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# Empowering Female Entrepreneurs Through Mentorship in Medellin, Colombia: Results From the Field

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Abstract: Utilizing the power of local knowledge and peer networking, this study attempts to quantify the impacts of mentorship among female micro-entrepreneurs in Medellin, Colombia on empowerment. Developing countries such as Colombia have disproportionately high rates of unprofitable micro-businesses, many of which are managed by women. Internal constraints, such as disempowerment, play a central role in perpetuating poverty. We implement a 6-month mentoring intervention by pairing 18 successful entrepreneurs with 52 disadvantaged female, microentrepreneurs in Medellin, Colombia to measure the additional benefit of localized knowledge to micro-borrowers. Using a process of random assignment, I measure the change in female empowerment, measured by its impact on support, self-confidence, self-efficacy, locus of control, aspirations, and positivity among mentees. I use principal component analysis and ANCOVA analysis to measure the mentorship effect on these psychological well-being variables. I find that mentorship increases female empowerment by .71 deviations in the short-run. Treatment effects disappear in the long-run. Moderation analysis suggests that mentor-quality is an important indicator of heterogenous treatment effects.

# 1. Introduction

Considering the prestige and honor we bestow upon entrepreneurs in highly developed countries such as the United States, it may be surprising to realize that most of the world's countries report extremely high entrepreneurial rates, and there are well over 400 million entrepreneurs in the developing world (Wennekers et al., 2005). Most of these people are also among the poorest on the planet (Banerjee & Duflo, 2011).

The urban subsistence labor force refers to individuals who identify themselves as self-employed business owners, but whose businesses stagnant with low or negative profits, and zero growth (Cole & Fayissa, 1991). In contrast to entrepreneurs in developed countries, these micro-entrepreneurs do not have employees, work in the informal sector (usually from home) and are likely to be female (Carr & Tate, 2000). They work long, hard hours, yet are unproductive. They rarely expand their business and they subsist in poverty (Banerjee & Duflo, 2011).

In an era where microfinance has expanded to even the most remote parts of the world, the problem of the unproductive micro-entrepreneur has remained a constant puzzle for researchers. Studies of micro-entrepreneurs with access to microfinance have consistently shown that increased availability to credit does not increase business profits. Why?

In *Poor Economics*, Banerjee and Duflo describe an “S” shaped business-growth model for micro-businesses. The marginal benefit of increasing investment is very high initially but tapers off quickly. To pass the hump and reach the next phase in business growth, a large investment would be needed. However, the amount needed is more than microfinance institutions are willing to give, or they charge interest rates that the poor cannot, or are not willing to pay. So, we see individuals invest little, earn little, and remain too poor to invest sufficiently in their business (Banerjee & Duflo, 2011).

Still an unsolved poverty trap, this study employs a new technique to stimulate small business growth in the developing, urban context of Medellin, Colombia, where urban subsistence labor is prevalent. We organize mentor meetings among female micro-entrepreneurs in an RCT study to causally assess the impact of mentorship on profits and empowerment. We theorize that mentorship is transformative by facilitating specific, localized knowledge transmission through networks and creating business connections (Foster & Rosenzweig, 1995). This study builds off of, and seeks to validate a 2017 RCT in Kenya, where

micro-entrepreneurs who received a mentor reported profits 20% higher than those who did not. (Brooks et al, 2017). Our study adds numerous psychological indicators to our assessment of mentorship because they provide critical insight to whether mentorship empowers and inspires female micro entrepreneurs to expand their business. We argue that female empowerment is an essential first step to business expansion, and consequently to increased profits and income. A lack of these subjective indicators may be a serious barrier to any poverty alleviation program.

