is not the case. Countries such as Italy and the United States have shown a thriving informal sector, along with many of the OECD

countries. A variety of studies will be reviewed which show the size, scope and effects of informal economies from all over the world.

The countries of Sub-Saharan Africa have shown a thriving informal sector, in spite of, and possibly because of, the heavy regulation, high taxation, high formal unemployment rates and, often times, military rule. The informalization view of the informal economy has been often used as the theoretical lens from which to view the informal sector of more developed nations. This view has been highly criticized because of the implications that productive formal labor could be efficiently subcontracted to informal producers. Meagher (1995) admits to the downfalls of this approach but believes it may offer a helpful view of the informal economic activity in Sub-Saharan Africa. She believes that this view offers insight into the dynamic characteristics of the informal sector that is not as pronounced in the formal sector. These dynamics exist due to high competition, vulnerability and subsistence incomes. However, as the social networks protect the informal sector from the formal market forces this is at the “expense of high levels of informal labour exploitation and political vulnerability” (Meagher, 1995). Meagher also believes that the informal sector develops as “a process of socio-economic restructuring instigated by the state and various groups within the formal sector...”

Shinder (1997) argues that the informal sector is vital for the growth of developing nations, in particular Zimbabwe, and asserts that much of the formally employed should be encouraged to become informal entrepreneurs. At the time of this study Zimbabwe’s budget deficit was \$4.3 billion, unemployment was over 30% and they were facing deteriorating living standards. Shinder was interested in determining whether the government should focus on decreasing the size of the informal economy or not. It is

understood that the informal sector is unregulated, avoids taxes and, at times, participates in illegal activities. At this time, the formal economy was shrinking and there were signs of growth in the informal sector. Shinder concludes that any policies aimed at the informal economy should be done with care. The behavior of informal entrepreneurs and firms differ greatly by industry. Therefore, Zimbabwe should develop industry specific policies that would target the sectors where the informal activity is not benefiting society as a whole and blanket policies that add more regulation to deter informal participation as a whole should be avoided. For political reasons, this was not the approach Zimbabwe's policymakers took and targeted the informal sector in 2005 and by this time, the informal sector was thought to be the main source of income for Zimbabweans (Coomer & Gstraunthaler, 2011).

Solomon (2011) aims to examine the impact of public policy on the size of the informal economy in Nigeria. Just as seen in Zimbabwe, the informal economy plays a major role in Nigeria, specifically in the agriculture and manufacturing sectors and has contributed to their growth. High taxes, heavy regulation, high cost of running a formal operation and the parallel exchange rate market are all reasons for the thriving Nigerian informal sector (Solomon, 2011). Solomon found that the negative oil-price shock increased the size of the informal economy. The shock reduced tax revenue which led to a decrease in government spending. She also asserts that as the government decided to balance the budget, seigniorage decreases which lowered inflation. Since inflation is in essence a production tax in the informal sector, the lower inflation led to expansion in the informal sector.

Nigeria and Zimbabwe are not the richest countries in Africa, at least as measured by per capita income. One of the richest, South Africa, has a relatively small informal sector when compared to economies of its size. This informal activity is concentrated in agriculture, light manufacturing, and trade/transport services (Davies & Thurlow, 2010). Crime and poor access to credit are significant barriers to entry in the formal sector in South Africa. However, unemployment has been a strong concern for South Africa, even as of late. The South African government has recently battled to get the unemployment rate under twenty-four percent. Davies & Thurlow (2010) investigate the relationship between informal-formal linkages and unemployment. They employ a general equilibrium model and develop a typology that allows them to examine the interaction between the formal and informal sectors. They define four types of informal employment: 1) informal producers that have a distinct informal good that price-competes with a formal good but there is no wage competition between the formal and informal workers, 2) informal traders that do not compete with formal producers and still there is no wage competition, 3) informally employed by the formal sector where there is wage competition and finally 4) non-competitive informal activities that generate goods which do not compete with formal sector goods. Their computable general equilibrium model allows them to model the functioning of the entire economy, including all sectors, institutions and markets. Conceptually, the linkages that occur between the formal and informal sectors, in their model, are the informal purchase of formal goods (and vice versa), informal wage income from the formal sector (this happens often in the construction and agricultural industries), informal participants borrowing from the formal economy and social transfers to the informal economy from the government. The model

is calibrated to the 2002 South African Formal-Informal Sector social accounting matrix. They find that one of the reasons that the South African informal sector is believed to be so small is that many estimates do not include informal employment in the formal sector. They also suggest that the recent liberalization policies of South Africa are widening the gap between the rich and poor and between the formal and informal sectors.

Development in Latin America has, at times, been characterized by slow formal economic expansion coupled with rapid economic growth. A large informal sector helps explain this phenomenon. Portes & Schauffler (1993) review some of the competing perspectives of the informal economy in Latin America. The article presents different measurement strategies, as applied to Latin America, and how the results inform public policy development. Earlier theories of the development of the informal sector in Latin America focused on the rural to urban immigrant migration that took place in the 1940s until the 1960s. This migration led to a surplus of labor in urban areas and these migrants were “forced” to create their own means of income generation (Souza & Tokman, 1976). This perspective assumes that the immigrants struggled to enter into the formal sector and were excluded from participating; they were marginalized. It was assumed that these immigrants were lower class and the settlements they created in the urban areas were wrought with poverty. However, that was not necessarily the case and this perspective failed to ignore the millions of successful and rightfully employed immigrants. De Soto (1989) began to show that the informal economies in Latin American were not necessarily comprised of marginalized individuals. He asserted that the formal economic participation was restricted to an elite few and the informal sector expanded as an alternative. Many of the informal participants were very efficient. They employed many

family laborers and used very little capital. De Soto, however, did agree that the rural to urban migrants were the primary informal sector participants.

Do the informal workers in Latin America have to accept lower wages? Or do the workers see a wage premium for participating in the informal sector and therefore choose the informal sector *over* formal employment? Marcouiller et al. (1997) use formal wage gap measures to determine if in fact a wage gap exists for workers in the informal sectors when compared to similar workers in the formal sector. They analyzed data from Mexico, El Salvador and Peru. The results were not the same for all countries. They estimated a wage premium for participating in the formal sector in El Salvador and Peru but a wage premium for informal employment in Mexico. This finding supports those who argue that the informal sector is not a catch all for unskilled, low paid workers who cannot find employment in the formal sector. They also found that middle-aged individuals are less likely to be informally employed when compared to older and younger workers and formal workers are more educated. The informal workers were mostly concentrated in retail; however, the construction industry included substantial informal activities.

