Policy Research Working Paper 11033

The Pecuniary and Non-Pecuniary Returns to Micro-Entrepreneurship

Evidence from a Cross-Section of Women in Mexico

Benjamin Williams
Jesica Torres
David C. Francis

WORLD BANK GROUP
Development Economics
Global Indicators Group
January 2025

Policy Research Working Paper 11033

Abstract

This paper estimates the monetary and full returns to micro-entrepreneurship using a cross-section of Mexican women leveraging self-reported reservation wages. A generalized Roy model of micro-entrepreneurship choice that accounts for selection bias and non-response in earnings is estimated. The analysis exploits variation in homicide rates as an exclusion restriction to identify the average treatment-on-the-treated. The average monetary return is 4.2 percent while the average full return is 68 percent, which points to substantial non-pecuniary benefits from entrepreneurship among women. The monetary return sharply increases with years of schooling. Full returns are less steep, suggesting that non-pecuniary benefits are more salient for less educated women.

This paper is a product of the Global Indicators Group, Development Economics. It is part of a larger effort by the World Bank to provide open access to its research and make a contribution to development policy discussions around the world. Policy Research Working Papers are also posted on the Web at http://www.worldbank.org/prwp. The authors may be contacted at bdwilliams@gwu.edu.

The Pecuniary and Non-pecuniary Returns to Micro-Entrepreneurship: Evidence from a Cross-Section of Women in Mexico*

Benjamin Williams[†1], Jesica Torres[2], and David C. Francis[2]

[1]George Washington University

[2]The World Bank

JEL classification: J24, J31, L26, O12, C81

Keywords: Female entrepreneurship, Roy Model, non-pecuniary benefits, selection correction, survey non-response.

*We thank Joaquin Lopez for his suggestions to an earlier version of this paper, as well as participants in the World Bank's DEC Half-Baked Seminar series. The findings, interpretations, and conclusions expressed in this paper are entirely those of the authors. They do not necessarily represent the views of the World Bank and its affiliated organizations, or those of the Executive Directors of the World Bank or the governments they represent.

[†]Corresponding author. E-mail address: bdwilliams@gwu.edu.

1. Introduction

Why do women choose to run a business? How important are earnings differentials relative to the value of the non-pecuniary benefits and costs from owning a firm? In this paper, we pool data from three separate cross-sections of women in Mexico from a large, national labor force survey to study the allocation of talent across wage work and micro-entrepreneurship. We ask whether these women micro-entrepreneurs would be better off if they worked for someone else for a wage, instead of running their own micro-business.

Our data consist of almost 42,000 prime-age women, 77% employees and 23% micro-business owners (with 10 or fewer workers in non-manufacturing sectors or 15 or fewer in manufacturing). In the data, the likelihood of micro-business ownership falls with years of schooling, while the earnings differential between employees and micro-entrepreneurs is negative across all levels of schooling. In combination, these descriptive results present a puzzling pattern: why would a predominant number of women operate businesses if their monetary returns are negative? This puzzle has been discussed extensively elsewhere in the context of high-income economies (refer to Åstebro (2012), e.g., for a review). However, in middle-income economies, similar puzzles have been explored to a lesser extent, and the evidence of high levels of business ownership (particularly when it is in the informal sector) has been taken as evidence of labor market segmentation (Harris and Todaro, 1970; Günther and Launov, 2012). However, the fact that we observe significantly negative levels of monetary returns even among women with high levels of education suggests that conclusions from such patterns as evidence of segmentation may need to be revisited. The fact that many jobs that offer wage work may also be undesirable in middle-income contexts may also imply that micro-business ownership offers additional non-pecuniary benefits that can help explain selection into the sector (Maloney, 1999).

We observe the self-reported reservation wage of entrepreneurs, the earnings that would induce her to leave her business. Presumably, in her response a micro-entrepreneur includes not only her labor earnings, but also the monetary value of the non-pecuniary benefits and costs from running a microbusiness, which can include satisfaction (Blanchflower et al., 2001; Benz and Frey, 2004), a flexible work schedule, personal independence, or appetite for risk, among others. We leverage this variable to explicitly incorporate in the estimation the non-pecuniary benefits of running a business, not only as a selection mechanism, but also as an outcome. We compute the monetary and the full returns to micro-entrepreneurship, which we compare to study the importance of non-pecuniary benefits in the sectoral choice.

To correct for selection bias in the occupational choice, we estimate a parametric version of the generalized sectoral choice model of Roy (1951), formalized by Sattinger (1975); Willis and Rosen (1979); Heckman and Sedlacek (1985, 1990), and Heckman and Honore (1990),

and applied by Gould (2002) and Mulligan and Rubinstein (2008), among many others. More recently, Eisenhauer et al. (2015) develop conditions that make it possible to identify non-parametrically the gross benefit and net surplus to participating in a program (in our context, the net surplus to entrepreneurship over wage work). Unlike them, we do observe the subjective costs and benefits of participation via the self-reported reservation wages, which in principle provides additional identifying power. We face, however, a non-negligible rate of non-response to the question on earnings (as in recent papers such as Åstebro and Chen (2014); Sarada (2024)), which is higher among more educated women and among employees. Importantly, we do not observe the earnings of 35% of the employees in the sample with 13+ years of schooling. Our empirical strategy also corrects for non-response by exploiting variation in homicide rates across both municipalities and timing of the interview. Presumably, in locations or in months when the homicide rate is atypically high, respondents will be more reluctant to answer questions on earnings for fear of extortion. Our preferred measure of returns is the treatment on the treated, which we can identify with the exclusion restriction and the variation in the propensity to become a micro-entrepreneur.

In our sample, the monetary return to entrepreneurship averages 4.2%, while the average full return is 68%, which suggests that non-pecuniary benefits to micro-entrepreneurship are an important driver of selection into the sector in Mexico. In contrast, least squares estimates are -44% for the monetary return and 37% for the full return, which indicates that not correcting for the double selection bias in the distribution of earnings and the distribution of reservation wages underestimates both the monetary gain and the full return. Only women entrepreneurs with 0-6 years of schooling exhibit negative monetary returns (-9%) but their full treatment on the treated averages 62%. By contrast, monetary returns are positive and sharply increase with years of schooling, from 3% for those with 7-9 years of formal schooling, to 7% for women with 10-12 years, and 39% for women with at least 13 years. Average full returns are less steep and range from 70% for women with 7-12 years of schooling to 80% among women with 13+ years.

An often-noted finding in the literature on entrepreneurship is that, on average, business owners report lower monetary returns relative to comparable wage work (Hamilton, 2000; Moskowitz and Vissing-Jørgensen, 2002; Kawaguchi, 2002; Borjas and Bronars, 1989; Evans and Leighton, 1990). Though this finding is not universal—among others Rosen and Willen (2002) and Berglann et al. (2011), for example, report positive conditional monetary returns to business ownership—the generality of negative monetary returns has merited further exploration. On the one hand, the prevalence of negative monetary returns is often, in part, used as motivation to demonstrate the existence of non-pecuniary benefits to business ownership. On the other hand, other researchers have highlighted that estimates of monetary

returns can be biased by the lack of suitable comparison groups or the ability to account for selection into and out of business ownership (Rosen and Willen, 2002). More recent work has bolstered the challenge of negative estimates of monetary returns, pointing out that the earnings of business owners may be misreported (Åstebro and Chen, 2014) or that owners' welfare is more appropriately captured by household consumption (Sarada, 2024); in fact, after attempts to correct for these sources of bias, monetary returns are often estimated to be positive. Our work contributes to these two branches of the literature by allowing for the possibility of non-pecuniary benefits to entrepreneurship while also correcting for non-response. We find that non-pecuniary benefits do play a substantial role in driving the selection of women into micro-entrepreneurship in Mexico, and that non-response does tend to bias downward monetary returns.

Motivated by largely negative monetary returns, much prior work has demonstrated the presence of non-pecuniary benefits among entrepreneurs (Hurst and Pugsley, 2015), most often showing that, say, job satisfaction is higher among business owners (Blanchflower, 2000; Benz and Frey, 2004). However, to our knowledge, there have been no efforts to quantify the relative magnitude of those non-pecuniary benefits, which can be critical when evaluating the relative costs and benefits of individuals' occupational choice.[1] One predominant reason for the lack of such estimates is that they require a subjective, self-reported estimate of the shadow returns for individuals to select out of entrepreneurship (Eisenhauer et al., 2015); that is, an estimate of the reservation wage as reported by entrepreneurs. In this paper, we take advantage of the availability of such a variable.

Comparatively few studies have sought to estimate the returns to entrepreneurship in non-high-income contexts. Business ownership is notably high in the Mexican context, as noted by Fairlie and Woodruff (2007). Using updated figures from the OECD as cited by those authors, the rate of business ownership in Mexico (as a percentage of the total employed population aged 15 years or older) was 31.8%, compared to an OECD average of 16.8%.[2] This rate of self-employment is only exceeded, among the countries for which the OECD reports data, by Colombia and Brazil, which have business ownership rates of 47% and 32%, respectively. We focus on women, specifically. Higher proportions of working men tend to enter business ownership when compared to women (for instance, as reported in Fairlie and Robb (2007)). Yet, compared to other countries with sex-disaggregated rates of

[1] Specifically, in contexts of high and persistent informality, where self-employment tends to be small-scale and less productive (La Porta and Shleifer, 2014), understanding such underlying returns is critical to policy design.