## 2. Literature Review

### 2.1 An Elaboration of the Problem

#### 2.1.1 *The Urban Subsistence Labor Force*

Empirically, self-employment is much higher in developing countries than in developed countries, although self-employed individuals tend to subsist in poverty (Banerjee & Duflo, 2011). A massive 100 country dataset created by Gindling and Newhouse shows that more than half of workers in low and middle-income countries are self-employed, compared to just 15% of high-income countries (Gindling & Newhouse, 2013). Moreover, Banerjee and Duflo find that 44% of the urban poor are micro-entrepreneurs, compared to just 12% in OECD countries (Banerjee & Duflo, 2011). Cole and Fayissa first distinguish the poor, urban self-employed from other types of labor in 1991. They classify this labor as individuals with street vendors, or other micro-businesses that require little or no education or skills (Cole & Fayissa, 1991). These character traits, or lack thereof, are what Del Mel et al, argue distinguish profitable micro-businesses from stagnant ones. They refer to the unproductive, unskilled microbusiness owners as “own-account workers”. In an analysis of a Sri Lanka labor dataset, they show that between two-thirds and three-fourths of own-account workers have critical characteristics (such as ability, personality, and ambition) more similar to wage-workers than to entrepreneurs (Del Mel et al, 2008). Moreover, own-account workers are likely to be less successful and poorer than both entrepreneurs and wage-workers (Gindling & Newhouse, 2013).

The fact that urban subsistence labor is characteristically very similar to wage labor, suggests that micro-entrepreneurs may become self-employed as a second-best option after being excluded from the wage-sector. Thus, in failing labor markets, we may see high micro-entrepreneurial rates, but little business growth.

### *2.1.2 The Role of Gender on Self-Employment Outcomes*

Due to long-standing perceived inequality of women in the workforce, women face barriers in entering formal labor markets. Notably, Ester Boserup argues that differential female labor participation is the result of gender norms as established by the divergence of female and male labor in the agricultural sector (Boserup, 1970). This theory was tested using data from the Food and Agriculture Organization and exploiting variation in the historical geo-climatic sustainability of crops that require plow use in their cultivation. Results indicate that in countries with historical plow use, women are significantly less likely to participate in the workplace, in politics, or in entrepreneurial activities (Alesina et al, 2013). Thus, history and culture alone are enough to exclude women from the formal business sector.

However, the gap between female and male self-employment appears to be less pronounced in low and middle-income countries out of necessity of a source of income (Minniti, et al, 2010). Marlow explains this saying that patriarchal norms cause women to seek out self-employment (Marow, 1997). Specifically, lack of upward career mobility and low wages may push women out of the formal job-sector (Marow, 1997). Although women may be motivated into self-employment due to patriarchal norms in the workplace, business-support resources (such as funding) are disproportionately allocated to men. The SME Finance Forum finds that while women run 23% of small and medium sized businesses in developing countries, they account for 32% of the MSME finance gap (The SME Finance Forum, 2019 )

This evidence points to an uncomfortable reality of female workers in developing countries; their labor may be misallocated, they are excluded from the wage-sector and pushed into self-employment out of necessity, and once there, they face additional marginalization in that male-dominated space. In this way, culture and institutions that perpetuate gender inequality add to the inefficiency of the female self-employed worker, who would be better off either as a wage-worker or as a more “successful” entrepreneur without facing gender discrimination constraints.

### *2.1.3 Internal Constraints to Poverty*

This experiment measures psychological indicators of self-efficacy, locus of control, self-confidence, aspirations, and happiness due to recent literature that suggests poor psychological well-being may hinder success. Debraj Ray describes a self-sustaining poverty trap where low aspirations lead to the lack of productivity or goal reaching, which perpetuates poverty (Ray,

2006). Poverty then, limits individuals' aspirations, creating the positive feedback loop that reinforces the poverty trap.

Moreover, Ray and Grenicot link aspirations to growth and inequality. They show that the larger state of the economy can determine individual level aspirations, which then affects the larger economic dynamic again (Grenicot & Ray, 2017). Thus, poverty affects initial levels of aspirations, but the level of aspirations also determines larger economic outcomes. These findings suggest that one crucial key to any poverty alleviation strategy is lifting the internal constraints of poverty through motivation, goal-setting, or aspirational talks.

