

ON THE PREFERENCES OF PRINCIPALS AND AGENTS

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One of the reasons why market economies are able to thrive is that they exploit the willingness of entrepreneurs to take risks that laborers might prefer to avoid. Markets work because they remunerate good judgment and punish mistakes. Indeed, modern contract theory is based on the assumption that principals are less risk averse than agents. We investigate if the risk preferences of entrepreneurs are different from those of laborers by implementing experiments with a random sample of the population in a fast-growing, small-manufacturing, economic cluster. As assumed by theory, we find that entrepreneurs are more likely to take risks than hired managers. These results are robust to the inclusion of a series of controls. This lends support to the idea that risk preferences is an important determinant of selection into occupations. Finally, our lotteries are good predictors of financial decisions, thus giving support to the external validity of our risk measures and experimental methods (JEL C93, D81, D86).

I. INTRODUCTION

A basic intuition in economics is that trade is not possible without heterogeneity of preferences or assets and that markets are best equipped to allocate resources and abilities to tasks. This paper takes this intuition to task by looking at risk. We investigate if risk preferences are heterogeneous in the field and if markets allocate people to tasks based on their risk preferences. We do this by implementing experiments with a random sample of managers in a fast-growing economic cluster.

The idea that markets need agents that are willing to take risks in order to develop dates back, at least, to Cantillon (1734). Later authors like Hayek (1969) and Knight (1921) note that entrepreneurs are needed to bear any extra

gains and losses from the efficient allocation of resources. However, there is no universal agreement that entrepreneurs must be willing to bear more risks. Schumpeter (1932), for instance, argues that, as markets develop, it is financial systems that should bear risks and not particular agents. However, in the presence of information asymmetries, there is no guarantee that financial markets will be able to absorb all risk. Perhaps the area of economics where the role of risk preferences is most explicit is that of contract theory. Standard treatments of the principal-agent model (Kreps, 1990) show that principals are able to offer incentive-compatible contracts that exploit the relative risk aversion of principals and agents. In this paper, we empirically investigate this asymmetry of risk.

There is little empirical evidence corroborating the basic assumption that principals are less risk averse than agents. Previous work in the entrepreneurship literature has used hypothetical risky investment questions or situational questions to measure risk, and comparisons have been across the general population and across various sectors.¹ The evidence is mixed. In early work, using mailed surveys to assess risk propensity, Brockhaus (1980) and Masters and Meier (1988) find no difference between owners and managers. Cramer et al. (2002) find

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1. Incentivized risk payments have been correlated with outside of the lab economic outcomes in previous research. Our focus is on risk aversion in situations with principals and agents.

a link between an ex post hypothetical lottery risk measure and entrepreneurial choice at some previous point in a person's life; however, they caution that their results are not causal. Ekelund et al. (2005) use a psychological measure of "fear of uncertainty" to measure risk. They find a direct link between their risk measure and being self-employed. More generally, Bonin et al. (2006) use a hypothetical risky investment question to measure risk and find a correlation between risk and variance in earnings across occupations. They do not study entrepreneurs per se.

A challenge in testing the hypothesis of heterogeneity of preferences is that we rarely observe people in these conditions. To wit, it is not clear that simple comparisons between people in managerial and nonmanagerial positions will provide the appropriate contrast. Indeed, those in managerial positions are likely to be more educated but otherwise similar to others. Also, relating variance in income and risk aversion across various sectors may pick up unexplained variation in wages across sectors that may be correlated with risk.

To avoid these problems, we collect experimental data on risk preferences in a sample of managers of micro-enterprises in a fast-growing economic cluster. All firms in this cluster are involved in small manufacturing and are geographically close. We exploit the fact that many firms in this sector are managed by owners (entrepreneurs), but many others are managed by agents. Owner-managers and agent-managers face similar risks and market conditions when making decisions for the firm. Moreover, in this context, business activity takes place with limited financial intermediation, so one expects risk preferences to be important. All this makes our sample ideal to compare the preferences of entrepreneurs with that of agents. If people select into activities according to their preferences, we should expect that those managing their own enterprises will be less risk averse than agents.