Brazil is the largest economy in Latin America and the second largest in the western hemisphere. Depending on how you define informal activities, the informal sector in Brazil has been estimated at 40% to over 60% of its GDP (Henley & Arabsheibani, 2009). Brazil has opened up its economy to foreign competition and has stabilized its currency but is still seeing growth in the informal sector. Brazil is highly bureaucratic and it is very difficult to open a business there, not to mention the three years that it may take to close it. Therefore, the informal sector thrives throughout the different economic sectors including construction, transportation, retail and service. Other

than the often cited bureaucratic hurdles in Brazil, access to credit can also be a barrier to entry into the formal sector. Though, access to credit is also difficult *because* of the bureaucratic hurdles. Aside from the difficulty in accessing credit, there is also a shortage in the credit that is available to start a formal venture. Formal ventures in Brazil will need funds just to begin operation due to the complexity of the tax system. Very few business owners would be able to properly and accurately complete their tax return; therefore, normally an accountant is paid a monthly salary to assist the business owners. Microcredit could be a solution that would lessen the barrier to credit and that may be an effective way to go in Brazil since the informal sector pays a premium price for capital when compared to the formal sector (de Paula & Scheinkman, 2011).

India is known to have a substantial amount of informal activity and is said to house more “black money” than the rest of the world combined, as reported by the Swiss bank. These estimates come from the amount of black money that is held in Swiss banks. The purpose of transferring or housing money in these types of accounts would be to end the paper trail of the monies in the home country or country in which business is being conducted. This black economy emerged in India post World War II because of tax policies that were created to spur investment and savings but also complicated tax reporting (Pandey, 2010). Pandey also reports that in India, even highly respected professionals, such as doctors and lawyers, overcharge their patients and do not provide them with a receipt. Often times, the charges do not match what is reported on income statements and the difference between these figures is considered black money. The black money generated in India is estimated at 40% of their GDP (Pandey, 2010).

As stated at the beginning of this section, informal activities are not necessarily a symptom of underdevelopment and inequality. A study by Bajada (1999) aims at estimating the size of the informal economy in Australia. He rightly notes that a large informal economy can have substantial policy implications specifically because there is an asymmetry problem. The government does not have perfect information about economic transactions and therefore cannot accurately assess their national economic state. Carter (1984) is one of the earliest studies that begins to discuss the informal sector in Australia and report that it may as simple as opportunities in the informal sector are more attractive than formal options. He insinuates that Australians may enjoy the flexibility, freedom and autonomy of the informal sector and that thriving by participating in this sector is better than succumbing to the routine and mundane activities involved in formal employment options. However up until Bajada's (1999) study, there was no time series estimation of the size of the informal sector in Australia. Bajada found recent increases in the size of the informal sector in Australia, which may be caused by increasing tax rates and welfare benefits. The estimates show that unreported income had risen to 15% of GDP and given the economic and political atmosphere in Australia, there was no reason to believe that this rising trend should change. Giving the estimations, Bajada came to the conclusion that formal sector economic shocks spurred both substitution (unemployment) and income (changes in income) effects. The income effect overweighed the substitution effect. Bajada also concluded that the informal sector was increasing the volatility of the formal sector business cycles.

Pickhardt & Pons (2006) set out to better estimate the size of the informal economy in Germany. They employ two approaches: the currency demand approach and

the MIMIC approach. The currency demand approach was covered earlier in the chapter however the original Multiple Indicators Multiple Causes MIMIC approach was not. The MIMIC model was first used in the context of the informal sector by Frey & Weck-Hanneman (1984). This model has two main equations, a measurement and structural equation. The measurable equation is related to a set of observable variables. The structural equation includes observables, for example tax burden, unemployment, inflation, etc., structural parameters and a latent variable. In this case, the latent variable is the informal sector. Due to the identification condition, the MIMIC model should have at least one cause with two indicators. The MIMIC approach is very sensitive to the causes and this is often cited as a criticism for using this model. The results from Pickhardt & Pons (2006) suggest that the size of the informal sector in Germany increased from the late 1980s until 2000 and decreased in size in 2001. Much of the informal sector in Germany can be attributed to taxes, particularly social security tax. This result lends itself easily to labor policy, which, specifically for Germany, may be an important policy tool that can, in tandem with fiscal policy, can act to reduce the size of the informal sector.

In the years 1999 to 2003, the United States was estimated to have a small percentage of its GDP generated from informal activities, ranging from 8.4% to 8.7% (Schneider F. , 2004). This may be a low percentage of GDP but since the United States has the highest GDP out of all countries, the amount of dollars circulating in transactions taking place outside of the formal sector is staggering. These low percentages are debatable, of course, and it is difficult to measure the amount of undocumented workers in the US that are receiving part or all of their income and not reporting this to the federal

government. This is said to be one of major types of informal problems, so to say, that the United States faces (Webb, Bruton, Tihanyi, & Ireland, 2012). As is with many developing countries, informal employment is concentrated among the lower income classes (Nightingale & Wandner, 2011). It is said that some of the economic slowdowns faced by the United States were not as severe as originally reported because no informal activities were included in those measures. For example, claims that the slowdown from 1970-89 was highly overstated because during this period the informal sector in the United States was expanding rapidly (Fichtenbaum, 1989). Along with undocumented workers' income, the U.S. currency finds itself often involved in informal transactions. It is estimated that over US\$2 trillion goes unreported every year and that 18% - 23% of total reported income is not properly reported to the IRS (Feige, 2012).

Tax evasion and entrepreneurship

One possible motivation for choosing entrepreneurship over wage-earning employment is the ease of evading taxes, as noted by Andreoni et. al. (1998). An entrepreneur, especially a self-employed, sole proprietor can underreport income and overstate deductions more easily than someone employed as a wage-earner. If the perceived probability of being caught is low and the penalty for underreporting is low then an entrepreneur may choose to risk underreporting if they can avoid paying the taxes on the income. If entrepreneurs behaved in this manner then one would believe that lower taxes could increase self-employment levels. Fölster utilized data from OECD countries and found that national tax burden and self-employment as a percentage of GDP were negatively related. It is difficult to determine if this actually supports the case where

entrepreneurs choose to become so to avoid taxes. The tax variable was not precise enough to determine their effects on self-employment.

Parker and Robson (2004) also examined OECD data, specifically from 1972 to 1996, to determine what explains international differences in rates of self-employment. The cross country analysis provided an interesting comparison between countries and the panel dataset allowed the researchers to examine the countries over time. The authors showed how multiple explanatory variables cointegrated with the self-employment variable. The results suggested that average income tax rates and self-employment rates are positively and significantly related. These findings supported an early study by Robson & Wren (1999). Taken at face value, the implications of such studies are that as individuals face higher tax rates they are more likely to enter into self-employment. This study offers more specifics about which taxes may be related to self-employment when compare to Fölster's study. However, the cross country macro level data sets, such as the OECD have many weaknesses. For example, reporting methods are not standardized throughout the member countries. Therefore, an individual that is categorized as self-employed in one country may not be categorized as such in another. Torrini (2005) also used OECD data to take a closer look at the relationship between public policy and self-employment. One of the results is that unemployment benefits are negatively related to self-employment, which suggests that unemployed workers with high benefit rates have little incentive to start their own business. However, these results were sensitive to model specifications.

