

# Gender differences in risk preferences of entrepreneurs

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**Abstract:** Women have been found to be more risk averse than men in a number of domains, including taking financial risk. We provide evidence that this is not always the case. Drawing from a representative sample of small businesses in two vibrant markets in Lima, Peru, we find that female entrepreneurs are more risk taking than male entrepreneurs. These differences cannot be reconciled with learning on the job to take more risks but rather are driven by the type of individuals who chooses to be entrepreneurs. Women may require a higher threshold of risk tolerance than men to be willing to start a business. Household income is more variable for women, and they may need to be more risk taking to be willing to start a business.

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# 1 Introduction

Most studies using incentivized experiments reveal that women are more risk averse and more homogeneous than men (Castillo and Freer, 2018; Croson and Gneezy, 2009). This suggests that women will be less likely to select into risky environments, and if they do, they will be on average more risk averse than men, based on the premise that the distribution of risk preferences of men has fatter tails. Further, with stable underlying characteristics of preferences, observing preference differences across environments would help distinguish the market conditions faced by men and women when making job choices. In this paper, we show the potential usefulness of this choice-based sampling approach.<sup>1</sup> We use experiments in combination with field data to help identify mechanisms that give rise to an unusual distribution of preferences.

Starting a business may be a feasible job choice in settings where women face barriers to entry in some sectors of the labor market and the gender wage gap is high. Starting a business, however, requires taking some risks to initiate the venture and survive. The question we explore is whether among those who choose to become entrepreneurs are there gender differences in underlying risk preferences and what might be driving these differences. We focus on entrepreneurs in a competitive sector with many small businesses and an environment that does not necessarily favor women to explore gender differences in risk tolerance and potential pathways.

Our approach is to fix the industry and the position within the business to reduce potential confounds of differences across industries or job positions. We then use an economic experiment to measure risk preferences over financial lotteries. The decisions are incentivized and payments depend on choices and luck. Because all participants face the same choice set and financial consequences for their decisions, this provides a measure of risk that is comparable across individuals and businesses.

We draw from a representative sample of entrepreneurs in two vibrant markets in Lima, Peru. Each market represents an agglomeration of small businesses focused on a particular industry (e.g. garments, wholesale fruits and vegetables). This allows for investigation of entrepreneurial activities and risk tolerance across industries within the same occupation. Our results are robust in both markets.

We find the following main results. First, female entrepreneurs in Peru are more risk taking than male entrepreneurs. In auxiliary representative samples of the population, this is not the case. Women are either more risk averse or no different from men in their propensity to take risks. Second, this difference in risk tolerance is not consistent with learning but seems to be driven by sorting of more risk-taking women into the sector. We find no effect of length of time in business on gender differences in risk preferences. The

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<sup>1</sup>An alternative approach would be to collect information on preferences first and observe choices later. Information on the distribution of preferences in the population would be combined to answer the question of selection into markets based on risk preferences (see Manski and McFadden (1981)).

higher willingness to take risks by women compared to men is prevalent for new entrants as well as survivors. Third, it might require a higher willingness to take risks for a women to become an entrepreneur in this environment compared to a man. The women who become small business owners also face more background risk than male owners, suggesting that these women would need to be more willing to tolerate risk to choose entrepreneurship.

The vast majority of the literature examining gender differences in the willingness to take financial risks show that women are more risk averse or no different than men (Atkinson, Boyce Baird, and Frye, 2003; Byrnes, Miller, and Schafer, 1999; Croson and Gneezy, 2009; Dwyer, Gilkenson, and List, 2002; Johnson and Powell, 1994; Powell and Ansic, 1997).<sup>2</sup> To our knowledge, this is the first study to show that the risk-taking propensity of women can exceed that of men.