#### *2.1.4 The Many Failures Microfinance and Microfinance Plus*

Keenly aware of the poor's inaccessibility to credit in Bangladesh, professor Muhammad Yunis founded what is commonly believed to be the first microfinance organization, Grameen Bank, in 1976, as a research project. Its success initiated a microfinance craze that lasted for decades (Jain, 1996). Theory tells us that the introduction of credit markets allows poor people to invest in fertilizer, inventory, a sewing machine, employees, and many other things, making themselves better off in the long run. However, in the past decade, it has become clear that microfinance interventions have fallen short of initial expectations. J.D. Roth points out that access to credit only improves outcomes when other factors align together, such as infrastructure, goods markets, and investment in human capital (Roth, 1997). A microfinance institution in a particularly rural location with few roads and no marketplace will not induce farmers to grow and sell cash crops, for example (Roth, 1997). Moreover, microfinance has been accused of not helping the poorest of the poor, as Copestake et al. conclude in their study where borrowers of a single loan in Zambia were made worse off, due to rigid and unforgiving repayment schedules (Copestake et al, 2001).

Underwhelming standalone microfinance results led to the emergence of "microfinance plus," the theory of supplementing a microfinance treatment to find more detectable impacts. The "plus" element of the treatment has frequently been business classes provided to micro-lenders (De Mel & Woodroof, 2014; Bali Swain et al, 2010). Swain et al, hypothesize that Indian households don't understand how to effectively use the loans they receive, leading them to randomize business training among a subset of micro-lenders. Results showed training induced asset accumulation but had no effect on income (Bali Swain et al, 2010). Randomly assigned business training to a Peruvian group lending program for female micro-entrepreneurs also

had no statistical impact on sales, employment, or household financial decision-making (Karlan & Valdivia, 2011). Both studies echo the larger disappointing literature on business training. A large-scale business class program called “Start-and-improve Your Business” has been replicated in many settings throughout the developing world, but shows classes have no impact on profits (De Mel & Woodruff, 2014; Blattman & Ralston, 2015).

## 2.2 The Facets of Mentorship and Why it Works

### *2.2.1 Mentorship as an Internal Constraint Lifting Tool*

Making use of the information cascades mentors provide, and by interacting with an individual who has a successful business, mentors can act as role models, and lift mentees’ internal barriers, which are often caused and reinforced by their poverty. For example, impoverished individuals tend to be risk-averse and have high discount rates, which certainly would hinder entrepreneurial success where risk and investment in the future are important. On risk aversion specifically, researchers from Princeton point out that the poor choose habitual, rather than goal-directed behaviors, which stifles productivity. They theorize that this initiates a positive feedback loop where risk-averse behavior causes poverty, and poverty reinforces risk-aversion (Haushofer & Fehr, 2014).

Mentorship interventions work to dismantle the positive feedback loop for own accord workers, whose poverty-induced mentality is the main contributor to their firm’s unproductiveness. Taking on a role model position, mentors can help their mentees improve the very traits necessary for business success, namely locus of control and self-efficacy. A study indeed finds that parent entrepreneurial role models were associated with increased education, aspirations, self-efficacy, and expectation for an entrepreneurial career among mentees (Scherer et al, 1989).

### *2.2.2. The Role of Locus of Control and Self-Efficacy on Entrepreneurial Outcomes*

To effectively lift internal constraints among micro-entrepreneurs (in this case through mentorship,) it is important to focus on psychological traits that are indicative of entrepreneurial success, such as self-efficacy and locus of control. Using various tests and survey questions, an individual’s locus of control and self-efficacy can be ascertained, and these can be used as indicators for entrepreneurial success, or as Lucas calls it, managerial technology.

The concept of self-efficacy was theorized by Albert Bandura in 1977. He describes it as the belief in oneself to successfully execute a behavior of interest (Bandura, 1977). Moreover, Bandura highlights the importance of one's perceived self-efficacy, which influences activities and expectations of eventual success, and therefore may be even more important than actual self-efficacy (Bandura, 1977). Using lab participants, he experimentally proves his theory and shows that self-efficacy is positively related with successful execution of a task (Bandura, 1977). This result indicates that a person's perception of ability affects actual ability when performing an action. Thus, self-efficacy is an important quality for self-employed workers because level of self-efficacy can motivate or de-motivate productivity. Extending Bandura's concept to this context, we can theorize that self-employed workers with low levels of self-efficacy lack the confidence necessary for a successful enterprise. This could also explain why own-accord workers in the informal sector tend to have low productivity, with no business expansion, and also reaffirms De Mel et al's result that own-accord workers lack key characteristics successful entrepreneurs have.