Donald Bruce (2000) investigated the dynamics of the U.S. tax system and individuals' choice of self-employment. The Panel Study of Income Dynamics provided a

good panel of U.S. data and his data set covered 1970 through 1991. The author was interested in determining the benefit that a self-employed person gains from being non-compliant. Differential taxes, specifically between wage-earning and the self-employed, were a focus of the study. Bruce computed the tax differentials for the transition from wage-earning into self-employment. The findings suggest that higher tax differentials led to a reduction in entry into self-employment. However, Bruce does not suggest that entrepreneurs choose to do so to avoid paying higher taxes. One implication of the study is that higher marginal tax rates for the self-employed could be associated with more deductions for filing as a business. Therefore, the higher marginal tax rates increase the benefits for the self-employed.

A further step in being able to tailor policies which create disincentives for tax evasion by the self-employed is to understand which of the self-employed are more likely to evade taxes. This information gives policymakers power to create specific policies that will focus on the sector of the population that are intended to be affected by the policy. Schuetze (2002) conducted a study that mainly focused on the demographic differences among the self-employed and which were more likely to be non-compliant. The data was collected from the Canadian Family Expenditure Surveys and covered the time span of 1969 to 1992. One major finding of the study is that those who were self-employed in the construction industry were more likely to be non-compliant, which may be due to the ease of underreporting in such industries. The construction industry was followed closely by service industries. Another interesting finding is that the level of non-compliance decreases with age. Also households that were headed by two self-employed individuals (as opposed to one) concealed less income.

Tax evasion is one of the manners in which individuals can participate in the informal economy. In the U.S., unreported or underreported income is a major source of informal activities. The ease of tax evasion is often associated with the decision to become self-employed. The model presented below begins to investigate the effects of tax evasion throughout the economy. It is important to note that no distinction is made between entrepreneurs, the self-employed and other wage-earners or agents in the model. The majority of literature reviewed at the beginning of the chapter has covered the informal economy at the macro level throughout the world. However, the model below does not give specific insight into the details of the informal economy; it only looks at the effects of one type informal activity, tax evasion. The review here was an opportunity to present a picture of the widely explored informal sectors and how they can be an inhibitor of or contributor to growth. In the model below, growth is not explained by the model and is taken as a given parameter that is based on the growth of productivity. Take the model below as a beginning to the theoretical investigation of informal activities and how the effects are felt throughout the economy. Many extensions of the model can be developed to include the differences between: entrepreneurs and wage-earners, informal and formal producers; and informal and formal entrepreneurs.

Model

The model below is an extension of the Ramsey model by including an income tax and the ability for an agent to evade this tax. The ability to more easily evade taxes is an often cited reason that individuals choose to become self-employed. This model specifically focuses how an income and tax evasion is felt throughout the economy. The model includes representative agents and firms interacting in a marketplace.

The Agent's Problem

First, representative agents maximize the constant relative risk aversion utility function below. For simplicity, utility is only a function of consumption. c_t is total consumption by a representative agent at time t .

$$u(c_t) = \frac{c_t^{1-\theta} - 1}{1-\theta} \quad (1)$$

The Arrow-Pratt measure of relative risk aversion for this functional form is equal to θ , which is a constant, hence the name of this functional form. $\sigma = 1/\theta$ is the elasticity of substitution between consumption in the present and consumption in the future. In this model, no differentiation is made between a wage-earner and an entrepreneur. To maximize utility, an agent solves the problem below.

$$\begin{aligned} \max_{c_t} \int_0^{\infty} \frac{c_t^{1-\theta} - 1}{1-\theta} e^{-(\rho-n)t} dt & \quad (2) \\ \text{s.t.} & \\ \dot{a}_t = (1 - \phi\tau)[w_t + r_t a_t] - c_t - n a_t & \\ a_0 = a_0 & \\ a_t \geq -B \quad \forall t & \\ c_t \geq 0 \quad \forall t & \end{aligned}$$

The first constraint shows how an agent's assets, a_t , accumulate over time. ρ is the discount rate w_t is the wages an agent earns from labor. r_t is the interest earned on assets. $n a_t$ is the dilution of assets due to population growth. Therefore, $[w_t + r_t a_t]$ is the income of a representative agent. τ is the income tax rate faced by all agents in the model. ϕ is the amount of taxes which an agent evades, $0 > \phi > 1$. A lower value for this parameter represents a higher level of tax evasion. As ϕ approaches one, an agent is paying more of the tax rate and as it approaches zero an agent is paying less. This shows

that a high level of tax evasion leads to more income for the agent. ϕ can be directly affected by government policy. For example, as penalties for being caught evading taxes increases an agent is more likely to evade a lower amount of taxes. If the probability of being caught increases then an agent is again more likely to evade a lower amount of taxes.

The second constraint shows that an agent starts with a given asset level at time zero. The third condition constrains an agent from running a Ponzi scheme. This condition maintains that at a given point in time an agent can no longer borrow. The final constraint restricts consumption levels to be positive at all times. To solve the maximization problem, the Hamiltonian equation below is used.

$$H_t = \frac{c_t^{1-\theta}-1}{1-\theta} e^{-\rho t} + \mu_t [(1 - \phi\tau)[w_t + r_t a_t] - c_t - n a_t] \quad (3)$$

μ_t is the marginal value of an agent's assets at time t . An agent's utility would increase by μ_t if they had one more unit of assets. The Hamiltonian, H_t , is the utility level, received from income, of a given agent at time t . The agent receives utility from their consumption in the present and receives future utility from their current savings. After first differentiating the Hamiltonian, the first order conditions (FOCs) below become evident.

$$\frac{\partial H_t}{\partial c_t} = 0 = c_t^{-\theta} e^{-\rho t} - \mu_t \Rightarrow \mu_t = c_t^{-\theta} e^{-(\rho-n)t} \quad (4)$$

$$\frac{\partial H_t}{\partial a_t} = -\dot{\mu}_t = \mu_t [(1 - \phi\tau)r_t] - n \quad (5)$$

$$\frac{\partial H_t}{\partial \mu_t} = \dot{a}_t = (1 - \phi\tau)[w_t + r_t a_t] - c_t - n a_t \quad (6)$$

$$TVC: \lim_{t \rightarrow \infty} \mu_t a_t = 0 \quad (7)$$

The transversality condition (*TVC*) keeps the system stable and forces that as times approaches infinity either the marginal value of assets or the level assets (or both) must be equal to zero. Now, equations (4) and (5) can be used to derive the “Euler Equation.” After logging and differentiating (4), equation (8) is the result.

$$\theta \frac{\dot{c}_t}{c_t} + \rho - n = -\frac{\dot{\mu}_t}{\mu_t} \quad (8)$$