[2] Source: Organisation of Economic Cooperation and Development (OECD), via this link. (Downloaded Aug. 28, 2024). The rates include both employers and own-account workers, but also unpaid family workers. Such unpaid, family work is excluded from our own analysis of the micro survey data.

self-employment in the OECD, Mexico stands out by the relative parity between those rates between men and women (see figure A1 in the appendix). That is, self-employment is an undeniably prominent feature of women's employment in Mexico. There is also strong reason to believe that the underlying non-pecuniary benefits—and therefore the magnitudes of full returns—may be more salient for women (Georgellis et al., 2007). Yet comprehensive surveys of the returns to entrepreneurship (see, for example, Van Praag and Versloot (2007); Åstebro (2012)) have focused primarily on men, to the extent that such papers disaggregate their analysis by gender. That is, an additional contribution of our paper is to provide estimates of the returns to entrepreneurship for women in a middle-income setting, where women's entrepreneurship is prominent.[3]

The remainder of the paper proceeds as follows. The next section describes the data. Section 3 describes our empirical strategy, and section 4 presents our results. We conclude in section 5.

2. Data

Our main source of data is Mexico's National Occupation and Employment Survey (Instituto Nacional de Estadística y Geografía (INEGI), 2005-2024), known by the acronym ENOE. We also use data from a supplemental survey to the ENOE called the National Survey of Microbusinesses (ENAMIN) (Instituto Nacional de Estadística y Geografía (INEGI), 1992-2012). Both surveys are administered by Mexico's statistics agency, the National Institute of Statistics and Geography (INEGI). The ENOE is a quarterly, nationally representative household survey that tracks the Mexican labor market, with a structure similar to the Current Population Survey in the US. The ENAMIN covers a sub-sample of self-reported microbusiness owners as identified in the fourth quarter of the ENOE. More precisely, business owners identified in the ENOE with 10 or fewer workers in non-manufacturing sectors or 15 or fewer in manufacturing were eligible for the ENAMIN supplement.[4] Own-account workers or the self-employed (those without employees) are also included in the ENAMIN.

The ENAMIN supplemental survey was intended to be administered as closely as possible to data collection of the ENOE, meaning comparisons between the ENOE and ENAMIN data are meaningful with minimal time elapsing between the two surveys.[5] The ENAMIN

[3]Verheul et al. (2012) provide a notable exception, studying the differing drivers of business ownership rates across gender dimensions.

[4]The size-threshold criteria include family members and unpaid workers. The size threshold for non-manufacturing businesses in 2008 was no more than 5 workers.

[5]In each year, most interviews in both surveys took place in October, November, and December, except in 2008 when data on some observations were collected in September. A small number of interviews in each year took place in January of the year after, which we dropped from our sample for consistency (432 observations in total).

was conducted eight times, roughly every two years, between 1992 and 2012 (the exception is a four-year gap between the 1998 and 2002 rounds). Prior to 2008, the ENAMIN was administered only to identified owners of microbusinesses in localities with at least 100,000 inhabitants via a precursor survey to the ENOE (known as the National Survey of Urban Employment or ENUE); starting in 2008, the ENAMIN was applicable to microbusinesses in all areas of the country. Given this expanded geographical coverage to both rural and urban areas—as well as the harmonization of methodological elements such as the wording of questions—we isolate our analysis to the last three available ENAMIN samples in 2008, 2010, and 2012.[6] That is, we combine the three separate cross-sections into a single sample but include year fixed effects in our specifications.

The ENOE asks the respondent about the occupation and earnings of each household member, but the respondent may or may not be the worker herself. The ENAMIN, on the other hand, directly interviews the micro entrepreneur. Given that the ENAMIN directly solicits profits from the business owner, and that such direct measures are believed to be more accurate than separate revenue-cost responses (de Mel et al., 2009), we prefer the direct monthly profit measure from ENAMIN as the monthly earnings measure for micro-entrepreneurs. For the wage workers, we use monthly earnings as reported in the ENOE.

2.1 Characteristics of the sample

We restrict our sample to prime-age women (ages 25 to 64). In addition, to remove measurement issues associated with only capturing those who have temporary or part-time work, we restrict our sample to those working at least 30 hours per week the 12 months of each year. We exclude workers who both run a business while maintaining a wage-working job or who work multiple wage-working jobs. We further exclude workers still in school, unpaid workers, workers in the primary sector, as well as government or public sector employees. To avoid issues that might arise with communities with intensive agricultural work, which can be highly seasonal, we further restrict our sample to areas with at least 15,000 residents.

In our analysis, an employee or wage worker is an individual who works for someone else, whereas a micro-entrepreneur is an individual who works on her own or runs her own microbusiness, either without employees or hiring other workers. Those who are entrepreneurs but have no workers are (solo) self-employed or own-account workers; all other entrepreneurs are termed as employers. Our final sample size consists of 41,798 women, 32,342 (77%) wage workers and 9,456 (22%) micro-entrepreneurs. Fourteen percent of our sample (5,986) work as

[6] See the methodological documentation of the 2010 ENAMIN here.

self-employed, meaning they have no employees. Table 1 summarizes the basic characteristics of the final data.

In our sample, women who own a microbusiness tend to be older (on average) and are more likely to be married compared to employees.[7] Micro-entrepreneurs are comparatively less skilled: a higher share report 0-6 years of schooling while employees are much more likely to have completed any post-secondary education (13+ years). In terms of sector, micro businesses are much more likely to be in the trade services (retail or wholesale), while employees are more likely to work in either manufacturing or other services. Lastly, in terms of hours worked, micro-entrepreneurs tend to work more hours per week compared to employees. The median age of female-owned microbusinesses is 5 years. These businesses are also small: 62% of employers in the sample employ only one worker.

Table 1: Sample sizes and characteristics of the sample.

	Employees	**Entrepreneurs**	**Total**
Sample size	32,342	9,456	41,798
Share	77%	23%	100%
Age	38	45	39
Married	38%	52%	41%
Children	66%	65%	66%
Yrs. of schooling			
0-6	17%	32%	22%
7-9	38%	35%	37%
10-12	19%	15%	18%
13+	24%	12%	23%
Sector			
Manufacturing	23%	11%	20%
Retail	28%	52%	33%
Services	49%	37%	47%
Hours worked	47	53	48

Notes: Retail includes wholesale. Hours worked corresponds to the weekly average. The data combines 13,383 observations from 2008; 13,969 from 2010; and 14,446 from 2012. Differences are statistically significant at the 5% level.

2.2 Monthly earnings and rates of non-response

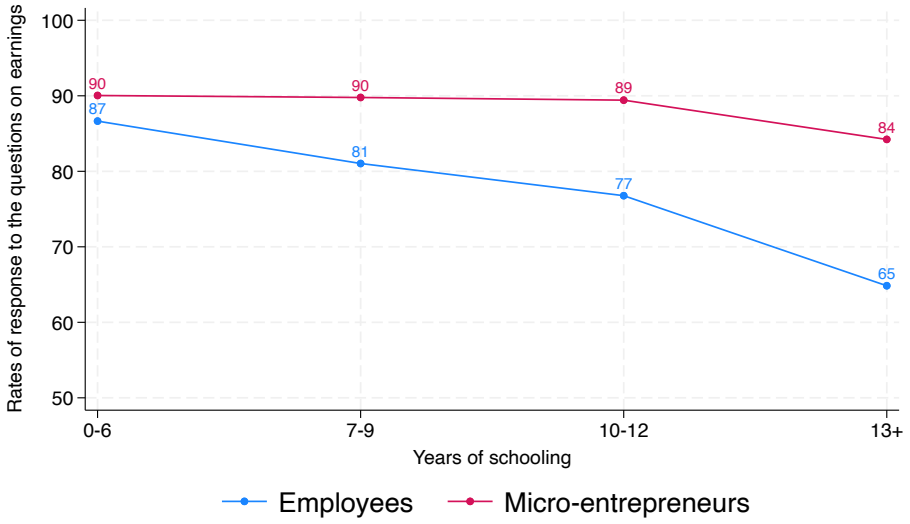
As discussed above, to measure earnings of the employees, we use the monthly wages reported in the ENOE. For micro-entrepreneurs, we use the monthly profits from the ENAMIN reported

[7] All differences are statistically significant with $p < .05$.

by the entrepreneur herself.[8]

The questions on earnings in both the ENOE and the ENAMIN surveys have non-negligible rates of non-response that are potentially non-random. Figure 1 plots the fraction of respondents with non-missing earnings. The (unconditional) probability of responding decreases with years of completed schooling, but the decline is much steeper among employees. Importantly, we do not observe the earnings of 35% of the employees in the sample with 13+ years of schooling. If the return to either running a micro-business or working for a wage varies monotonically with schooling, as is potentially the case, then estimates of the average return to micro-entrepreneurship will be biased. We show how we correct for this non-random non-response in our empirical strategy in Section 3.

Figure 1: Rate of response to the question on earnings across years of schooling.



Notes: The figure shows the share of missing values in the questions on earnings for each occupation and for women with different years of completed schooling. The data on earnings for wage workers come from the ENOE while the profits question for the entrepreneurs comes from the ENAMIN.

2.3 Reservation wages in the ENAMIN

The ENAMIN asks respondents about their reservation earnings—the earnings that would induce her to leave her microbusiness. Specifically, the question reads:

> What is the monthly salary that you would accept to leave your business or activity?[9]

[8] All Mexican peso values in our data are deflated to 2012. To convert into USD, we use an exchange rate of 13.15 MXN per USD (the average during 2012).