Our study also points to selection into this sector rather than learning. Starting a small business is risky and entails a willingness to enter a potentially competitive sector, such as the markets we study. Studies on the willingness to take risks of entrepreneurs compared to other groups find mixed results. Many studies find no difference between entrepreneurs and the general population (Andersen, Harrison, Lau, and Rutstrom, 2014; Brockhaus, 1980; Caliendo, Fossen, and Kritikos, 2009), yet entrepreneurs have been found to be more risk taking than managers (Castillo, Petrie, and Torero, 2010; Stewart and Roth, 2001). Gender differences in risk preferences among entrepreneurs do not uncover differences. If anything, women are still found to be more risk averse than men (Birley, 1989; Masters and Meier, 1988). Our finding that women need to be even more risk taking than men to be an entrepreneur in Peru speaks to the barriers that women may face to succeed. Given the potentially high returns and flexibility to working as an entrepreneur relative to wage work in the formal sector (Yamada, 1996), the loss in earnings for women who decide not to start a small business could be large.

## 2 Study setting

We draw our sample from two dynamic economic clusters in Lima, Peru - Gamarra and el Mercado Mayorista. These markets are characterized by a large number of entrepreneurs who located there to established small businesses. These areas are dynamic and attractive to those willing to take risks.

Gamarra is similar to the Garment District in New York in that it is full of businesses 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 environment to study how market forces work.<sup>3</sup> Gamarra was established in the 1960s and known as an

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<sup>2</sup>Studies do show that women are more likely than men to take social risks (Morgenroth, Fine, Ryan, and Genat, 2017).

<sup>3</sup>In 1995, a new simplified tax system was implemented to make it possible for small business to pay

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, it hosts thousands of small firms engaged in small manufacturing (i.e., retail, consumption, and wholesale goods) and trade.

El Mercado Mayorista is a wholesale fruit and vegetable market in Lima. It attracts entrepreneurs as well and was located adjacent to Gamarra.<sup>4</sup> Mayorista was established in the 1980's. Because of the nature of the businesses that locate in the market, e.g. fruits and vegetable vendors, the physical space and capital requirements needed to conduct business are lower than those in Gamarra. Compared to Gamarra, the number of businesses are fewer, more employees are employed in each business and each business has been in operation for a longer period of time.

### 3 Data collection

#### 3.1 Survey

In order to secure a random sample of the population of businesses in Gamarra and Mayorista, first, a census of all businesses was conducted. There were 13,246 businesses in Gamarra and 771 in Mayorista at the date of the census in 2003. From the population of businesses, a random sample of businesses was selected (n=360 for Gamarra, n=250 for Mayorista). The manager of the business was surveyed on the characteristics of the business. This survey collected information on the assets, age, size, and financial matters of the business as well as informal business networks. A separate, extensive survey was conducted to gather information on the manager's household.

#### 3.2 Experimental design

In a separate visit, the manager was asked a few incentivized lotteries questions. These questions are designed to measure risk preferences. The manager makes two decisions. In each decision, the manager is asked to choose one out of five lotteries. Each lottery has one of two possible payments that are each realized with 50% probability (a coin toss). The manager is paid in cash the outcome of the chosen lottery, so payment depends on decisions and luck. The first decision involves choosing one of five lotteries with strictly positive payoffs, which we refer to as the gain-gain lottery. The second decision involves choosing one of five lotteries that have both positive and negative payoffs, which we refer to as the gain-loss lottery.

The lotteries used in the two decisions are listed in Table 1. These are a simplified version of those presented in Binswanger (1980). The left-side panel shows the payoffs for taxes. Further modifications were introduced in 2003.

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<sup>4</sup>At the time of the study, the two markets were adjacent. Since then, the market was moved to a new location and placed under new management.

Table 1: Risk Experiment Decisions

	Gain-Gain Lotteries (choose one)		Gain-Loss Lotteries (choose one)	
	Heads	Tails	Heads	Tails
G1	50	50	GL1	0
G2	80	40	GL2	30
G3	110	30	GL3	60
G4	140	20	GL4	90
G5	170	10	GL5	120

Payoffs are in cents. 100 cents equal one sol.

the five options in the gain-gain lottery. G1 is a lottery that pays 50 cents for sure.<sup>5</sup> G2 pays 80 cents if a coin flip results in heads and 40 cents if the result is tails. Each subsequent lottery is increasing in expected payoff and variance. The right-side panel shows the payoffs for the five gain-loss lotteries. GL1 pays nothing for sure, and GL2 pays 30 cents if the coin lands heads and results in a loss of 10 cents if the coin lands tails. Each subsequent lottery increases the expected payoff and also the variance.