And by rearranging (5), a different representation of $-\frac{\dot{\mu}_t}{\mu_t}$ is found and represented in equation (9).

$$\frac{\dot{\mu}_t}{\mu_t} = r_t - n \quad (9)$$

Setting (8) and (9) equal gives the “Euler Equation” seen in equation (10).

$$\frac{\dot{c}_t}{c_t} = \frac{1}{\theta} [(1 - \phi\tau)r_t - \rho] \quad (10)$$

There are two opposing forces on consumption for this agent. The agent is impatient and would rather consume today than save, however, the positive interest rate incentivizes the agent to save (invest) now to be able to consume even more in the future. Also, notice that if the interest rate exactly equals the discount rate then the agent will save just enough to keep consumption levels constant over time. If the interest rate is greater than the discount rate then the agent receives a higher reward for saving and therefore the agent consumes less today so they can consume more tomorrow. On the other hand, if the reward to saving is less then the agent will consume more today and consumption will decrease over time. The agent also has to choose whether to participate in informal activities by choosing how much tax to evade.

With equation (10) and our restraint on asset accumulation, there are two differential equations for consumption and assets, show in equations (11) and (12).

$$\dot{c}_t = \frac{c_t}{\theta} [(1 - \phi\tau)r_t - \rho] \quad (11)$$

$$\dot{a}_t = (1 - \phi\tau)[w_t + r_t a_t] - c_t - n a_t \quad (12)$$

However, the phase diagrams cannot be drawn because wages and returns to investing in assets are determined in the marketplace and therefore the behavior of firms needs to be examined. Notice that when adding income tax rate and the ability to evade taxes to the model the agent now does not care about the interest rate on investments; he or she is more interested in the “after-tax” interest rate, which is the rate they will actually receive on their investments. This after-tax rate is dependent not only on the tax rate but also on the level of tax evasion.

The Firm's Problem

The firm's maximization problem, including productivity growth, A_t , is seen below. As is normally assumed, the productivity growth is associated with more productive labor. Even if capital is becoming more advanced, the laborers will become more productive by utilizing the more sophisticated capital. A future version of this model could be developed by differentiating between types of producers. For example, producers in this model could be only entrepreneurs, which have the choice to participate either in the formal or informal economy, or a combination of the two. The production function below is a function of capital, K_t , and labor productivity, $A_t L_t$.

$$\max_{K_t, L_t} F(K_t, A_t L_t) - w_t L_t - R_t K_t \quad (13)$$

s.t.

$$K_t, L_t \geq 0$$

The first order conditions here will represent the marginal product of capital, equation (14), and the marginal product of labor, equation (15). The marginal product of capital

equals the rents paid on the capital and the marginal product of labor is equal to the wages.

$$F_K(K_t, A_t L_t) = R_t \quad (14)$$

$$A_t F_L(K_t, A_t L_t) = w_t \quad (15)$$

In intensive form the first order conditions are as follows.

$$F_K(k_t, A_t) = R_t \quad (14')$$

$$F(k_t, A_t) - k_t F_K(k_t, A_t) = w_t \quad (15')$$

Agent's Solutions

$$\dot{c}_t = \frac{c_t}{\theta} [(1 - \phi\tau)r_t - \rho] \quad (11)$$

$$\dot{a}_t = (1 - \phi\tau)[w_t + r_t a_t] - c_t - n a_t \quad (12)$$

$$TVC: \lim_{t \rightarrow \infty} \mu_t a_t = 0 \quad (7)$$

$$a_t \geq -B \quad \forall t \quad (19)$$

Firm's Solutions

$$F_K(k_t, A_t) = R_t \quad (14')$$

$$F(k_t, A_t) - k_t F_K(k_t, A_t) = w_t \quad (15')$$

Market Clearing Conditions

$$N_t = L_t \quad (20)$$

$$a_t = k_t \quad (21)$$

$$R_t = 1 - \phi\tau r_t + \delta \quad (22)$$

$$\phi\tau[w_t + r_t a_t] = \varphi_t \quad (23)$$

Equation (20) restricts the labor market to equal population in the model.

Equation (21) shows that the banks hold all of the agents' assets and rents the capital to

entrepreneurs. δ is the depreciation rate of capital. Therefore, equation (22) shows that a competitive bank makes zero profits, assuming constant returns to scale. Equation (23) is the government's budget constraint. It holds by definition. It just says that φ_t is the revenue the government will collect given this income tax rate. Notice that it is dependent on the level of tax evasion. If a representative agent evades a high level of taxes then the government has lower income. Therefore, the government, in this model, should work to deter agents from evading taxes. This could be done by higher penalties or a ensuring a higher probability of being caught.

Combining equations (11), (14') and (21) gives equation (24), which is a representation of the change in consumption over time. Notice that this representation will not include prices. This equation is more easily presented in a phase diagram. Also, combining equations (12), (14'), (15'), (20), (21) and (22) gives us a similar, price-free representation of the change in capital over time, seen in equation (25).

$$\dot{c}_t = \frac{c_t}{\theta} [(1 - \phi\tau)(F_K(k_t, A_t) - \delta) - \rho] \quad (24)$$

$$\dot{k}_t = (1 - \phi\tau)[F(k_t, A_t) - \delta k_t] - c_t \quad (25)$$

Now that prices are gone, the equations are one step closer to being able to be displayed in a phase diagram. The only part of the equations that keep this from happening is the growth in productivity. This variable is changing over time; therefore the two sets of equations are not yet autonomous. To derive the necessary equations, new variables are defined below.

$$\hat{c}_t = \frac{\dot{c}_t}{c_t} - g \hat{c}_t \quad (26)$$

$$\hat{k}_t = \frac{\dot{k}_t}{k_t} - g \hat{k}_t \quad (27)$$

$g = \frac{\dot{A}_t}{A_t}$. Therefore, the system of differential equations can be seen in equations (28) and (29).