Indeed, we find strong evidence that agents are more risk averse than owners as theory suggests. In our experiments, agent-managers are more conservative in paid lotteries over gains as well as in lotteries over gains and losses. We test if our results are robust to the inclusion of covariate data, and we find that our basic result changes little. People sort into activities according to risk preferences. Moreover, we find evidence that the experimental

data correlates with important financial decisions. This provides evidence of the usefulness of experimental methods in understanding basic economic hypotheses and also of the importance of carefully selecting samples to make these hypotheses testable.

The paper is organized as follows. Section II discusses the sample and experimental methods. Section III presents basic experimental results and its relationship with economic decisions. Section IV concludes.

II. SAMPLE SELECTION AND DESIGN

The study was conducted in Gamarra, a fast-growing economic cluster in Lima, Peru. Gamarra is akin to the Garment District in New York; it is a sector full of firms involved in small-scale manufacturing and trade. Most of Gamarra's entrepreneurs are migrants who started their business outside the formal financial system. Until the early nineties, this sector has faced little regulation or support, making it a unique laboratory of how market forces work.²

Gamarra is a 12-square block area in Lima, Peru. It emerged in the 1960s as an area where migrants started small textile businesses to supply the growing garment industry. Since its inception, the area has attracted migrants and entrepreneurs for its agglomeration economies. Now, the area hosts thousands of small firms engaged in small manufacturing (i.e., retail, consumption, and wholesale goods) and trade. Because of their small size, firms are capable of quickly adapting production to the needs of the market. This makes the area dynamic and attractive to those willing to take risks.

In order to secure a random sample of the population of businesses, first, a pre-census of all establishments was conducted. Then, a random sample of establishments was selected. The manager of the establishment was surveyed on the characteristics of the firm. This survey collected information on the assets, age, size, and financial matters of the firm as well as informal business networks. A separate, extensive survey was conducted to gather information on the manager's household. In a separate visit, the manager was asked a few lottery questions. These lotteries were only asked of managers,

2. In 1995, a new simplified tax system was implemented to make it possible for small business to pay taxes. Further modifications were introduced in 2003.

many of whom were owners of the firm as well.³ The experimental procedures are explained further below.

Table 1 presents a summary of the population of managers and firms. The data are restricted to firms managed by men because, of the 360 firms interviewed, only 47 were managed by women. More notably, of the firms managed by women, 91% are also owners. So, there is little variation in agents and owners among women. This also suggests that the type of women who become entrepreneurs may be different than men who become entrepreneurs.⁴ Therefore, to limit possible noise from unobservables, we focus our analysis on the male-managed firms. All the results in the paper hold, however, if women are included.

Looking at Table 1, 60% of firms are managed by their owners. Eighty-eight percent of managers are married, 85% finished high school, and 23% have a college degree. The average age is 43 yr. The table shows that the households of managers are not rich by Peruvian standards. In Peru, average annual per-capita income at the time of the study was 18,000 soles. The average per-capita income of managers in our sample is 8,890 soles. The households are not poor either. The income of managers is three and one half times higher than the poverty line of 6.94 soles a day.⁵ Owners have a higher annual income than nonowners. They make over 2,000 soles more per year. The amount of money saved in the manager's household in all financial accounts (personal savings) is about 10% of average annual income, and the implicit monthly interest rate is less than 1%.

The average size of the firm is 3.3 members, with a maximum size of 26 members in our sample. Most firms are relatively young, 5.1 yr old on average, with the youngest being less than a year and the oldest being 32 yr old. The firms have an average annual income slightly above US\$31,000 per year and the value of assets is around US\$14,000. In a typical month, the

3. In the United States, entrepreneurs of growing firms may give up some or all ownership through initial public stock offerings, venture capital funding, etc. In Gamarra, this type of movement between roles of owner to manager does not occur. Some agent-managers may become owners of a firm, but not the one they are currently managing.

4. One notable difference between men and women is their risk aversion. Women are *not* more risk averse than men. This issue, however, is reserved for another paper.

5. Two dollars a day (6.94 soles) is one poverty-line measure. This income equates to around 2,533 soles a year at the time of the survey (US\$1 = 3.47 soles).