[9] In Spanish the question reads "¿Cuál es el salario mensual por el que usted aceptaría dejar su negocio o actividad?"

Presumably, in her response a micro-entrepreneur includes not only her monthly labor earnings but also the monetary value of the non-pecuniary benefits and costs from running a microbusiness, which allows us to estimate both the monetary and the full return from micro-entrepreneurship.

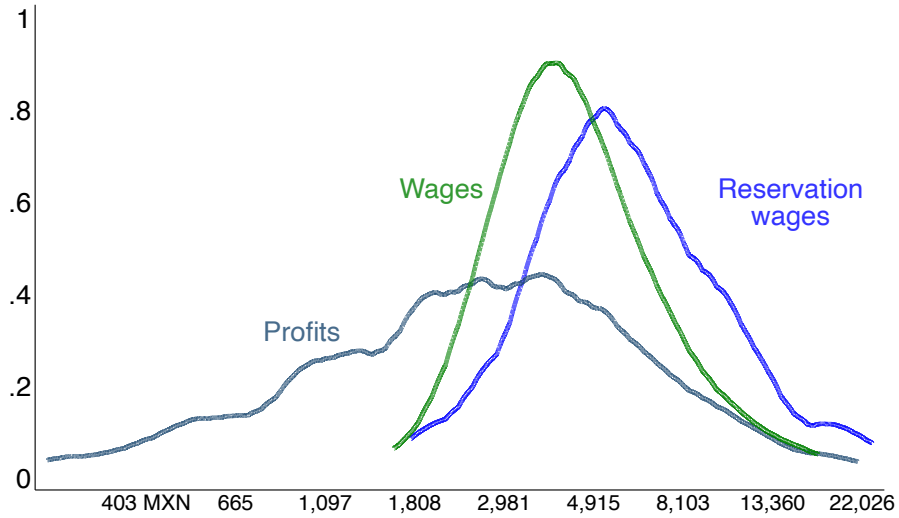
Because the question on the reservation wage of the micro-entrepreneurs is a monthly figure, in our computations we work with monthly earnings. Using earnings per hour worked instead would require us to divide the reservation wage by a counterfactual number of monthly hours worked as a wage worker, which we do not observe. Working with monthly figures helps us avoid introducing this additional bias. Moreover, it is reasonable to assume that the respondent is already accounting for potential adjustments to her hours worked when thinking of leaving her business to work for someone else for a wage.

In our estimations, we trim the top and bottom 1% of the earnings distribution for each occupation and the top and bottom 1% of the distribution of reservation wages.

2.4 Returns to entrepreneurship

Figure 2 shows the distribution of (the log of) wages for employees as well as monthly profits and reservation wages for micro-entrepreneurs. Table 2 shows the average monthly earnings in each occupation (in levels), and the average reservation wage among entrepreneurs (the standard deviations are in parentheses). Notably, there is less dispersion in the earnings of wage workers compared to the earnings of micro-entrepreneurs. Women entrepreneurs in our sample report earnings 23% lower compared to wage workers (with a large standard deviation in the profits distribution compared to the wage distribution), while their average reservation wage is 36% higher than the average observed wage.

Figure 2: Distributions of earnings and reservation wages



Notes: The figure shows kernel densities estimated over the full sample of women. The range shown in the figure excludes values below the 1st and above the 99th percentile for profits, wages, and reservation wages, respectively. Each uses a bandwidth of 0.15.

Table 2: Moments of the distribution of earnings in each occupation.

Wages	Profits	Reservation wages
5,026	3,865	6,829
(2,872)	(3,939)	(4,185)

Notes: Figures in MXN pesos. Standard deviation in parenthesis.

Let $D_i = 1$ if woman i is a micro-entrepreneur and $D_i = 0$ if she works for a wage. Let Y_{1i} and Y_{0i} denote agent i's potential earnings in micro-entrepreneurship and wage work, respectively. In other words, Y_{1i} denotes her profits if she runs a microbusiness and Y_{0i} denotes her wage if she works for someone else. Let C_i denote individual i's monetary value of the net subjective costs associated with running a microbusiness. Thus if $C_i < 0$ the worker perceives micro-entrepreneurship as more subjectively beneficial than working for a wage; if $C_i > 0$ then the worker perceives micro-entrepreneurship as more subjectively costly than working for someone else; $C_i = 0$ indicates that the worker considers only the monetary rewards when choosing an occupation.

Following Eisenhauer et al. (2015), we define the monetary return to entrepreneurship (gross benefit) as

$$M_i = Y_{1i} - Y_{0i} \tag{1}$$

and the full return (net benefit or surplus) as

$$F_i = M_i - C_i = Y_{0i}^* - Y_{0i} \tag{2}$$

where $Y_{0i}^* \equiv Y_{1i} - C_i$ denotes i's reservation wage.

Table 3 shows least squares estimates of the monetary and full returns to running a microbusiness (the full set of results is available in the appendix). In the first column, we show the coefficient on the binary indicator for whether the woman is a micro-entrepreneur in a regression where (log) earnings are the dependent variable; in the second column, we show the coefficient on the dummy variable using the (log) reservation wage as the dependent variable for the micro-entrepreneurs, and (log) earnings for the wage workers. We control for schooling and sector dummies, age and age squared, a binary variable for whether the woman is married, a binary variable for whether there are children in the household, and city and year fixed effects.

The least squares results suggest that non-pecuniary benefits are a significant component to the decision of running a microbusiness among women in Mexico (that is, average non-pecuniary costs are negative). While monthly profits are on average 44% less than monthly wages in the full sample, reservation wages are 36% higher. These patterns are not markedly different when we condition on years of schooling. The least squares monetary return does increase nominally with years of schooling, but it remains negative. The full return, on the other hand, does not show any discernible pattern.

Table 3: Least squares returns to entrepreneurship.

	Monetary return	**Full return**
Full sample	-44%	37%
0-6 years of schooling	-47%	35%
7-9 years of schooling	-45%	38%
10-12 years of schooling	-47%	36%
13+ years of schooling	-33%	37%

Notes: The monetary return is the coefficient on the dummy for whether the woman is a micro-entrepreneur in a regression where earnings are the dependent variable. The full return has the reservation wage as the dependent variable for the micro-entrepreneurs, and earnings for the wage workers. In the top row, both regressions control for schooling and sector dummies, age and age squared, whether the woman is married, whether there are children in the household, and city and year fixed effects. Rows 2 through 4 condition on years of schooling. The full set of results is available in the appendix.

3. The Generalized Roy Model with observed costs and survey nonresponse

To estimate the returns to micro-entrepreneurship, we need additional assumptions because we do not observe earnings and reservation wages for all individuals. Instead, we only observe

wages for individuals in the sample with $D_i = 0$, and we only observe profits and reservation wages for those with $D_i = 1$. Moreover, the sorting of workers into sectors (wage work or micro-entrepreneurship) induces selection bias. An additional difficulty with identifying the returns is that there is a non-negligible rate of non-response for the wages and profits that may be correlated with the potential for higher returns.

Our empirical strategy is to estimate a parametric version of the generalized sectoral choice model of Roy (1951), formalized by Sattinger (1975); Willis and Rosen (1979); Heckman and Sedlacek (1985, 1990), and Heckman and Honore (1990), and applied by Gould (2002) and Mulligan and Rubinstein (2008), among many others. Our two sectors are wage work and micro-entrepreneurship. In the simple Roy model, sectoral earnings are determined by sector-specific abilities and skill prices and individuals choose the sector in which their earnings are higher. In our context, this model would suggest that the observed profits of the micro-entrepreneurs should be equal to the self-reported reservation wage. The gap between these two variables in our data suggests an important role for unobserved costs and/or benefits of micro-entrepreneurship in sectoral choice. Therefore, we adopt the generalized Roy model in which individual i works as an entrepreneur ($D_i = 1$) if $F_i = Y_{1i} - Y_{0i} - C_i \geq 0$ and works for a wage ($D_i = 0$) otherwise. That is, agent i will choose to run a micro-firm if her full return, which combines the monetary return and the value of the non-pecuniary benefits from running a micro-firm, is positive. Put differently, an entrepreneur will have a higher reservation wage, Y_{0i}^*, than her counterfactual wage, Y_{0i}.

Let X_{1i}, X_{0i} and X_{0i}^* denote vectors of covariates, which may include variables in common. In order to estimate the model, we impose the following linear specification:

$$
\begin{aligned}
Y_{1i} &= \beta_1' X_{1i} + U_{1i} \\
Y_{0i} &= \beta_0' X_{0i} + U_{0i} \\
Y_{0i}^* &= \beta_0^{*\prime} X_{0i}^* + U_{0i}^*
\end{aligned}
$$

where $(U_{0i}^*, U_{0i}, U_{1i})$ are unobserved error terms. The selection equation can then be written as:

$$
\begin{aligned}
D_i^* &= Y_{0i}^* - Y_{0i} = \beta_0^{*\prime} X_{0i}^* - \beta_0' X_{0i} + U_{0i}^* - U_{0i} \\
D_i &= \mathbf{1}(D_i^* \geq 0)
\end{aligned}
$$

Identification and estimation of this generalized Roy model when $Y_i = D_i Y_{1i} + (1 - D_i) Y_{0i}$, D_i, and the covariates X_{1i}, X_{0i}, and X_{0i}^* are observed is well-understood (Heckman and

Vytlacil, 2005; Eisenhauer et al., 2015). Average treatment effects can be identified but the full distribution of treatment effects is not identified without further restrictions (see, e.g., Carneiro et al., 2003; Aakvik et al., 2005; d'Haultfoeuille and Maurel, 2013). Observing the reservation wage, Y_{0i}^*, provides additional identifying power in principle. However, we are also faced with substantial non-response which in addition, is correlated with years of formal schooling. To model survey non-response, let $R_i = 1$ if individual i reported their earnings and $R_i = 0$ otherwise. We assume a latent index models, $R_i = \mathbf{1}(\beta_R' X_{Ri} \geq U_{Ri})$.