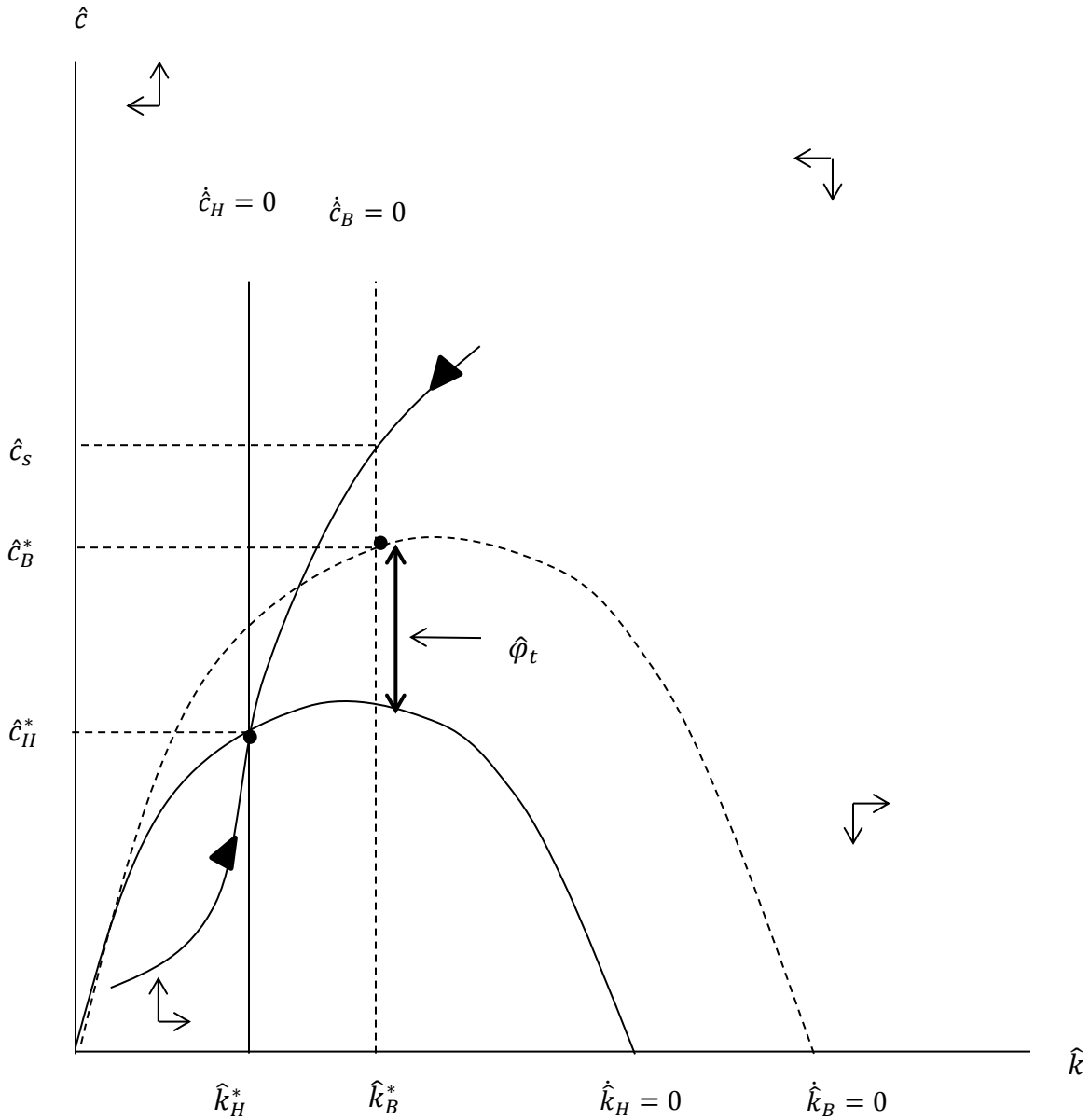
$$\dot{\hat{c}}_t = \frac{\hat{c}_t}{\theta} [(1 - \phi\tau)(f'(\hat{k}_t) - \delta - \rho - \theta g)] \quad (28)$$

$$\dot{\hat{k}}_t = (1 - \phi\tau)[f(\hat{k}_t) - \delta\hat{k}_t] - \hat{c}_t - g\hat{k}_t \quad (29)$$

A phase diagram can now be drawn for these two equations, shown in Figure 1. The interest for this chapter lies in the level of tax evasion and its effects throughout the economy. For comparative purposes, a baseline, indexed with a B on the graph, level of tax evasion is assumed and then this level is increased. The increased level of evasion is indexed with an H . This allows for the model to show how an increase in the level of evasion affects the economy. The tax rate faced by agents in this model is assumed to be constant throughout the analysis. The isocline for the increased level of evasion is rotated downward when compared to the isocline of the baseline level of tax evasion. Due to this difference between the isoclines, the higher level of tax evasion leads to lower steady-state levels of capital and consumption.

To see the effects of an increase in tax evasion on capital and consumption levels over time it is useful to take a look at the time paths for these two variables. At the baseline level of tax evasion, the economy is in a steady state. There are two effects at play here, the substitution and income effects. The substitution effect is evident when a lower level of tax evasion leads to a decrease in an agent's return on savings, therefore it is more worthwhile to consume today. But the income effect is leading to a different outcome, where the lower level of evasion leads to the agent becoming poorer therefore they are forced to consume less today. To be able to draw the time paths, one of the

Figure 1. Phase Diagram



effects has to dominate. Moving forward, the substitution effect overrides the income effect. Therefore, $\hat{c}_s > \hat{c}_B^*$. Before the time paths for capital and consumption can be

drawn, one final illustration must be made. Remember $\hat{k} = \frac{k}{A}$, therefore $k = \hat{k}A$ and after

logging and differentiating this representation of capital it can be seen that Equation (30) shows that

$$\frac{\dot{k}}{k} = \frac{\dot{\hat{k}}}{\hat{k}} + \frac{\dot{A}}{A} \Rightarrow \gamma_k = \gamma_{\hat{k}} + g$$

(30)

when \hat{k} is at its steady-state level, when $\hat{k} = \hat{k}^*$, the economy never stops accumulating capital. And this growth in capital is exactly equal to productivity growth. The same analysis can be done for consumption and the results tell the same story, $\gamma_c = \gamma_{\hat{c}} + g$. See Figures 2 and 3 for the time paths of capital and consumption respectively.