TABLE 1
Descriptive Statistics—Gamarra—Means

Managers	
Owner (percent)	60.38 (3.0)
Married (percent)	88.45 (5.0)
High school (percent)	84.98 (2.0)
College (percent)	23.32 (2.0)
Age (years)	43.40 (0.68)
Annual per cap. income (,000)—soles	8.89 (0.62)
Annual per cap. inc.—Owner (,000)—soles	9.76 (0.97)
Annual per cap. inc.—Nonowner (,000)—soles	7.57 (0.54)
Household size	3.89 (0.10)
Personal savings (,000)—soles	0.81 (0.20)
Implicit interest rate for savings	0.80 (0.01)
Firms	
Number of workers	3.31 (0.14)
Age of firm (years)	5.07 (0.30)
Annual income (,000)—soles	107.62 (8.53)
Profit (percent)	61.74(6.74)
Total capital (,000)—soles	49.32 (9.70)
Loan size (,000)—soles	1.41 (0.23)
Implicit interest rate for loans	3.54 (0.38)
Firms formally registered (percent)	87.86 (1.85)
Observations	313

Notes: Standard errors in parentheses. Exchange rate, 3.47 soles = US\$1.

average profit per firm is 62 cents per dollar. The amount of money taken out in loans by the firm over the past year is slightly above 1% of average annual income, and the implicit monthly interest rate is 3.5%. Roughly 88% of firms are formally registered and pay taxes.

To elicit risk preferences, all managers were asked to respond to a series of simple lotteries. The lotteries are a simplified version of the lotteries first used by Binswanger (1980). Managers were asked to choose one of five risky prospects that gave a high and low payoff with equal probability. The lotteries are listed in Table 2. They were constructed by either adding $30 \times k$ or subtracting $10 \times k$, $k = 1, \dots, 4$, to an initial high and low payoff of (50, 50) or (0, 0). The first set of lotteries, therefore, were over gains and the second over gains and losses. The units of the lottery were cents of the local currency.⁶ The lottery payments were set large enough to be salient, but small enough to afford a large number of observations.

6. One hundred cents, or 1 sole, could buy a person lunch in Gamarra.

The experimental procedures were as follows. After the firm and household surveys were administered, in a separate visit from the visits for the surveys, the lottery questions were asked. Managers were asked to make their lottery decision over gains, then over gains and losses. Once decisions were made, lotteries were resolved by flipping a coin. Managers were then paid in cash the sum of their earnings from the gain and gain-loss lotteries. Managers knew of these procedures before making their decisions.

III. RESULTS

A. Basic Results

This section discusses the results of our experiment. Table 2 presents the frequency with which each lottery was chosen and the average decisions made according to several socioeconomic variables. Forty-nine managers (15.6%) did not answer the lottery question. There does not appear to be selection on observables. While richer households are more likely to answer the lottery question, owners are no more likely than nonowners to answer. There are no other differences (i.e., by age, education, etc.).

The top panel of Table 2 shows that choices are distributed evenly in the lottery over gains. The lottery over gains and losses, however, generates a significantly larger proportion of safe choices.⁷ The significant increase in risk aversion in the lotteries over gains and losses is as pronounced as the shift toward safe bets reported by Binswanger (1980, 1981) and Holt and Laury (2002) in lotteries with large stakes versus lotteries with small stakes.

That behavior across lotteries varies in an intuitive way gives us confidence that subjects took them seriously despite the small stakes. This would seem to be at odds with the assumption that the utility function for money is arbitrarily close to linear over small amounts of money. However, Holt and Laury (2002) show significant evidence of risk aversion even when lotteries use small stakes, and that risk aversion increases as payoffs are scaled up. They

7. Because each manager made a decision for the gain lottery and the gain/loss lottery, the two distributions are not independent. The appropriate test for the null hypothesis of identical distributions is a Friedman test for matched groups. The test statistic is 384.39 and is distributed $\chi^2(1)$ with a p -value $< .000$. A Wilcoxon signed rank test also rejects equality (p -value $< .000$), and a sign test that tests the null hypothesis that the median of the difference between the two lottery choices is zero is also rejected (p -value $< .000$).

also show that it is possible to find evidence of risk aversion over small stakes without implying impossibly high levels of risk aversion over large stakes.