Let X_i denote the unique elements of X_{1i}, X_{0i}, X_{0i}^*, and X_{Ri}. We assume that X_i is independent of $U_i = (U_{0i}^*, U_{0i}, U_{1i}, U_{Ri})$ and that $U_i \sim \mathcal{N}(0, \Sigma)$. Define $U_{Di} = U_{0i} - U_{0i}^*$ and let $\sigma_{U_D}^2 = Var(U_{0i} - U_{0i}^*)$ and $\sigma_{U_R}^2 = Var(U_{Ri})$. Then

$$\begin{aligned} E(Y_i \mid R_i = 1, D_i = 1, X_i) &= \beta_1' X_{1i} + E(U_{1i} \mid R_i = 1, D_i = 1, X_i) \\ &= \beta_1' X_{1i} + E(U_{1i} \mid \beta_R' X_{Ri} \geq U_{Ri}, \beta_0^{*\prime} X_{0i}^* - \beta_0' X_{0i} \geq U_{Di}, X_i) \\ &= \beta_1' X_{1i} + \psi_1' \Lambda \left(\tilde{\beta}_R' X_{Ri}, \tilde{\beta}_0^{\ *\prime} X_{0i}^* - \tilde{\beta}_0^{\ \prime} X_{0i}; \rho_{RD} \right) \end{aligned}$$

where $\tilde{\beta}_R = \beta_R / \sigma_{U_R}$, $\tilde{\beta}_0^{\ *} = \beta_0^* / \sigma_{U_D}$, and $\tilde{\beta}_0 = \beta_0 / \sigma_{U_D}$; $\Lambda(z_1, z_2; \rho) = E(Z \mid Z_1 \leq z_1, Z_2 \leq z_2)$ for $Z = (Z_1, Z_2)$ jointly normal with standard normal marginals and correlation ρ; $\rho_{RD} = Correl(U_R, U_D)$; and

$$\psi_1 = \begin{pmatrix} 1 & \rho_{DR} \\ \rho_{DR} & 1 \end{pmatrix}^{-1} \begin{pmatrix} \frac{Cov(U_1, U_R)}{\sigma_{U_R}} \\ \frac{Cov(U_1, U_D)}{\sigma_{U_D}} \end{pmatrix} \tag{3}$$

To simplify our notation, let $\Lambda_{1i} = \Lambda \left(\tilde{\beta}_R' X_{Ri}, \tilde{\beta}_0^{\ *\prime} X_{0i}^* - \tilde{\beta}_0^{\ \prime} X_{0i}; \rho_{RD} \right)$.

The bivariate selection correction term $\psi_1' \Lambda_{1i}$ captures the combined effect of non-response and selection bias due to sectoral choice. This term reduces to the conventional Heckman selection correction in the case without non-response, i.e., when $\tilde{\beta}_R' X_{Ri} \to \infty$. Indeed, as $z_1 \to \infty$, $\Lambda(z_1, z_2; \rho) \to \begin{pmatrix} \rho \\ 1 \end{pmatrix} E(Z_2 | Z_2 \leq z_2)$, where $E(Z_2 | Z_2 \leq z_2)$ is the conventional inverse Mills ratio, $\lambda(z_2) = -\frac{\phi(z_2)}{\Phi(z_2)}$. Second, it can be shown that $\psi_1' \begin{pmatrix} \rho \\ 1 \end{pmatrix} = \frac{Cov(U_1, U_D)}{\sigma_{U_D}}$. Also, if $\rho_{DR} = 0$, then the first term of $\psi_1' \Lambda_{1i}$ reduces to the usual correction for sectoral choice, while the second term is the correction for non-response. Importantly, this result suggests a procedure for estimating β_1 and ψ_1. Similar to the usual two-step procedure, we can first estimate the joint selection equations for sectoral choice and non-response. Then in the $D_i = 1$ sample we can estimate a regression of Y_i on X_{1i} and an estimate of Λ_{1i} from the

first stage. We can then estimate a similar regression in the $D_i = 0$ sample since

$$E(Y_i \mid R_i = 1, D_i = 0, X_i) = \beta_0' X_{0i} + \psi_0' \Lambda_{0i}$$

where $\Lambda_{0i} = \Lambda\left(\tilde{\beta}_R' X_{Ri}, -\tilde{\beta}_0^{*\prime} X_{0i}^* + \tilde{\beta}_0' X_{0i}; -\rho_{RD}\right)$ and

$$\psi_0 = \begin{pmatrix} 1 & -\rho_{DR} \\ -\rho_{DR} & 1 \end{pmatrix}^{-1} \begin{pmatrix} \frac{Cov(U_0, U_R)}{\sigma_{U_R}} \\ -\frac{Cov(U_0, U_D)}{\sigma_{U_D}} \end{pmatrix} \tag{4}$$

Finally, assuming that any non-response in the reservation wage is random, we also have

$$E(Y_{0i}^* \mid D_i = 1, X_i) = \beta_0^{*\prime} X_{0i}^* + \psi_0^* \lambda\left(\tilde{\beta}_0^{*\prime} X_{0i}^* - \tilde{\beta}_0' X_{0i}\right)$$

where $\lambda(z) = -\frac{\phi(z)}{\Phi(z)}$ and $\psi_0^* = \frac{Cov(U_0^*, U_D)}{\sigma_{U_D}}$.

Given estimates of β_1, β_0, and β_0^*, it is straightforward to compute estimates of the average treatment effects. The average monetary return, or monetary average treatment effect, is $MATE(x) = E(Y_{1i} - Y_{0i} \mid X_i = x) = \beta_1' x_1 - \beta_0' x_0$. The average full return, or full ATE, is $FATE(x) = E(Y_{0i}^* - Y_{0i} \mid X_i = x) = \beta_0^{*\prime} x_0^* - \beta_0' x_0$. Similarly, we can also define treatment on the treated effects, our preferred measures of returns, as follows. The average **monetary treatment on the treated** is:

$$\begin{aligned} MTT(x) &= E(Y_1 - Y_0 \mid D = 1, X = x) \\ &= \beta_1' x_1 - \beta_0' x_0 + (Cov(U_1, U_D)/\sigma_{U_D} - Cov(U_0, U_D)/\sigma_{U_D})\, \lambda(\tilde{\beta}_0^{*\prime} X_{0i}^* - \tilde{\beta}_0' X_{0i}) \end{aligned}$$

The average **full treatment on the treated** is:

$$\begin{aligned} FTT(x) &= E(Y_0^* - Y_0 \mid D = 1, X = x) \\ &= \beta_0^{*\prime} x_0^* - \beta_0' x_0 + (Cov(U_0^*, U_D)/\sigma_{U_D} - Cov(U_0, U_D)/\sigma_{U_D})\, \lambda(\tilde{\beta}_0^{*\prime} X_{0i}^* - \tilde{\beta}_0' X_{0i}) \end{aligned}$$

The coefficients on the inverse Mills ratio terms can be computed from the coefficients ψ_1, ψ_0, and ψ_0^* and ρ_{DR}.

Identification of the treatment on the treated requires the bivariate selection correction terms, Λ_{1i} and Λ_{0i}, to not be collinear with X_{1i} (or X_{0i}^*) and X_{0i}, respectively. There are two ways to achieve this: with sufficient variation in the two propensities (to be an entrepreneur and to report earnings) to obtain identification from the nonlinearity, or with an exclusion restriction—a variable that affects the selection but not the outcome. We follow the first strategy for the entrepreneurial choice and the second strategy to correct for non-response.

3.1 Instrument for the rate of non-response: variation in homicide rates

Our exclusion restriction for the rate of non-response comes from variation across both locations and years in the monthly homicide rate, which we obtain from administrative data as compiled by Mexico's national statistical agency (Instituto Nacional de Estadística y Geografía (INEGI), 1990-2023). More precisely, we use as an instrument the homicide rate the month in which respondents were interviewed for the ENOE. Practically, this means we use homicide rates for the last quarter of the year for 2008, 2010, and 2012 for the 124 municipalities in our data.[10] Presumably, in locations or in months when the homicide rate is atypically high, respondents will be more reluctant to answer questions on earnings for fear of extortion.[11] At the same time, the homicide rate is unlikely to affect observed earnings because the question on earnings refers to earnings in a typical month, while the homicide rate corresponds to the month of the interview (any shock to the homicide rate is unlikely to be reflected in the response on typical earnings yet).