Figure 2. Time Path of Capital

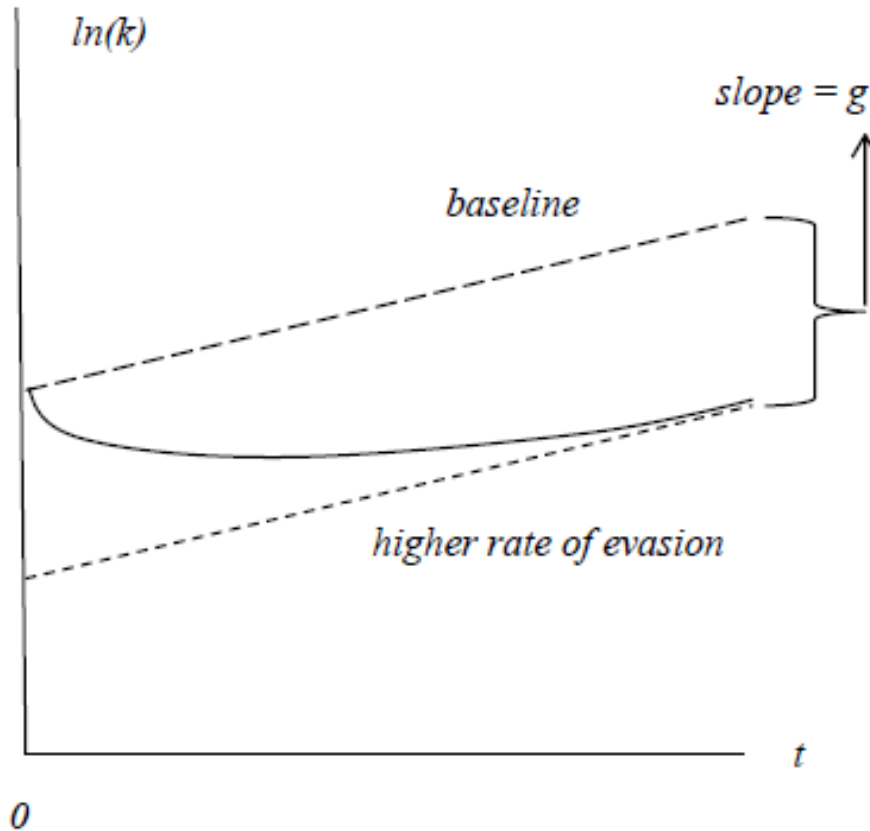
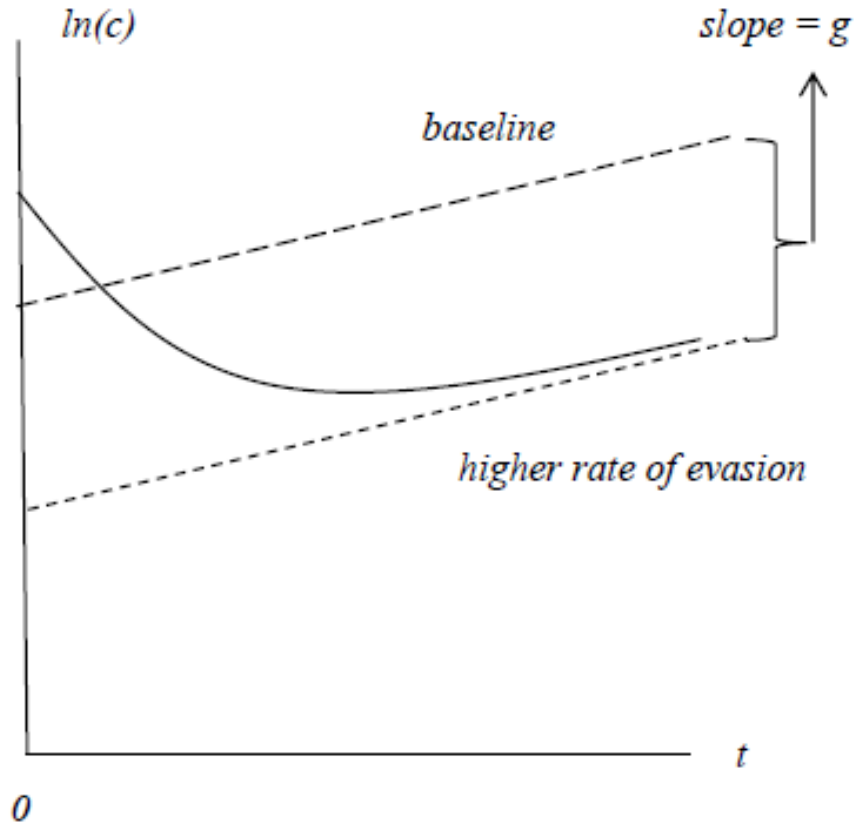


Figure 3. Time Path of Consumption



The results seen in the time paths show that the tax evasion activities do not affect the long term growth rate, which is only dependent on productivity growth. A higher rate of tax evasion leads to a lower level of capital per worker and, since the substitution effect outweighs the income effect, tax evasion leads to lower levels of consumption. No assumptions are made here as to what the agents will do with the income that they save from evading taxes.

How does this affect government revenue? Remember that government revenue is represented by the equation below. As the level of tax evasion increases, $\phi \rightarrow 0$, the amount of government revenue decreases. Remember, $\varphi_t = \phi\tau[w_t + r_t a_t]$, and define,

just as before $\hat{\varphi} = \frac{\varphi}{A}$. Now by looking at the phase diagram above it is easy to see the difference in government revenue due to tax evasion activities, $\hat{\varphi}_t$.

It is important to note that the previous model is only the beginning of the theoretical investigation of informal activities. The Ramsey model, and its possible extensions, offers a variety of ways to investigate the informal economy. For example, a functional form for the production function could be assumed. Also, the production function for formal production and informal production could be different and a producer would have to choose the output level that would maximize his or her profits. Producers in the models could also be assumed only to be entrepreneurs. Those types of extensions are future avenues of research.

Conclusion

All economies in the world face some level of informal activities, even those that have been historically considered ideal economic environments. It does not matter whether an economy is experiencing high rates of growth and is among the most developed in the world or if the economy is facing stagnant growth rates and is considered to be underdeveloped. There is no clear picture as to whether informal activities are indicators of a flourishing entrepreneurial environment or if it is a sign of an overly bureaucratic system. More often than not governments attempt to reduce the amount of informal economic activity that is happening in their economy. However, if that is the case and at the same time entrepreneurs and self-employed choose to be so to evade taxes then the government is working against the potential entrepreneurs in the economy. It is important to know, however not included in this model, what a tax evader does with the extra income that they saved from evading taxes. The model here gives a

simple look at the effects of tax evasion throughout the economy. One of the most obvious results is that as the level of tax evasion increases, government revenue decreases. The model also shows that investment into capital and levels of consumption will decrease as more taxes are evaded. However, the long term growth rate of the economy remains unchanged as a result of tax evasion. A possible extension of the model is to include assumptions about how agents use the money they save from evading taxes.

CONCLUSION

Encouraging entrepreneurship is only one of the focuses for policy makers but for long-term, sustainable growth, it should be considered an important one. As economists, we are tasked with analyzing policies, among other duties. Policy analysis and assistance in policy development are especially crucial when deciding how a nation can support entrepreneurial activities and the growth and development of the small business sector. The small business sector is an important provider of middle class jobs and creates competitive markets that drive down prices for consumers and offer them more choices on the marketplace. A healthy middle class can ensure healthy economic growth and low unemployment rates. This dissertation focuses on three distinct approaches to informing policymakers on the behavior of potential entrepreneurs and how they respond to policy changes.