Participants made both decisions and then a coin was tossed to determine payment for the first decision and then again for the second decision. Participants were paid in cash for the amount they earned in the gain-gain and gain-loss lotteries at the end of the interview.

## 4 Results

### 4.1 Description of sample

Characteristics of the managers and businesses in Gamarra and Mayorista are summarized in Table 2. Businesses in Mayorista are more likely to be managed by owners (80%) than in Gamarra (64%), and the businesses in Mayorista have been established for a longer period of time (21.5 years versus 5.2 years) and are slightly larger (4.3 workers employed versus 3.2 workers).

Managers in Gamarra and Mayorista are not particularly wealthy. The average annual income in Peru was 18,000 soles at the time of the study. Managers earn slightly less than that (17,057 soles). The households are not poor either – they make about seven times more than the poverty line of 6.94 soles a day. For over half of our sample, the highest level of education is secondary school, and 20% have completed college.

Businesses have an average annual income slightly above US\$66,282 per year, and the value of assets is around US\$8,871.<sup>6</sup> In a typical month, the average profit per business is 50 cents per sol invested. The amount of money taken out in loans by the business over the

<sup>5</sup>One hundred cents, or one sol, could buy a person lunch at the time of the study.

<sup>6</sup>At the time of the survey, the exchange rate was 3.47 soles = US\$1.

Table 2: Characteristics of managers and businesses in Gamarra and Mayorista

	Gamarra	Mayorista	Total
Managers:			
Owner (%)	64.4	80.8	71.1
Married (%)	78.3	73.2	76.2
Secondary school (%)	57.0	56.6	56.8
High school (%)	2.7	1.8	2.2
College (%)	22.3	15.8	20.0
Age (years)	43.1	51.2	46.4
Annual income (soles)	16,877	17,316	17,057
Annual income (soles) - Owner	19,148	18,004	18,614
Annual income (soles) - Non-owner	12,797	14,436	13,244
HH size	3.7	4.1	3.8
Personal savings (soles)	5,466	7,710	6,386
Implicit monthly interest rate for savings	0.79	0.80	0.80
Businesses:			
Number of workers employed	3.2	4.3	3.65
Age of business (years)	5.2	21.5	11.9
Annual income (soles)	186,100	293,296	230,033
Return per sole invested (soles)	0.62	0.32	0.50
Value of assets (soles)	46,869	7,617	30,782
Amount of credit approved (soles)	1,373	1,808	1,551
Implicit monthly interest rate for loans	3.5	2.6	3.1
Businesses formally registered (%)	79.3	80.0	80.0
Number of obs	360	250	610

Exchange rate was 3.47 soles = US\$1 at time of study.

past year is slightly above 0.7% of average annual income, and the implicit monthly interest rate is 3.1%. Roughly 80% of businesses are formally registered and pay taxes.

## 4.2 Risk preferences and outcomes

Prior to analyzing gender differences in risk preferences, we examine the correlation between our experimental measure of risk preferences of managers and financial decisions. Table 3 reports ordinary least squares regressions of household savings (in soles) and amount of credit taken by the business (in soles) on the manager's risk preferences and characteristics of the manager's household and characteristics of the business. To account for zero savings, the dependent variable of savings is the inverse hyperbolic sine of household savings. The dependent variable credit is the total amount of credit currently held by the business. The savings variable is a household decision, and the credit variable is a business decision.