Table 4 presents some moments of the distribution of homicide rates across municipalities in our sample. The average in our observation period is 0.13 homicides per 10,000 people. Figure 3 shows that between 2008 and 2012, homicides in Mexico dramatically increased, especially in municipalities in the north. Figure 4 shows substantial variation in the homicide rate also across space. The figure shows, for each municipality, the range (from the minimum to the maximum in the vertical gray bars) of the homicide rate over the 9 months considered (October, November, December in each year). The blue markers show the mean over these specific months, with each municipality ordered from the lowest mean homicide rate to the highest (left to right). Some municipalities are outliers in terms of their homicide rates. Acapulco, Chihuahua, and Tijuana, for instance, have mean monthly homicide rates of over 0.50 per 10,000 people.

Table 4: Moments of the distribution of homicide rates across municipalities in the sample.

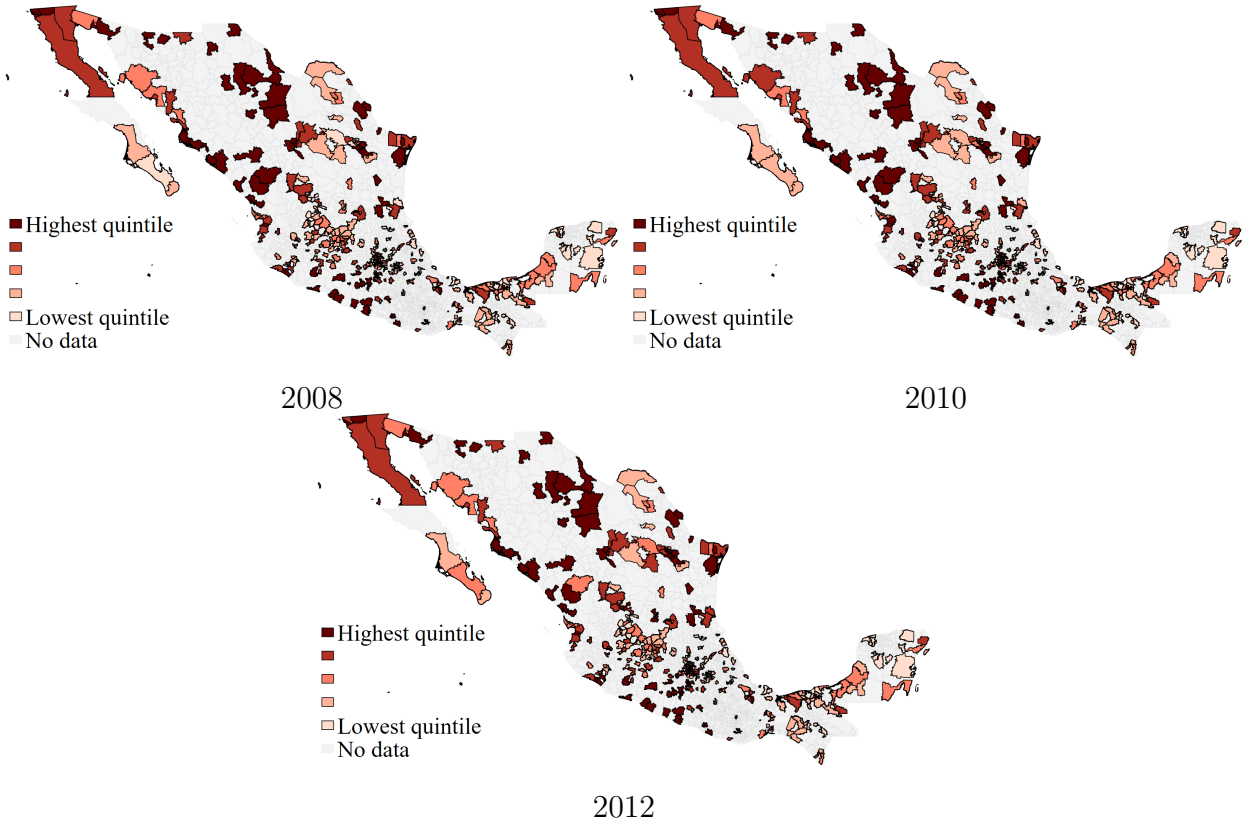
	2008	**2010**	**2012**	**Overall**
Mean	0.09	0.14	0.14	0.13
Std. Dev.	0.17	0.18	0.18	0.18
Median	0.05	0.09	0.11	0.08
90th percentile	0.22	0.36	0.30	0.30

Notes: Number of homicides per 10,000 population (for the 124 municipalities in the analysis). Observations are limited to the last quarter of each year to correspond to the ENOE/ENAMIN data.

[10] In 2008, 553 observations were recorded in September. Homicide rates for September 2008 are included in our merged data.

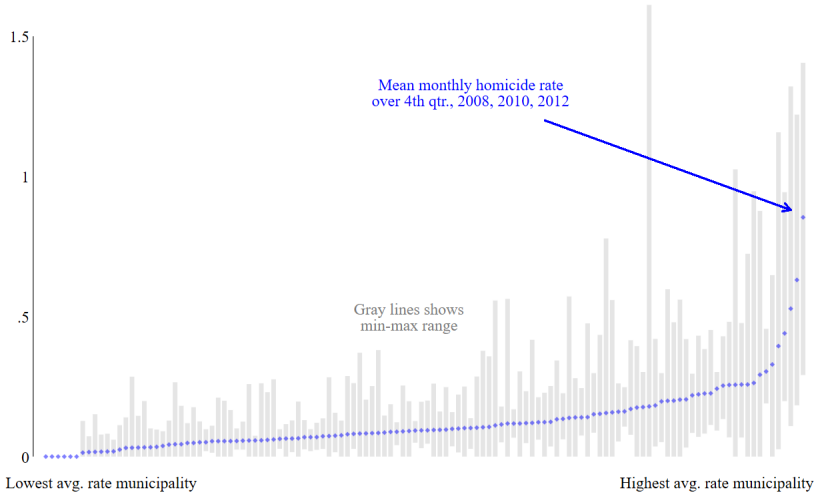
[11] Our controls for the response equation include year fixed effects, meaning we only exploit shocks to the homicide rate.

Figure 3: Variation in the homicide rate across time and across municipalities.



Notes: Each of the 124 municipalities is shaded according to the average homicide rate in the final three months of the year, shown for 2008, 2010, and 2012, separately. The legend contains quintiles estimated over all years, meaning that cutoff points are fixed across time. Thus, changes in intensity are indicative of changes over time.

Figure 4: Range and average of the monthly homicide rates by municipality (homicides per 10,000 people; 4th quarter of 2008, 2010, and 2012).



Notes: The blue diamonds represent the average homicide rate across the last three months of the year (Oct., Nov., Dec.) for three years of the ENOE-ENAMIN data (2008, 2010, 2012, 9 months in total). The vertical gray bars show the range between the minimum and maximum homicide rate over these 9 months, by municipality. The bars are sorted by the mean homicide rate.

3.2 Estimation procedure

Our procedure to estimate the average monetary and full treatment on the treated is as follows:

1. Estimate a bivariate Probit with binary outcomes R and D. From this model, we get an estimate of ρ_{RD} that helps us construct estimates of $\tilde{\beta}_R' X_{Ri}$ and $\tilde{\beta}_0^{*\prime} X_{0i}^* - \tilde{\beta}_0' X_{0i}$.

2. Using estimates from step 1, we construct[12] a bivariate equivalent of the inverse Mills ratio

$$\Lambda_{1i} := \Lambda\left(\tilde{\beta}_R' X_{Ri}, \tilde{\beta}_0^{*\prime} X_{0i}^* - \tilde{\beta}_0' X_{0i}; \rho_{DR}\right)$$

   We can then regress Y_i on X_{1i} and $\hat{\Lambda}_{1i}$ for the $D_i = 1$ subsample.

3. Similarly, using estimates from step 1 we can construct

$$\Lambda_{0i} := \Lambda\left(\tilde{\beta}_R' X_{Ri}, -\tilde{\beta}_0^{*\prime} X_{0i}^* + \tilde{\beta}_0' X_{0i}; -\rho_{DR}\right)$$

   We then regress Y_i on X_{0i} and $\hat{\Lambda}_{0i}$ for the $D_i = 0$ subsample.

[12] We numerically approximate the truncated mean of a bivariate normal via Monte Carlo integration. Our results are generally robust to increasing the number of draws in the approximation.

4. Assuming that any non-response in the reservation wage is conditionally random, we can use the conventional inverse Mills ratio term, regressing Y_i^* on X_{0i}^* and $\lambda(\tilde{\beta_0}^{*\prime} X_{0i}^* - \tilde{\beta_0}' X_{0i})$ for the $D_i = 1$ subsample.

In the main specification that we estimate, $X_{1i} = X_{0i}^* = X_{0i}$ is the same vector of controls used in the OLS results in Section 2, specifically, schooling and sector dummies, age and age squared, a binary variable for whether the woman is married, a binary variable for whether there are children in the household, and city and year fixed effects. In the choice equation for response/non-response to the earnings question, the vector of covariates X_{Ri} is the same as X_{0i} except that it includes two variables on local crime (the homicide rate and a binary for cities with typically high homicide rates).[13]

4. Results

Table 5 shows the estimates from the bivariate probit. The estimated coefficient of correlation in the model is statistically significant and positive (0.24), which means that micro-entrepreneurs are more likely to respond to the question on earnings even after controlling for variation in observables (consistent with the patterns in Figure 1). Table 6 reports the marginal effects. The homicide rate has a negative and statistically significant effect on the likelihood of responding to the questions on earnings. An increase of one unit in the homicide rate is associated with a decrease of 6 percentage points in the likelihood of answering the question on earnings. Rates of response are also lower among more educated women. Women with 13+ years of schooling are on average 19 percentage points less likely to answer the question on earnings compared with women with 0-6 years of schooling. This finding is consistent with the patterns observed in Figure 1. In addition, younger women, married women, and women with children in the household are more likely to respond, all else equal.