The first approach as outlined in the first chapter is to take an existing policy and determine if it has affected the behavior of individuals in the manner that it set out to do. The benefits of this type of approach are that the unintended effects of the policies can be ignored and the difference-in-difference model allows for the isolation of the effects of the policies on a very specific group of people. State level policy makers wanted to develop a policy that would increase the take-up rate for insurance by subsidizing the costs. A major focus of all of the state level policies was to specifically cut the costs of health insurance for the self-employed, small business owners and those who are employed by small businesses. The analysis laid out in chapter one focused on the effects of the policies on the self-employed, which make up a large percentage of the uninsured. The results showed that the subsidies did increase the take-up rate among the self-

employed. This makes self-employment more attractive and is a very effective way of rewarding those who take the risk to become self-employed. Another possible effect of the policy could have been that it encouraged more people to choose self-employment over wage earning but the results did not support this. This is only one example of how a well-designed policy scheme can build the confidence of the self-employed and show them a sign that they are important members of society. This increase in take-up rates can lower healthcare costs because fewer people would use emergency services, which drives up costs. More individuals would see primary care physicians. This type of analysis is very important to the recent changes in the healthcare market as a whole. It gives policy makers a look at how certain policy designs have had the intended effects on individuals' behavior.

Unfortunately, not all policies have the intended effects and therefore, economist and other social and political scientists must work to advise policymakers while policies are being devised and considered. That is where chapter two attempts to come into play. The focus was to determine if there was a difference in the behavior of different groups of people. Policies are derived to encourage or discourage certain behaviors and isolating the effects of policies on specific groups of people is difficult without clear, personal level data to inform these decisions. One of the most effective ways to gather such data is by conducting an experiment. The second chapter offers information about the risk taking preferences among more and less entrepreneurial individuals. It is often assumed that entrepreneurs are by nature less risk averse but that is not necessarily the case. It may be that entrepreneurs believe that they may face more risk if he or she puts the control of his or her income in the hands of others but controlling it himself or herself is less risky. The

experiment investigated college students in the U.S. and Brazil to determine if there were differences in the groups' risk taking preferences. Weak support was found for the case that more entrepreneurial subjects were more financially risky than less entrepreneurial subjects. This was probably due to a low sample size. However, it gives a great starting point for investigating this possibility using experimental economics, which had not been done in the past. And with more funding, this study could easily be extended and replicated. One possible extension to the study would be to not use the survey tool to categorize individuals as more or less entrepreneurial but to have actual entrepreneurs and non-entrepreneurs take part in the experiment and determine if there is a fundamental difference in the behavior between the two groups.

A final way in which economists can help inform policy makers is through the development and testing of economic theories. As economists are often touted for simplifying the world with their theories and depiction of the world in a way that is too far from reality, many of the predictions of theoretical models have gained empirical support. One of the main points of theoretical exercises is the critical thinking behind the model development. The critical thinking often leads to future research questions, rethinking of assumptions and constructive criticism of existing models. These thought experiments, backed by the power of mathematics, allow economists to predict behavior and effects of economic changes on the economy as a whole. The ability to change parameters in a model and then trace out the effects offers powerful insights into the functioning of an economy.

The final chapter uses theoretical economics, specifically the Ramsey model, to investigate the effects of tax evasion on the economy as a whole. Of course, one of the

obvious effects is the decrease in government revenue as the level of tax evasion increases. It is quite convenient when economic theory supports intuitive reasoning and there is no less value in the model if it aligns with the intuition. One of the purposes of the theoretical models is to answer the questions as to why our intuition leads us to believe in certain happenings. Answering the “why” questions is very powerful for policy makers and they can easily access this information. One other interesting prediction of the model is that tax evasion does not affect the long-term growth rate of an economy, only productivity growth affects the growth rate.

This dissertation offers a very brief look into three of the ways in which economists can determine the effects of policies on the behavior of entrepreneurs. As noted, it is important to evaluate current policies, inform the development of policies using individual level data and also taking theoretical look at economic phenomenon. This is only the beginning of the research that can come out of thinking about the economics of entrepreneurship in this way and hopefully this will lead to more critical thinking on the topic. It is of high value to continue to inform policy on how important entrepreneurship is for economic growth and how these types of ventures can be healthily supported.

APPENDIX

Table 1A. Comparative Stats for Control (C) and Treatment (T) States by Industry GDP as a Percentage of State GDP

State	Region	Median Income	Ag/For/Fish*	Mining	Utilities	CNST	Mftg*	Finance	Retail	Trans*	R.E.*	P.S.*
Arizona (T)	West	57,855	0.64%	1.69%	2.29%	5.55%	7.75%	7.69%	2.65%	8.50%	15.36%	5.95%
Colorado (C)	West	68,943	0.82%	3.88%	1.36%	4.56%	6.98%	5.52%	2.51%	6.65%	13.32%	9.61%
Kentucky (T)	South	49,801	1.37%	2.39%	1.91%	4.02%	16.21%	6.30%	4.56%	5.55%	9.21%	4.40%
West Virginia (C)	South	47,659	0.34%	10.30%	3.05%	4.35%	8.85%	7.13%	3.01%	4.68%	9.41%	3.92%
Maine (T)	NW	56,566	N/A	N/A	1.78%	3.84%	10.39%	8.47%	2.37%	7.58%	14.02%	5.22%
Ohio (C)	Midwest	57,360	0.56%	0.39%	2.05%	3.29%	15.60%	6.42%	3.10%	9.60%	11.14%	6.03%
New Mexico (T)	West	51,994	1.45%	6.71%	1.96%	5.16%	5.30%	6.61%	2.56%	4.01%	11.93%	8.83%
Nevada (C)	West	60,829	0.21%	3.41%	1.85%	7.51%	4.12%	6.43%	3.44%	9.56%	13.71%	4.96%
Maryland (T)	South	84,254	0.25%	0.04%	2.10%	4.93%	5.30%	5.45%	1.88%	6.20%	16.85%	10.84%
New Jersey (C)	NE	83,381	0.16%	0.01%	1.66%	3.38%	7.99%	5.89%	2.91%	8.83%	17.36%	9.32%
Massachusetts (T)	NE	81,033	0.22%	0.04%	1.46%	3.37%	8.88%	4.52%	1.55%	11.10%	14.39%	11.89%
Rhode Island (C)	NE	69,350	0.17%	0.08%	1.82%	4.41%	8.09%	5.39%	1.44%	12.13%	15.07%	5.68%
Montana (T)	West	55,010	3.23%	4.64%	2.93%	5.63%	5.57%	6.68%	4.37%	5.48%	12.18%	5.10%
North Dakota (C)	Midwest	63,507	8.43%	3.07%	2.74%	4.55%	8.61%	6.40%	4.31%	6.76%	10.87%	3.41%
Tennessee (T)	South	51,344	0.57%	0.11%	0.72%	3.31%	14.27%	7.54%	4.74%	7.06%	10.80%	6.06%
Alabama (C)	South	50,779	1.21%	1.53%	2.97%	4.42%	15.76%	7.23%	2.73%	5.73%	9.93%	6.56%

*Ag/For/Fish represents agriculture, forestry fishing and hunting. CNST represents construction Mftg represents manufacturing. Trans represents transportation. R.E. represents real estate. Professional services represents professional services.

Data sources: U.S. Census Bureau, 2009 American Community Survey and 2009 Bureau of Economic Analysis, U.S. Department of Commerce.