Table 3: Risk aversion and financial outcomes

	(1)	(2)	(3)	(4)
	Savings (inv. hyp. sine)		Credit (,000)	
Choice in gain-gain lottery	0.128*		0.397	
	[0.071]		[0.669]	
Choice in gain-loss lottery		0.102		1.417*
		[0.083]		[0.736]
Male	0.605	0.571	0.755	0.752
	[0.378]	[0.378]	[2.835]	[2.804]
Owner	0.129	0.133	13.011***	12.618***
	[0.268]	[0.271]	[2.978]	[2.943]
High school	-0.156	-0.128	-1.219	-1.314
	[0.284]	[0.281]	[2.596]	[2.569]
College	-0.049	-0.054	3.695	3.687
	[0.284]	[0.284]	[2.533]	[2.515]
Age (years)	-0.101*	-0.101*	0.668	0.687
	[0.057]	[0.058]	[0.571]	[0.566]
Age squared	0.001	0.001	-0.008	-0.008
	[0.001]	[0.001]	[0.006]	[0.006]
Household income (inv. hyp. sine)	0.055	0.091	2.790*	3.173*
	[0.162]	[0.162]	[1.687]	[1.691]
Family size	0.071	0.071	0.814	0.884
	[0.064]	[0.064]	[0.603]	[0.597]
Index of household characteristics	0.164	0.164	-0.250	-0.238
	[0.187]	[0.187]	[1.302]	[1.286]
Index of household assets	0.337***	0.323***	0.162	0.107
	[0.090]	[0.090]	[0.934]	[0.925]
Age of business (in months)	-0.000	-0.000	-0.003	-0.002
	[0.001]	[0.001]	[0.008]	[0.008]
Number of workers	0.037	0.034	0.053	0.015
	[0.039]	[0.040]	[0.339]	[0.339]
Business is registered	1.527***	1.517***	-2.057	-2.454
	[0.489]	[0.491]	[3.667]	[3.645]
Effective annual saving rate	0.844**	0.833**		
	[0.372]	[0.362]		
Effective annual borrowing rate			0.062	0.055
			[0.132]	[0.130]
Constant	6.396***	6.163***	-72.274***	-78.508***
	[2.136]	[2.146]	[24.454]	[24.727]
Observations	532	532	532	532
R-squared	0.099	0.096		

Robust standard errors in brackets. \*\*\* p<0.01, \*\* p<0.05, \* p<0.10

Controls include demographic characteristics of the manager and his/her household and business characteristics.

The table shows that the propensity to take risks of the manager has a positive and significant effect on household savings and the level of credit taken by the business. Columns (1) and (2) show that the more risk taking the manager is in the gain-gain lottery the higher the level of household savings. In addition, households with more assets (index of household assets) save more. Columns (3) and (4) show that the more risk taking the manager is in the gain-loss lottery the more credit the business has taken. If the manager is also the owner of the business, the amount of credit taken is also higher.

These results illustrate that the experimental measure of the willingness to take risks does have explanatory power in the financial outcomes of households and businesses, even controlling for household and business characteristics.

### 4.3 Risk preferences

The distribution of lottery choices by men and women in the gain-gain and gain-loss decisions are shown in Figure 1 (panel (a) and (b)). Women are significantly more risk taking than men in both the gain-gain lotteries and the gain-loss lotteries (chi-squared test for difference in distribution, gain-gain p-value = 0.042, gain-loss p-value = 0.010). Note that if the sample is restricted to owners, we get the same results. Female owners are more risk taking than male owners (chi-squared test for difference in distributions, gain-gain p-value=0.049, gain-loss p-value = 0.003).