Also, our lotteries provide a direct test of the hypothesis of constant absolute risk aversion. By design, the payoffs of both lotteries differ only by a constant (50). The definition of constant absolute risk aversion implies, therefore, that we should not expect any change in behavior across lotteries. We conclude then that managers possess either decreasing absolute risk aversion or suffer from loss aversion.⁸

The second panel of Table 2 compares risk preferences across different segments of the population of managers. The first 3 columns of numbers in the bottom panel present comparisons for the lotteries over gains and the last 3 columns present comparisons for the lotteries over gains and losses. The lottery measure is the number of the lottery choice. So, a 1 means the person chose the first lottery, and a 5 means he chose the fifth lottery. We find that owners are significantly less risk averse than agents. This is true in both lotteries.⁹ On average, the decision of an owner-manager is 19% higher than that of an agent-manager. While we find differences across other populations, evidence on other personal or household characteristics is less robust.

Table 3 presents regression analysis of individual decisions. We take this approach because the availability of survey data on managers and their households allows us to control for different socioeconomic backgrounds and see if the difference between owners and agents still holds. We do not take the results as evidence of causation. Rather, we view the analysis as a check on our main result that risk aversion of owners and agents is significantly different. Since choices are ordered by risk, with 1 being the safest choice and 5 being the riskiest choice, we use an ordered logit regression. The regressions control for education, age, income, family size, and a polychoric index (Angeles and Kolenikov, 2004) of household assets and durable goods. Note that the education variables are nonexclusive. The coefficient on high school measures the effect of high school versus no high school, and the coefficient on college is the

8. Given the small stakes of our lotteries, the hypothesis of loss aversion seems more plausible.

9. In a smaller sample ($n = 55$) of male owners and agents with monetary stakes 20 times larger, owners are significantly less risk averse than agents over gains and gains/losses.

TABLE 2
Experimental Data

Distribution of Choices						
Lottery	Gains		Gains & Losses			
	High and Low Payoff	Frequency	High and Low Payoff	Frequency		
1	(50,50)	18.56	(0,0)	31.44		
2	(80,40)	23.86	(30,-10)	29.19		
3	(110,30)	20.45	(60,-20)	20.45		
4	(140,20)	18.18	(90,-30)	13.26		
5	(170,10)	18.94	(120,-40)	5.68		
	Observations	264	Observations	264		

Average Responses						
Variable	Gains			Gains & Losses		
	No	Yes	<i>t</i> -test (<i>p</i> -value)*	No	Yes	<i>t</i> -test (<i>p</i> -value)*
Owner	2.70	3.12	-2.45 (0.02)	2.15	2.44	-1.93 (0.05)
40 Yr or Older	2.96	2.94	0.11 (0.91)	2.45	2.21	1.60 (0.11)
Above Median Income	2.86	3.05	-1.11 (0.27)	2.23	2.42	-1.22 (0.22)
High School	2.48	3.04	-2.37 (0.02)	2.03	2.38	-1.72 (0.09)

*The same comparison of means results hold with a Wilcoxon rank sum test.

differential effect of college from high school. The results in the table are unchanged if additional controls are added or if we control by type of business (i.e., retail, consumption, or wholesale).¹⁰

Table 3 confirms that the effect of ownership remains even when controlling for additional covariates. Those with high school education make riskier choices, and completing college reduces the risky choice by half. Our results suggest that entrepreneurs are different from other managers. Even controlling for income and wealth, owners that manage their own firms are significantly less risk averse than managers who do *the same job* but for others. Our sampling procedure gives us confidence that confounding factors have been minimized because occupation and market conditions are held constant. The results are important because they confirm economists' fundamental views of markets and social interactions. Entrepreneurs are more tolerant to risk and agents are more risk averse than principals.

Evidence that simple lotteries capture differences in preferences across the population is

10. For instance, the results are similar if we add controls for experience and household age composition, among others.

mixed.¹¹ Eckel and Grossman (2008) use an instrument similar to ours, and their results suggest that some instruments might be better suited to capture differences in preferences in the population. Clearly, if instruments only weakly capture subjects' preferences, it would be difficult to find effects unless they are really strong or the instrument is well calibrated.