A second psychological concept critical to entrepreneurial success, is the notion of locus of control. One's locus of control refers to their perception of how much control they exert over outcomes (Rotter, 2004). Based on their perception, individuals are classified as either internal or external, referring to whether they view control as an internal or external force (Rotter, 2004). Business and management literature cite locus of control as an indicator of entrepreneurial success (Furnham, 1986; Adekunle, 2011). Particularly, being identified as having internal locus of control is an indicator of entrepreneurialism (Howell & Avolio, 1993).

Another way to think about locus of control is to think about the role individuals believe luck plays in their lives. Alesina and Giuliano argue that individuals from various cultural backgrounds can observe the same reality but conclude differently about the role of luck in success (Alesina & Giuliano, 2015). While they focused on why different people have different attitudes about the hard work vs. luck debate about success, what is important in this paper is that workers view the source of their success differently. It has been argued that entrepreneurial-minded people believe hard work is the source of success, and thus, have a diligent work ethic (Alesina & Giuliano, 2015). We can imagine some self-employed workers with an external locus of control, that is to say, who perceive luck to have a large role in their success, as having a more hands-off approach to their business growth.



### *2.2.3 Mentors as Information-Updating Devices*

We can refer to the transfer of knowledge from a successful business owner to a micro-entrepreneur as mentorship, and we can think of mentors as information updating tools for own-account workers who lack the ability to expand or change their business in way that would make it more successful.

While never applied to a developing context or to micro-entrepreneurs, the impacts of general business mentorship are well documented. A 1979 study argued that mentorship increases work effectiveness, and found that about two-thirds of all observed, distinguished American executives had mentors. These executives earned more money at a younger age and reported being happier in their careers compared to their counterparts who did not have mentors (Roche 1979). The theory of mentorship was most famously developed by Christopher Orpen, who argues that interactions between organizational agents (read: mentors) and employees creates perceptions that they are cared about, making the individual want to succeed for sake of the mentor. (Orpen, 1997). Further, Scandura finds that mentor-relationships in a manufacturing plant was positively related to promotion rate and salary rate, even after controlling for several mentee characteristics (Scandura, 1992). Several recent studies list a host of benefits of mentorship. For example, in a female focused e-mentoring intervention, researchers found that the intervention positively influences mentees attitudes towards facing uncertainty, flexibility and innovation (Kyrgidou & Petridou, 2013).

The well-theorized and empirically proven results of mentorship may stem from the fact that own-account labor work inefficiently due to a lack of business-updating. Mentors introduce new business (and culturally) specific information, which essentially acts as a technology introduction for the mentee. Interestingly, anthropologists have discovered that human behavior changes not from environmental learning alone, but rather with a combination of environmental stimuli and cultural transmission (Hendrich, 2001). This theory can be translated to mentorship, where own-account workers do not react to outside market forces alone (ie: a changing customer base); rather they need a mentor to act as a cultural agent to pass along updated information.

### *2.2.4 The Role of Social Learning in Entrepreneurial Success*

The information passed from mentor to mentee is an example of social learning. Social learning is the process of learning through information cascades and through one's social

network. Numerous studies have shown how social learning can impact economic outcomes, such as a 1995 study by Foster and Rosenzweig that shows the adoption of high yield variety seeds induce learning spillovers among Indian farmers (Foster & Rosenzweig, 1995). Farmers are more likely to adopt the new seed if their neighbors have adopted it, and farmers with neighbors experienced with the new technology were more profitable than farmers who had inexperienced neighbors (Foster & Rosenzweig, 1995). Thus, simple information transmission by neighbors can increase the adoption of a new farm technology and move all players in this stag-hunt game to the pareto optimal outcome due to more productive farm technology.