The propensity to run a micro-firm, rather than work for a wage, decreases with years of schooling, all else equal. The second column of Table 6 shows that women with 13+ years of schooling are 11 percentage points less likely to select into entrepreneurship compared to women with 0-6 years of formal schooling. Older women are more likely to run a micro-firm by almost 1 percentage point per year, and this age effect does not diminish over the life cycle. Women who are married and women in a household with children are 7 and 3 percentage points more likely to enter entrepreneurship. Sector also has a large and statistically significant effect on the propensity to run a micro-firm.

In Table 7 we show the results from the two-stage estimation strategy of the Roy model described in Section 3.2. The estimation strategy corrects for both non-random selection

[13]The cities are Chihuahua, Acapulco, Tijuana, Culiacan, and Tepic. Once we include this high-crime city dummy, we get significantly higher explanatory power.

into entrepreneurship and non-random non-response. Earnings in both sectors increase significantly with years of schooling, as does the reservation wage. The skill gradient is steeper for entrepreneurs relative to wage workers, while reservation wages are flatter compared to the earnings profile of entrepreneurs. This suggests that the non-pecuniary benefits of entrepreneurship are more salient for less educated women. We also see that the reservation wage increases substantially with age, by 5 percent per year. This is consistent with the finding that the propensity to run a micro-firm increases with age. And both of these findings are also consistent with the much steeper age gradient for earnings in entrepreneurship relative to wage-work. Entrepreneurship becomes more likely over the life-cycle largely because the *monetary* returns increase with age.

The coefficients on the λ terms in the earnings and reservation wage regressions can be transformed according to equations (3) and (4) to back out estimates of the covariances between unobservables in these equations and the unobservables in the selection equations. These estimates are reported in Table 8. According to these estimates there is positive selection into both sectors. The unobservable component of entrepreneurial earnings is positively correlated with the propensity to be an entrepreneur. But the unoservable component of wages is negatively correlated with the propensity to be an entrepreneur. The non-response bias is negative for entrepreneurs as those with higher earnings are less likely to report earnings. But the non-response bias is negative for wage-workers.

Next we compute next the average monetary and full treatments on the treated. In our sample, the monetary return to entrepreneurship averages 4.2%, while the average full return is 68%. Our least squares estimates are -44% for the monetary return and 37% for the full return, which means that not correcting for the double selection bias in the distribution of earnings and the distribution of reservation wages underestimates both the monetary gain and the full return. This result holds for every schooling level in the sample. Figure 5 plots the average estimated MTT and FTT by education. For comparison, the OLS returns from Table 3 are shown in the right panel.

The OLS monetary returns are negative, on average, across all education levels. The corrected MTT estimates from the generalized Roy model are higher and, in contrast, they are negative only among the least educated women. They range from -9% among women with 0-6 years of schooling to 39% among women with 13+ years of schooling. The FTT estimates corrected for the double selection bias are also higher compared to the OLS returns. Moreover, the corrected FTT exhibits a higher gradient with years of schooling compared to the OLS estimates. Women with 13+ years of schooling exhibit full returns to entrepreneurship that are 18 percentage points higher compared to women with 0-6 years of schooling, while the OLS full returns do not vary significantly with education.

Table 5: Results from the bivariate probit

	R=1	D=1
Homicide rate	-0.227**	
	(0.045)	
High crime dummy	0.454**	
	(0.031)	
7-9 yrs schooling	-0.249**	-0.238**
	(0.022)	(0.020)
10-12 yrs schooling	-0.396**	-0.303**
	(0.025)	(0.024)
13+ yrs schooling	-0.721**	-0.415**
	(0.024)	(0.024)
Wholesale & retail	0.030	0.770**
	(0.021)	(0.022)
Services	0.007	0.245**
	(0.019)	(0.022)
Age	-0.017**	0.030**
	(0.006)	(0.006)
Age squared	0.000**	0.000
	(0.000)	(0.000)
Married	0.131**	0.284**
	(0.015)	(0.015)
Children in HH	0.172**	0.126**
	(0.016)	(0.017)
2010	0.080**	0.080**
	(0.018)	(0.018)
2012	-0.030*	0.058**
	(0.018)	(0.018)

Notes: N= 41,748; ρ= 0.244. Standard errors in parenthesis. City fixed effects are included in the selection equation for the sectoral choice. The equation for the rate of response does not include city fixed effects. The omitted categories are 0-6 years of schooling, manufacturing, and year = 2008. Children in HH = children in the household. The high-crime dummy is 1 for Chihuahua, Acapulco, Tijuana, Culiacan, and Tepic, where the homicide rate is consistently high in our sample period.

* $p < 0.10$, ** $p < 0.05$, ** $p < 0.01$

Table 6: Marginal effects in the bivariate probit

	R=1	D=1
Homicide rate	-0.061**	
	(0.012)	
High crime dummy	0.122**	
	(0.008)	
7-9 yrs schooling	-0.067**	-0.060**
	(0.006)	(0.005)
10-12 yrs schooling	-0.106**	-0.077**
	(0.007)	(0.006)
13+ yrs schooling	-0.193**	-0.105**
	(0.006)	(0.006)
Wholesale & retail	0.008	0.195**
	(0.006)	(0.005)
Services	0.002	0.062**
	(0.005)	(0.006)
Age	-0.004**	0.008**
	(0.002)	(0.002)
Age squared	0.000**	0.000
	(0.000)	(0.000)
Married	0.035**	0.072**
	(0.004)	(0.004)
Children in HH	0.046**	0.032**
	(0.004)	(0.004)
2010	0.022**	0.020**
	(0.005)	(0.005)
2012	-0.008*	0.015**
	(0.005)	(0.005)

Notes: N= 41,748; ρ= 0.244. Standard errors in parenthesis. City fixed effects are included in the selection equation for the sectoral choice. The equation for the rate of response does not include city fixed effects. The omitted categories are 0-6 years of schooling, manufacturing, and year = 2008. Children in HH = children in the household. The high-crime dummy is 1 for Chihuahua, Acapulco, Tijuana, Culiacan, and Tepic, where the homicide rate is consistently high in our sample period.

* $p < 0.10$, ** $p < 0.05$, ** $p < 0.01$

Table 7: Least squares estimates in the second stage of the generalized Roy model.

	(1) Y_0	(2) Y_1	(3) Y_0^*
7-9 yrs schooling	0.107***	0.236***	0.113***
	(0.017)	(0.070)	(0.038)
10-12 yrs schooling	0.218***	0.382***	0.205***
	(0.025)	(0.103)	(0.049)
13+ yrs schooling	0.509***	0.914***	0.513***
	(0.046)	(0.185)	(0.068)
Wholesale & retail	-0.049**	0.117	0.320***
	(0.020)	(0.148)	(0.119)
Services	0.012	0.371***	0.226***
	(0.008)	(0.058)	(0.045)
Age	0.016***	0.059***	0.052***
	(0.003)	(0.013)	(0.009)
Age squared	-0.000***	-0.001***	-0.000***
	(0.000)	(0.000)	(0.000)
Married	0.045***	-0.052	0.099**
	(0.012)	(0.064)	(0.045)
Children in HH	-0.010	-0.107**	-0.022
	(0.012)	(0.050)	(0.025)
2010	-0.040***	-0.033	-0.109***
	(0.008)	(0.031)	(0.021)
2012	-0.073***	-0.080***	-0.133***
	(0.007)	(0.028)	(0.020)
λ_1	-0.539***	0.932	
	(0.144)	(0.673)	
λ_2	-0.191***	-0.298	
	(0.065)	(0.284)	
λ_R			-0.522**
			(0.210)
R-squared	0.285	0.121	0.226
N	24,453	8,256	4,958

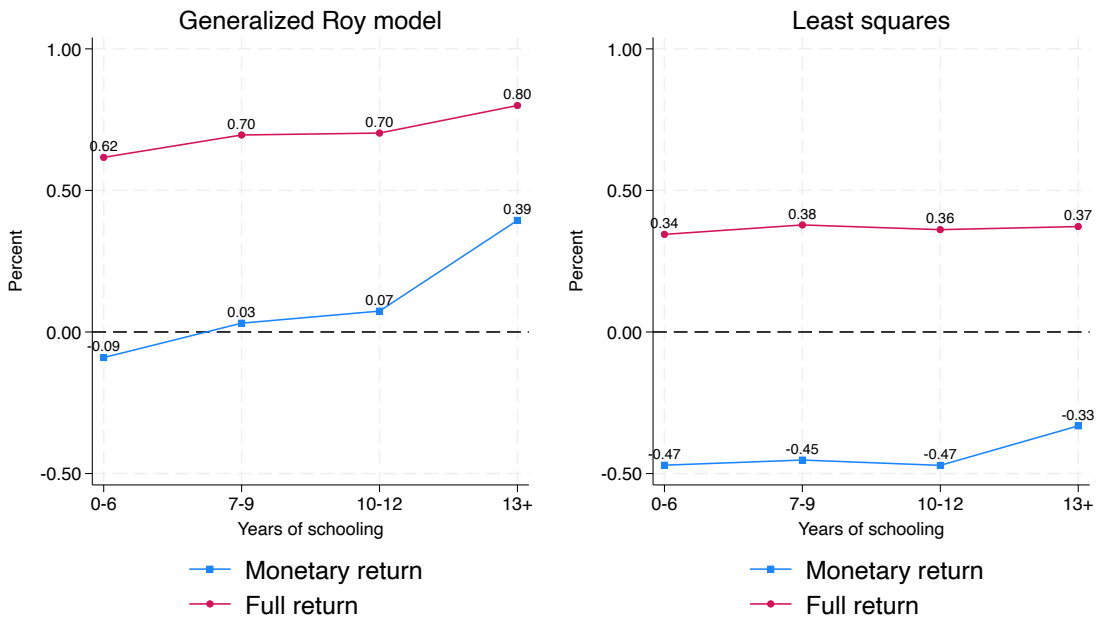
Notes: Standard errors in parenthesis. The estimations also include city fixed effects. The omitted categories are 0-6 years of schooling, manufacturing, and year = 2008. Children in HH = children in the household.