We would also like to know if risk preferences elicited with the lotteries and actual economic outcomes are correlated. The evidence from the literature is mixed. Some have found a correlation. For example, Binswanger (1980, 1981) finds agricultural investment decisions related to risk measures. Eckel et al. (2007) find a correlation between risk measures and experimentally provided educational subsidies. Jacobson and Petrie (2009) find no correlation between financial decisions and risk measures. We speculate that these inconclusive results may be due to the types of decisions (i.e., household vs. business) to which these risk preferences are

11. For instance, Holt and Laury (2002) find that risk aversion is weakly related or not at all with gender, major, or race. Dave et al. (2007) find a correlation between several risk measures and gender. Dohmen et al. (2005) find correlations between risk lotteries and gender, age, and height. For an excellent review of the literature on risk and gender, see Croson and Gneezy (2008).

TABLE 3
Ordered Logit Regressions on Lottery Choices

	Gains	G&L	Gains	G&L
Owner	0.602** (0.011)	0.463* (0.052)	0.602** (0.011)	0.452* (0.059)
High school	1.082*** (0.002)	0.782** (0.027)	1.113*** (0.002)	0.664* (0.066)
College	-0.582** (0.037)	-0.311 (0.257)	-0.576** (0.041)	-0.371 (0.181)
Age (years)	0.004 (0.958)	0.005 (0.943)	0.002 (0.976)	-0.006 (0.928)
Age squared	0.000 (0.821)	-0.000 (0.857)	0.000 (0.802)	-0.000 (0.908)
Log of household income	0.259* (0.079)	0.183 (0.207)	0.275* (0.095)	0.063 (0.700)
Family size	-0.112 (0.115)	-0.031 (0.664)	-0.120* (0.093)	-0.026 (0.717)
Index of household characteristics			0.089 (0.503)	0.059 (0.644)
Index of household assets			-0.068 (0.556)	0.170 (0.137)
Constant	2.228 (0.266)	1.742 (0.381)	2.347 (0.290)	0.054 (0.981)
Log-likelihood	-411.38		-384.04	-382.61
N	264		264	264

Notes: *p*-values in parentheses; **p*-value < .10, ***p*-value < .05, ****p*-value < .01.

being related. In the next section, we look at the correlation between our risk measures and household and business decisions.

B. Risk Preferences and Economic Decisions

A potential concern is that experimental data, while strongly correlated with personal characteristics, is uncorrelated with important economic decisions.¹² Table 4 presents Tobit regressions on the amount of money saved in the manager's household in all financial accounts and on the amount money taken out in loans by the firm over the past year. The latter is the monetary amount of loans approved, not the amount applied for.¹³ The first decision is a household financial decision, and the second is a firm financial decision.¹⁴ All regressions control for household and firm characteristics and

for whether the manager is the owner or not. Finally, we include the decisions made by the manager either in the lottery over gains or in the lottery over gains and losses.

We find that while decisions in the experiments are insignificantly correlated with household savings, lotteries over gains and losses are positively and significantly correlated with the amount of credit held by the firm. This result is to be expected as household decisions are not solely a function of the manager's preferences but, potentially, also of other household members' preferences. Credit decisions, on the other hand, are under the control of managers. This result reassures us that our measures actually explain decisions and of the external validity of experimental methods. Because we have already established that risk preference is partially captured by being an owner, the effect measured in this regression is likely to underestimate the total effect of risk preferences on economic decisions.

The estimates indicate that the marginal effect of one higher choice in the lottery over gains and losses would increase the amount of credit held by the firm by 1,863 soles. This is true even controlling for personal and firm

12. Of course, preferences may not be correlated with economic decisions because of heterogeneous expectations. We do not explore that here.

13. Summary statistics for these variables are shown in Table 1.

14. While entrepreneurs make a variety of decisions, we focus on this financial decision because it is a good example of an economic decision by the firm.