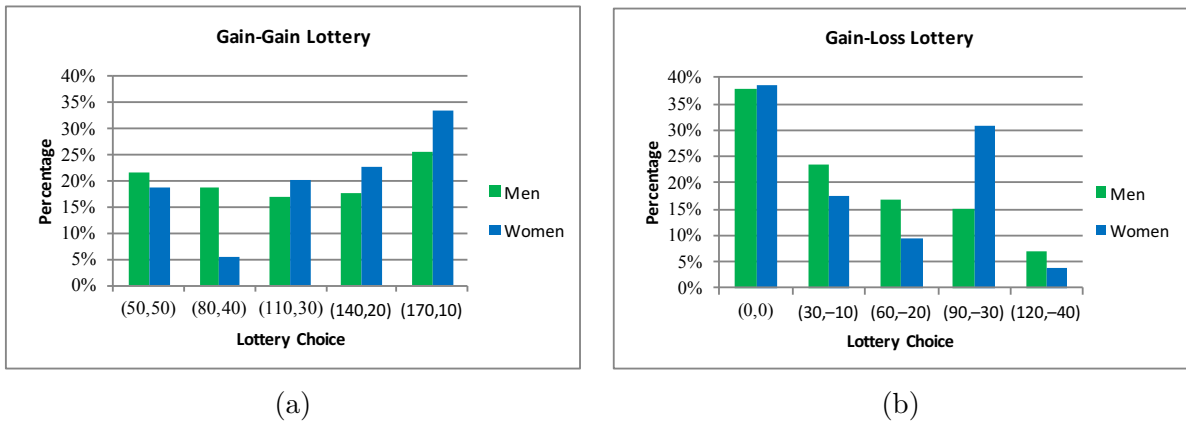


Figure 1: Entrepreneurs - distribution of risk preferences by sex and lottery type

The greater willingness of female entrepreneurs to take risks relative to males does not hold in the general population in Peru. In a sample of retrenched public sector wage workers who were presented with the same incentivized lotteries, there is no significant difference in the propensity to take risks between men and women. Figure 2 (panels (a) and (b)) show these results.<sup>7</sup>

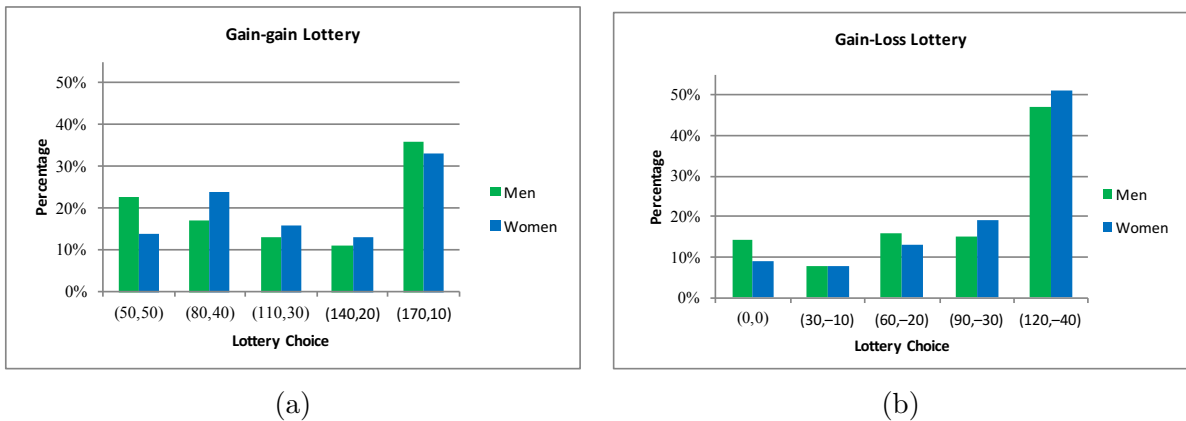


Figure 2: Wage workers - distribution of risk preferences by sex and lottery type

<sup>7</sup>Chi-squared test for difference in distribution, gain-gain p-value = 0.197, gain-loss p-value = 0.491)



Additional evidence from other studies using representative samples from Peru confirm the result from the wage workers. In general, women in Peru are not more risk taking than men. Cardenas and Carpenter (2013) use an instrument similar to ours, in that participants choose one of six lotteries, to measure risk preferences in a stratified, representative sample of the population of Lima, Peru (n=541).<sup>8</sup> They use lotteries with gain-gain and gain-loss payoffs as well as test for ambiguity aversion. That data show that women are more risk averse than men. Castillo, Petrie, Reddy Cotla, and Torero (2017) use a large representative sample (n=9676) of the population of poor in Peru and different instruments to measure risk aversion. They find that women are more risk averse than men.

In sum, our sample of female entrepreneurs are more risk taking than male entrepreneurs. We can discard the hypothesis that this is due to Peruvian women being more risk taking in general. In different, representative samples, women are found to be more risk averse than men, which is consistent with the larger literature on gender differences in risk aversion (Croson and Gneezy, 2009).