* $p < 0.10$, ** $p < 0.05$, ** $p < 0.01$

Table 8: Covariance Estimates

	U_D/σ_{U_D}	U_R/σ_{U_D}
U_0	0.062	-0.493
U_1	-0.075	0.861
U_0^*	-0.522	

Figure 5: Returns to entrepreneurship in the Generalized Roy model and without controlling for selection into sectors and non-response

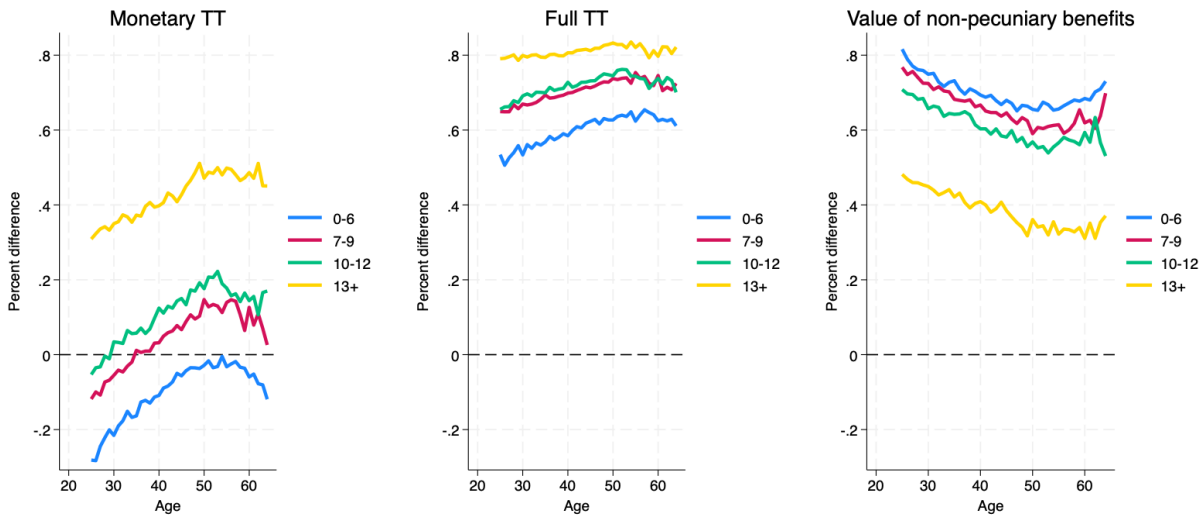


Notes: The left panel shows the MTT and the FTT conditional on years of schooling from estimates of the generalized Roy model. The right panel shows the estimates from Table 3.

In Figure 6 we compute the returns to entrepreneurship across the life cycle and conditioning on levels of years of schooling. The monetary return follows an inverted-U pattern with age, except among relatively skilled women (13+ years of formal education), where values flatten out in the latter years of the cycle. The full return in the second panel follows a similar, albeit smoother, relation with age. Among women with 13+ years of schooling, the FTT does not vary significantly during the life cycle. The value of non-pecuniary benefits to entrepreneurship shown in the third panel, while positive, decreases with both age and skill. In particular, the value of non-pecuniary benefits to entrepreneurship is the highest among women with 0-6 years of schooling, which results in positive and quantitatively significant FTT despite their negative monetary returns. While their negative MTT would suggest that

women with 0-6 years of schooling are necessity micro-entrepreneurs since they earn less than their estimated counterfactual wage, their high reservation wages would indicate that they place a high value on the non-pecuniary benefits from being a micro-entrepreneur.

Figure 6: MTT and FTT to micro-entrepreneurship over the life cycle.



Notes: The first two figures shows the monetary and the full returns conditioning on both age and years of schooling. The final panel shows the difference between the full and the monetary return.

5. Concluding remarks

We find that the monetary return to entrepreneurship among women in Mexico is relatively low, while the full return, including the value of the non-pecuniary benefits of running a micro-firm, is substantial. Our results suggest that the non-pecuniary benefits of entrepreneurship seem more relevant to the occupational choice among the less educated. Our results also suggest that while we cannot identify who is a necessity entrepreneur, we cannot determine the existence of necessity entrepreneurship based on monetary returns alone since the value of non-pecuniary benefits from running a micro-firm seem significant in a context like Mexico's.

Our analysis indicates that women in the sample seem to want to be compensated significantly for a wage working job, which can have different interpretations to the one we offer in this paper. Perhaps the subjective estimate for the market value of the skills of the women in the sample is off relative to what the market is offering to pay, and that is why they are running their firm. In other words, they could be overstating the market value of their skills (which is why they report high reservation wages). We leave potential corrections for this possibility to future work.

References

A. Aakvik, J. J. Heckman, and E. J. Vytlacil. Estimating treatment effects for discrete outcomes when responses to treatment vary: an application to norwegian vocational rehabilitation programs. *Journal of econometrics*, 125(1-2):15–51, 2005.

T. Åstebro. The returns to entrepreneurship. *Handbook of entrepreneurial finance*, 45:108, 2012.

T. Åstebro and J. Chen. The entrepreneurial earnings puzzle: Mismeasurement or real? *Journal of Business Venturing*, 29(1):88–105, 2014.

M. Benz and B. S. Frey. The value of autonomy: Evidence from the self-employed in 23 countries. *Institute for Empirical Research in Economics Working Paper*, (173), 2004.

H. Berglann, E. R. Moen, K. Røed, and J. F. Skogstrøm. Entrepreneurship: Origins and returns. *Labour economics*, 18(2):180–193, 2011.

D. G. Blanchflower. Self-employment in oecd countries. *Labour economics*, 7(5):471–505, 2000.

D. G. Blanchflower, A. Oswald, and A. Stutzer. Latent entrepreneurship across nations. *European Economic Review*, 45(4-6):680–691, 2001.

G. J. Borjas and S. G. Bronars. Consumer discrimination and self-employment. *Journal of political economy*, 97(3):581–605, 1989.

P. Carneiro, K. T. Hansen, and J. Heckman. 2001 lawrence r. klein lecture estimating distributions of treatment effects with an application to the returns to schooling and measurement of the effects of uncertainty on college choice. *International Economic Review*, 44(2):361–422, 2003.

S. de Mel, D. J. McKenzie, and C. Woodruff. Measuring microenterprise profits: Must we ask how the sausage is made? *Journal of Development Economics*, 88(1):19–31, 2009. ISSN 0304-3878. doi: https://doi.org/10.1016/j.jdeveco.2008.01.007. URL `https://www.sciencedirect.com/science/article/pii/S0304387808000138`.

X. d'Haultfoeuille and A. Maurel. Inference on an extended roy model, with an application to schooling decisions in france. *Journal of Econometrics*, 174(2):95–106, 2013.

P. Eisenhauer, J. J. Heckman, and E. Vytlacil. The generalized roy model and the cost-benefit analysis of social programs. *Journal of Political Economy*, 123(2):413–443, 2015.

D. S. Evans and L. S. Leighton. Some empirical aspects of entrepreneurship. *The economics of small firms*, pages 79–99, 1990.

R. W. Fairlie and A. Robb. Families, human capital, and small business: Evidence from the characteristics of business owners survey. *ILR Review*, 60(2):225–245, 2007.

R. W. Fairlie and C. Woodruff. Mexican entrepreneurship: A comparison of self-employment in mexico and the united states. In *Mexican immigration to the United States*, pages 123–158. University of Chicago Press, 2007.

Y. Georgellis, J. Sessions, and N. Tsitsianis. Pecuniary and non-pecuniary aspects of self-employment survival. *The Quarterly Review of Economics and Finance*, 47(1):94–112, 2007.

E. D. Gould. Rising wage inequality, comparative advantage, and the growing importance of general skills in the united states. *Journal of Labor Economics*, 20(1):105–147, 2002.

I. Günther and A. Launov. Informal employment in developing countries: Opportunity or last resort? *Journal of development economics*, 97(1):88–98, 2012.

B. H. Hamilton. Does entrepreneurship pay? an empirical analysis of the returns to self-employment. *Journal of Political economy*, 108(3):604–631, 2000.

J. R. Harris and M. P. Todaro. Migration, unemployment and development: a two-sector analysis. *The American economic review*, 60(1):126–142, 1970.