Table 2A. Conversion from Education Attainment to Years

Highest level of attainment reported	Conversion to years
Less than 1st grade	0
1st, 2nd, 3rd, or 4th grade	2.5
5th or 6th grade	5.5
7th or 8th grade	7.5
9th grade	9
10th grade	10
11th grade	11
12th grade no diploma	12
High school grad, diploma or equivalent	12
Some college but no degree	13
Associate degree in college--occupation/vocation program	14
Associate degree in college--academic program	14
Bachelor's degree	16
Master's degree	18
Professional school degree	21
Doctorate degree	21

Exhibit 1 Recruitment Script

Your voluntary participation is being requested for an experiment in the Economics Department. The study is interested in finding more information about financial and economic risk decisions. You will be paid \$10 for participating with the opportunity to leave with more or less than that amount. You could leave the experiment with up to \$40. The experiment will last around one and a half hours. To be eligible, you must be a student at UNM and be at least 18 years of age. If you have questions or are interested in participating then please contact Dennis Barber III at dbarber3@unm.edu.

Exhibit 2 Experimental Script

ALL NON-ITALISIZED TEXT WAS SPOKEN. This script began after we reviewed the consent form and it was signed by each student.

Welcome to this study. Thank you for participating.

Each student will be seated at a desk with a study packet in front of them. This will include an envelope containing 10 one dollar bills, the 21 question survey and an envelope that they will use for the first round of investments.

Each of you have in front of you a study packet made up of an envelope containing 10 one dollar bills, a 21 question survey and another empty envelope. The ten dollar is your payment for completing the 21 question survey. However, at this time, do not remove this money from the envelope. Please complete the survey and pay close attention to the answers for each question. After you have completed the survey please sit quietly and wait for further instructions. Make sure you do not skip any questions on the survey. Are there any questions?

Time was given for them to complete the survey.

I will now come by and collect the surveys. I will soon explain what the empty envelope will be used for once I have collected all of the surveys.

The survey was then collected and each student was asked to remove the blank envelope in their study packet in which they will place their investment for the first round of investments.

You will now be asked to make a decision. You will decide how much money to invest in a risky asset. There is a 60% chance that you will earn more money if you invest in this asset and a 40% chance that you will lose the money invested in this asset. You can invest any or all of the ten dollars that you received for completing the survey. Whether you win or not will be determined by each of you drawing a card. I have here ten cards, the ace of spades, which we will call one, through the 10 of spades. If you draw a one, two, three, four, five or six then you will keep your investment and will gain an amount equal to that which you invested. If you draw a seven, eight, nine or ten then you will lose only what you invested. This gives you a sixty percent chance of gaining from your investment. For example, if you invest five dollars and draw a one through six then you will win five additional dollars. However, if you draw a seven through ten then you will lose only the five dollars that you invested.

You received an empty envelope. Without talking to anyone around you, please decide how much of your ten dollars you would want to invest and place that amount inside the empty envelope. Then wait for further instructions. Are there any questions?

Once everyone had decided, I went around to each person and shuffled the cards. They then chose a card from the stack. This determined if they had a gain or loss from their investment.

I am going to walk around the room to each of you individually. Please choose a card from this stack. If you draw a one through six then you will double your investment. If you draw a seven through ten then you will lose only what you invested. *As they win or lose, I marked that on the front of the envelope and collected them one by one.* Then my trusty assistant will take your envelopes in the back room. If you won then your envelope will be returned with your investment plus an additional amount equal to your investment. For example, if your envelope contains five dollars then it will be returned with ten. If you lost then you will receive an empty envelope. Please do not look at your neighbors' investments and do not share your results with them. Are there any questions?

All of the envelopes were then be collected and we took them into the other room. There we recorded the results from the first round and either added or took money from the subjects' envelopes. We then brought out the envelopes and give them to the students. Attached to each envelope was another empty envelope that had their study ID already recorded.

I will now pass back the envelopes with your gains or losses from the investment choices that you made. You will also be given another empty envelope that looks very similar to your first.

You now have the opportunity to invest in the same asset again. You will be able to invest any or all of your initial dollars and any or all of your gains from the first investment. The outcome will be determined in the same manner as before with a sixty percent chance of gaining from your investment. I will shuffle the same ten cards and you will draw one card from the stack. If you draw a one through six then you will gain from your investment at the same rate as before and if you lose then you will lose only what you invested.

If you won then your envelope will be returned with your investment plus an additional amount equal to your investment. For example, if your envelope contains five dollars then it will be returned with ten. If you lost then you will receive an empty envelope. Please do not look at your neighbors' investments and do not share your results with them. Are there any questions?

All of the envelopes were collected and we again took them into the other room. There we recorded the results from the second round and either added or took money from the subjects' envelopes. We then brought out the envelopes and give them to the students. We also filled out receipts for each study ID as we gathered the data. The receipts were given with the second round winnings.

Here are your gains and/or losses from the second investment. Please take your gains from the envelope. You will now all receive a receipt for your gains. I will come by each desk and give you each a receipt. Please verify and sign your receipt. What money you have now is yours to keep.

As I went by each person individually...

Please take a look at this receipt and verify that the information is correct by signing here. Please fill out the information on the receipt. Thank you for participating in this study.

Exhibit 3 Survey Tool

All questions were answered on a scale from 1 to 10, where 1 is “strongly disagree” and 10 was “strongly agree”.

1. I often approach business tasks in unique ways.
2. I enjoy being the catalyst for change in business affairs.
3. I believe that when pursuing business goals or objectives, the final result is far more important than following accepted procedures.
4. I don't hesitate to take control in unstructured situations.
5. I enjoy being able to use old business concepts in new ways.
6. It is important to continually look for new ways to do things in business.
7. I believe that in order to succeed, one must conform in accepted business practices.
8. I've often created the business opportunities I have taken advantage of.
9. I am ultimately responsible for my own business success.
10. My knack for dealing with people has enabled me to create many of my business opportunities.
11. It is exciting to aggressively pursue business opportunities.
12. I get a sense of accomplishment from the pursuit of my business opportunities.
13. I believe it is more important to think about future possibilities than past accomplishments.
14. I feel real satisfaction when my work is among the best there is.
15. I often sacrifice in order to take advantage of business opportunities.
16. I never put important matters off until a more convenient time.
17. I feel very self-conscious when making business proposals.
18. I feel uncomfortable when I'm unsure of what my business associates think of me.
19. I spend a lot of time looking for someone who can tell me how to solve all my business problems.
20. I always try to make friends with people who may be useful in my business.
21. I feel self-conscious when I am with very successful business people.

The questions associated with each subscale score are:

Innovation—1, 2, 3, 5, 6 and 7

Achievement—12, 13, 14, 15 and 16

Personal Control—4, 8, 9, 10 and 11

Self-Esteem—17, 18, 19, 20 and 21

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