TABLE 4
Tobit Regressions on Financial Decisions

	Savings (,000)		Loans (,000)	
Choice in gain lottery	1.093 (0.114)		1.069 (0.254)	
Choice in gain and loss lottery		0.293 (0.703)		1.863* (0.065)
Owner	1.583 (0.449)	2.157 (0.312)	10.904*** (0.001)	10.702*** (0.001)
High school	-0.566 (0.864)	-0.232 (0.945)	-4.149 (0.257)	-3.709 (0.298)
College	2.460 (0.247)	1.938 (0.369)	4.087 (0.181)	3.847 (0.199)
Age (years)	0.423 (0.564)	0.529 (0.485)	2.112** (0.041)	2.148** (0.036)
Age square	-0.007 (0.393)	-0.008 (0.346)	-0.024** (0.036)	-0.025** (0.033)
Log of household income	1.534 (0.265)	1.809 (0.205)	4.556** (0.020)	4.765** (0.014)
Family size	-0.646 (0.332)	-0.807* (0.225)	-0.230 (0.782)	-0.152 (0.854)
Index of household characteristics	-1.734 (0.132)	-1.672 (0.158)	-0.003 (0.998)	-0.054 (0.972)
Index of household assets	3.472*** (0.000)	3.489*** (0.000)	-1.807 (0.187)	-2.105 (0.130)
Firm age (months)	-0.009 (0.565)	-0.007 (0.639)	-0.017 (0.444)	-0.014 (0.502)
Number of workers	0.545* (0.074)	0.593* (0.061)	0.247 (0.566)	0.197 (0.644)
Firm is registered	4.236 (0.364)	4.495 (0.355)	-3.479 (0.415)	-3.287 (0.441)
Implicit interest rate (00)	0.662 (0.753)	0.800 (0.712)	0.222* (0.077)	0.218* (0.078)
Constant	-38.731* (0.067)	-42.225* (0.053)	-105.684*** (0.001)	-110.779*** (0.001)
Log-likelihood	-158.68	-159.86	-266.96	-265.86
Observations	264	264	264	264

Notes: p -values in parentheses; * p -value < .10, ** p -value < .05, *** p -value < .01.

characteristics.¹⁵ This is important because our experiments not only detect important differences in the preferences of the population, but also identify statistically and economically significant consequences of risk preferences on decisions. This suggests that previous results showing that risk experiments are either insensitive to preferences or uninformative about decision making might partially be due to the experimental instrument and sample choice. Indeed, the issue of heterogeneity of beliefs is

15. Choices in the lotteries are correlated with other financial decisions like having participated in credit groups or holding credit cards.

less of a problem in our sample due to the fact that subjects in our experiment face similar market conditions.

IV. CONCLUSIONS

We investigate whether risk preferences of economic agents are important in market economies and explain sorting into jobs. Using a simple experimental procedure, we measure risk preferences in a random sample of business managers. All the managers work in a dynamic small-manufacturing cluster, share similar socioeconomic backgrounds, face similar market conditions, but differ in their ownership

of a business. By restricting our sample to managers, we reduce any confounding effects from different market conditions and increase the external validity of our results.

We find two key results. First, managers who own the firm where they work are significantly less risk averse than managers who do not own the firm. This result is robust to the inclusion of socioeconomic characteristics of managers and type of manufacturing. This supports the theoretical assumption that agents are more risk averse than principals. It is also consistent with the view that entrepreneurs are overly optimistic.¹⁶ Second, our study gives strong support to the basic economic intuition that entrepreneurs are different and markets encourage them to sort into activities that require dealing with significant risks. Our measures of risk aversion are correlated with business financial decisions made by the manager.

Our study gives support to the importance of field experiments, as articulated by Harrison and List (2004). Taking experimental methods to the population of interest and sampling from a population where confounding effects are less likely to be an issue seem to be important. Experimental methods cannot only be a powerful tool to detect differences in preferences, but they can also detect evidence of sorting. The distribution of preferences across principals and agents in a business sector seems to be consistent with economic theory.

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16. de Meza and Southey (1996) argue the overly optimistic will become entrepreneurs. Busenitz and Barney (1997) find that entrepreneurs may have certain cognitive biases, such as excessive optimism and overconfidence.