J. J. Heckman and B. E. Honore. The empirical content of the roy model. *Econometrica*, 58 (5):1121–1149, 1990.

J. J. Heckman and G. Sedlacek. Heterogeneity, aggregation, and market wage functions: an empirical model of self-selection in the labor market. *Journal of Political Economy*, 93(6): 1077–1125, 1985.

J. J. Heckman and G. L. Sedlacek. Self-selection and the distribution of hourly wages. *Journal of Labor Economics*, 8(1, Part 2):S329–S363, 1990.

J. J. Heckman and E. Vytlacil. Structural equations, treatment effects, and econometric policy evaluation 1. *Econometrica*, 73(3):669–738, 2005.

E. G. Hurst and B. W. Pugsley. Wealth, tastes, and entrepreneurial choice. National Bureau of Economic Research Working Paper 21644, 2015.

Instituto Nacional de Estadística y Geografía (INEGI). https://www.inegi.org.mx/sistemas/olap/proyectos/bd/continuas/mortalidad/defuncioneshom.asp?s=est, 1990-2023.

Instituto Nacional de Estadística y Geografía (INEGI). La encuesta nacional de micronegocios (ENAMIN). https://www.inegi.org.mx/programas/enamin, 1992-2012.

Instituto Nacional de Estadística y Geografía (INEGI). La encuesta nacional de ocupación y empleo (ENOE). https://en.www.inegi.org.mx/programas/enoe/15ymas/#microdata, 2005-2024.

D. Kawaguchi. Compensating wage differentials among self-employed workers: Evidence from job satisfaction scores. *Available at SSRN 318026*, 2002.

R. La Porta and A. Shleifer. Informality and development. *Journal of economic perspectives*, 28(3):109–126, 2014.

W. F. Maloney. Does informality imply segmentation in urban labor markets? evidence from sectoral transitions in mexico. *The World Bank Economic Review*, 13(2):275–302, 1999.

T. J. Moskowitz and A. Vissing-Jørgensen. The returns to entrepreneurial investment: A private equity premium puzzle? *American Economic Review*, 92(4):745–778, 2002.

C. B. Mulligan and Y. Rubinstein. Selection, investment, and womenś relative wages over time. *The Quarterly Journal of Economics*, 123(3):1061–1110, 2008.

H. Rosen and P. Willen. Risk, return and self-employment. *University of Chicago/Princeton University Discussion Paper, USA*, 2002.

A. D. Roy. Some thoughts on the distribution of earnings. *Oxford Economic Papers*, 3(2): 135–146, 1951.

Sarada. The unobserved returns to entrepreneurship. *Review of Economics and Statistics*, pages 1–45, 2024.

M. Sattinger. Comparative advantage and the distributions of earnings and abilities. *Econometrica*, 43(3):455–468, 1975.

C. M. Van Praag and P. H. Versloot. What is the value of entrepreneurship? a review of recent research. *Small business economics*, 29(4):351–382, 2007.

I. Verheul, R. Thurik, I. Grilo, and P. Van der Zwan. Explaining preferences and actual involvement in self-employment: Gender and the entrepreneurial personality. *Journal of economic psychology*, 33(2):325–341, 2012.

R. J. Willis and S. Rosen. Education and self-selection. *Journal of Political Economy*, 87(5, Part 2):S7–S36, 1979.

Appendix

Table A1: Least squares estimates of the monetary return to micro-entrepreneurship

	(1)	(2)	(3)	(4)	(5)
	Full sample	0-6	7-9	10-12	13+
D=1 if entrepreneur	-0.442***	-0.470***	-0.452***	-0.471***	-0.332***
	(0.008)	(0.016)	(0.012)	(0.019)	(0.021)
7-9 yrs schooling	0.167***				
	(0.009)				
10-12 yrs schooling	0.302***				
	(0.011)				
13+ yrs schooling	0.676***				
	(0.011)				
Wholesale & retail	-0.035***	-0.058***	0.033**	0.017	-0.248***
	(0.009)	(0.020)	(0.013)	(0.023)	(0.027)
Services	0.079***	0.050***	0.104***	0.137***	-0.051**
	(0.009)	(0.018)	(0.013)	(0.022)	(0.025)
Age	0.028***	0.028***	0.020***	0.014*	0.047***
	(0.003)	(0.006)	(0.004)	(0.007)	(0.007)
Age squared	-0.000***	-0.000***	-0.000***	-0.000	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Married	0.007	-0.020	-0.000	0.011	0.072***
	(0.007)	(0.014)	(0.010)	(0.016)	(0.017)
Children in HH	-0.052***	-0.002	-0.048***	-0.050***	-0.128***
	(0.007)	(0.016)	(0.012)	(0.018)	(0.017)
2010	-0.043***	-0.052***	-0.027**	-0.047**	-0.056***
	(0.008)	(0.016)	(0.012)	(0.019)	(0.019)
2012	-0.072***	-0.055***	-0.073***	-0.095***	-0.061***
	(0.008)	(0.017)	(0.012)	(0.019)	(0.019)
R-squared	0.281	0.200	0.167	0.168	0.133
N	32,709	7,985	12,741	5,921	6,062

Notes: The estimations also include city fixed effects. The omitted categories are 0-6 years of schooling, manufacturing, and year = 2008. Children in HH = children in the household.

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

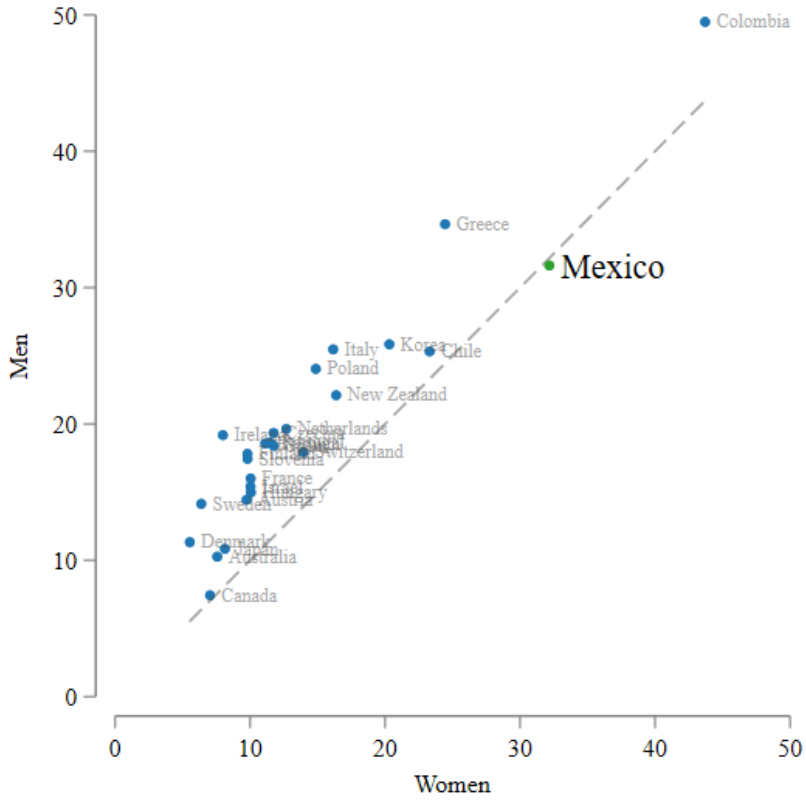
Table A2: Least squares estimates of the full return to micro-entrepreneurship

	(1)	(2)	(3)	(4)	(5)
	Full sample	0-6	7-9	10-12	13+
D=1 if entrepreneur	0.368***	0.345***	0.378***	0.362***	0.372***
	(0.007)	(0.012)	(0.010)	(0.017)	(0.022)
7-9 yrs schooling	0.159***				
	(0.007)				
10-12 yrs schooling	0.297***				
	(0.008)				
13+ yrs schooling	0.675***				
	(0.008)				
Wholesale & retail	-0.025***	-0.036***	0.026***	0.034*	-0.207***
	(0.007)	(0.013)	(0.010)	(0.018)	(0.024)
Services	0.027***	-0.023**	0.056***	0.107***	-0.092***
	(0.007)	(0.011)	(0.010)	(0.018)	(0.022)
Age	0.022***	0.019***	0.012***	0.007	0.048***
	(0.002)	(0.004)	(0.003)	(0.006)	(0.007)
Age squared	-0.000***	-0.000***	-0.000***	-0.000	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Married	0.025***	-0.003	0.012	0.030**	0.090***
	(0.005)	(0.009)	(0.008)	(0.012)	(0.015)
Children in HH	-0.051***	-0.009	-0.035***	-0.042***	-0.136***
	(0.006)	(0.010)	(0.009)	(0.014)	(0.015)
2010	-0.063***	-0.060***	-0.046***	-0.071***	-0.084***
	(0.006)	(0.011)	(0.009)	(0.015)	(0.017)
2012	-0.080***	-0.060***	-0.070***	-0.111***	-0.081***
	(0.006)	(0.011)	(0.009)	(0.015)	(0.016)
R-squared	0.302	0.184	0.178	0.174	0.150
N	29,501	6,582	11,702	5,471	5,746

Notes: The estimations also include city fixed effects. The omitted categories are 0-6 years of schooling, manufacturing, and year = 2008. Children in HH = children in the household.

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

Figure A1: Percentages of workers that are self-employed, men and women (2022)



Notes: authors' calculations based on OECD data. Each axis shows the percentage of employed persons (by sex) that are self-employed (15+ years old). Self-employed includes employers and own-account workers but also unpaid family workers. A 45-degree dashed line is shown.