#### 4.4 Possible mechanisms

Two possible pathways for the higher propensity to take risks among female entrepreneurs in these sectors is learning and sorting. It could be that women who enter these markets are more risk averse than men, however, over time, they learn to be more risk taking to survive and thrive in business. Alternatively, the women who choose to enter these highly competitive markets are fundamentally more risk taking than the men who enter these markets.

These two pathways predict alternate gender differences in risk aversion for owners by year in business. If women learn to be more risk taking, gender differences among young business owners should be no different, or reversed, however, if it is due to sorting, then the higher propensity of women to take risks compared to men should exist for new and older entrants.

We focus first on business owners and examine differences in men and women along several dimensions in Table 4. The table shows that male and female owners do not significantly differ in observable personal and household characteristics. Importantly, the average number of years in business for men and women is no different either in Gamarra (6.6 years) or Mayorista (22 years). That is, neither men nor women are more or less likely to stay in business in either market.

Next, we look at the level of risk aversion of men and women controlling for the number of years in business. Table 5 shows ordinal logit regression results for the lottery choice in the gain-gain lottery and the gain-loss lottery and ordinary least squares results for a combined

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<sup>8</sup>As noted earlier, our design is based on Binswanger (1980), and Cardenas and Carpenter (2013)'s presentation is more similar to that of Eckel and Grossman (2002).

Table 4: Characteristics of male and female business owners

	Men	Women	Diff in mean p-value
Years in occupation	14.5 (sd 12.5)	14.4 (sd 11.7)	0.971
Gamarra	6.5	6.7	0.829
Mayorista	22.6	23.1	0.836
Age (years)	46.3	47.0	0.680
Annual income (median, soles)	18,000	18,306	0.888
Education (highest level completed - %)			
Secondary	57.9	52.8	0.440
High school	2.6	1.4	0.566
Some college	6.2	7.1	0.759
College	19.4	12.8	0.200

risk measure (using the gain-gain and gain-loss lottery choices) for the entire sample of managers and for the subsample of owners. Control variables include characteristics of the manager, as well as a dummy variable for whether or not the manager is relatively young in the business (below the median years in business in Gamarra and in Mayorista) and an interaction term of gender and a young business.<sup>9</sup> We also control for the market (Gamarra or Mayorista) in which the manager works.

Columns (1) and (2) show that women are significantly more risk taking than men in the gain-gain lotteries controlling for demographics and whether or not the business is young. Columns (3) and (4) show the same results for the gain-loss lotteries. Women are also more risk taking, but this is not precisely estimated.<sup>10</sup> Columns (5) and (6) use a combined risk measure using the choices in the gain-gain and gain-loss lotteries and confirm that women are more risk taking than men.<sup>11</sup> This is significant for the entire sample of managers and is less precise for owners. The combined risk measure allows us to see the size of the effect of gender on risk preferences – the effect size of being a woman is 0.24 of a standard deviation. In all regressions, there is no significant effect of being a young business or the interaction of gender of the manager and young business on risk aversion. These results confirm that female business owners are more risk seeking than men, and this is not tempered by the years in business. Women who are more willing to take risks are more likely to enter these markets, and we do not find evidence that they become more risk seeking with exposure to

<sup>9</sup>Given that number of years in business differs across the two markets, a young business in Gamarra is one where the manager has worked for less than the median number of years for Gamarra (5 years). Businesses in Mayorista are coded as young if the manager has worked for less than the median number of years for businesses in Mayorista (20 years). In Mayorista, roughly 10% of managers have been in business for less than five years.

<sup>10</sup>Quantal regressions reveal that the effect on the gain-gain lotteries is a shift in the distribution while the effect in the gain-loss lotteries is concentrated in the upper tail of the distribution.

<sup>11</sup>For the combined risk measure, we standardize the choice in the gain-gain and gain-loss decisions and average them. The dependent variable has a mean of zero.

Table 5: Risk aversion and years in business

	(1)	(2)	(3)	(4)	(5)	(6)
	Gain-Gain Manager	Gain-Gain Owner	Gain-Loss Manager	Gain-Loss Owner	Combo risk Manager	Combo risk Owner
Male	-0.76** (0.33)	-0.64* (0.35)	-0.37 (0.33)	-0.27 (0.36)	-0.28** (0.14)	-0.23 (0.15)
Age of manager (years)	0.02* (0.01)	0.03*** (0.01)	0.00 (0.01)	0.01 (0.01)	0.00 (0.00)	0.01** (0.00)
Young business	-0.38 (0.42)	-0.10 (0.44)	-0.29 (0.44)	-0.16 (0.46)	-0.16 (0.19)	-0.05 (0.20)
Male x Young business	0.42 (0.45)	0.15 (0.48)	0.24 (0.46)	0.09 (0.50)	0.17 (0.20)	0.06 (0.21)
Annual income	0.01 (0.02)	0.22** (0.09)	0.00 (0.02)	0.06 (0.08)	0.00 (0.01)	0.07** (0.04)
Secondary school	0.69*** (0.25)	0.69** (0.28)	0.27 (0.25)	0.19 (0.30)	0.23** (0.11)	0.23* (0.13)
High school	0.67 (0.54)	1.03 (0.64)	1.08* (0.57)	0.97 (0.63)	0.39 (0.25)	0.47 (0.29)
Some college	0.93** (0.39)	1.21*** (0.46)	0.12 (0.39)	0.22 (0.45)	0.23 (0.18)	0.34* (0.20)
College	0.55* (0.29)	0.69** (0.35)	0.16 (0.30)	0.36 (0.36)	0.18 (0.13)	0.27* (0.15)
Mayorista	0.27 (0.17)	-0.18 (0.21)	-0.37** (0.18)	-0.68*** (0.21)	-0.00 (0.08)	-0.20** (0.09)
Observations	528	379	528	379	528	379
R-squared					0.02	0.05
Log likelihood	-831.69	-589.71	-773.11	-556.68	-619.44	-441.38

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.10

the market.

Women may face more hurdles in this market than men and this could manifest in more variable profits. If so, a person willing to enter this market would need to be more risk-taking. We do not find this to be the case. Looking at the average return per sol expended, women and men realize similar returns (0.51 for men, 0.48 for women, diff in means p-value=0.8122). However, the standard deviation in return per sol expended is higher for men than for women (1.23 for men, 0.77 for women, diff in means p-value=0.0000). That is, the variance in profit is lower for women than men and does not support this explanation.

Another explanation for women being more risk-taking than men in these markets is that women have a higher threshold of risk tolerance to enter. That is, women may not be willing to become an entrepreneur unless the level of willingness to take risks is quite high, and this level surpasses that for men. This could be because they face more background risk in their lives and need to be more risk-taking to be willing to take on a new business. Background risk could manifest in a higher variance in household income for women than men. Indeed, that is what we find in our data. The variance in household per capita income for women is 22,553 soles and for men is 16,199 (difference in mean p-value=0.0016). Female

entrepreneurs in our sample come from households with more variable income than male entrepreneurs, and they are more willing to take risks.

## 5 Conclusion

Starting a new business venture requires initiative to get started and uncertainty as to whether or not it will work. Given that only one in five businesses continue after the first year, this type of work would need to attract individuals willing to take on this risk. This study examines whether there are gender differences in risk tolerance among entrepreneurs in a representative sample of small businesses in Lima, Peru.

Using survey data on the business and household characteristics of the manager, in combination with an experimental measure of risk preferences, we document that women are more risk taking than men in these entrepreneurial markets. Female entrepreneurs exhibit higher willingness to take on risk than male entrepreneurs along the entire gradient of time in business. Women who choose to start a small business are more risk taking from the beginning and do not appear to increase their willingness to take risks relative to men as they spend more time in business.

Our results offer new insights into the differences in risk preferences of men and women in the labor market. While the prevailing findings are that women are more risk averse than men, our study suggests that, at least in the competitive environment of self-employment we study, the type of women who choose to enter this sector and those who stay possess a higher tolerance for risk than comparable men. Barriers to entry in these sectors could be higher for women and those who ultimately choose to enter may face more background risk.

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