Similarly, Conley and Urdy demonstrate the social learning process of pineapple adoption in Ghana. In this 2-year study, results showed that farmers adjusted their inputs to align with their neighbors who were successful at growing pineapples in the previous period (Conley & Urdy, 2010). Furthermore, their results indicated that inexperienced farmers were the most responsive to the neighbors who had adopted the pineapple, providing more evidence of learning (Conley & Urdy, 2010).

### 3. Data and Experiment

#### *3.1 Experimental Design*

We implement a mentorship program experiment similar to one developed by Brooks et al in their 2017 paper “Mentors or Teachers? Microenterprise Training in Kenya”. Since our experiment differs in location and sample size, and since we have additional outcomes of interest, we modify the basic design for our needs.

We promote the mentor program to female microentrepreneurs through a microfinance organization and a local, government sponsored entrepreneurial program. Women who meet our participation criteria are invited to reunions throughout the city, where the experiment is explained, and baseline data is collected. We additionally recruit potential mentors through microfinance organizations, present the project as a community leadership position, and conduct baseline surveys.

#### *3.2 Randomization*

The experiment involves half of the microentrepreneurs to randomly become “mentees,” who are assigned to treatment, and half who become the control group. We use a pairwise matching technique during the randomization process to ensure a balanced sample. Individuals

were grouped first by the location from which we conducted their baseline survey. Then, they were further grouped by type of business (clothing, food, personal services, general store, artesian crafts, imitation jewelry, and other,) and years of experience in their current business (where we first binned individuals with 0-2.9 years of experience together, and 2.9-5 years of experience together). Finally, if a further criterion was needed to make a pair, we grouped individuals with the most similar business type together (for example, baker with baker, shirt-maker with shirt-maker). Once we obtain a pair of two microentrepreneurs with the same or most similar covariates, we divide the pair into pile A and pile B. We do this for all individuals for a given location, so randomization occurs within each survey location. We flip a coin to assign treatment to either pile A or pile B. A graphic of the randomization process is included in the appendix.

### *3.3 Treatment Description*

Three to five treatment mentees are grouped together by business type and location and then assigned with the geographically closest mentor with the same business type. Mentees meet with their assigned group once a week for five weeks, then once a month for five months, so the treatment spans six months and entails ten meetings. A follow up survey is completed by everyone after the completion of the weekly meetings. A second wave survey is completed following the end of all ten meetings. A final survey is completed 6 months after the treatment ends, and one year after the experiment commenced. Mentors follow a mentor curriculum developed by Professor of Economics, Bruce Wydick, which is included in the appendix. Mentors and mentees cover business topics such as accounting and managing an employee, and internal psychological struggles including goal-setting, and conceptualizing pathways out of poverty. However, organic conversation and need-specified deviations from the curriculum are highly encouraged.

Mentees are paid a transportation stipend of 5,000 Colombian pesos (COP) for each meeting they attend, paid only after the completion of the meetings. Both treatment and control are paid 10,000 COP for their time completing the surveys and invited to participate in a one-hour accounting course where they receive an accounting notebook. We do not suspect this class to impact the experimental results, since research indicates that business courses targeted to micro-entrepreneurs have no impacts (De Mel & Woodruff, 2014; Blattman &

Ralston, 2015). Moreover, the class meets only once for one hour. Mentors are paid a stipend of \$120,00 COP for their participation and to cover any transportation costs.

### *3.4 Location*

We conduct the one-year mentorship experiment in Medellin, Colombia, beginning in June of 2018. We choose a Latin American context because of the high female micro-entrepreneurial rate. Colombia has a steadily decreasing poverty rate, which is currently 26.9%, and has an urban poverty rate of 8.7%, as of 2017 (World Bank Data, 2018). Increased development and commerce makes Colombia a promising candidate for poverty alleviation targeted towards the marginally poor (such as the mentorship program).

Since Medellin is Colombia's second-largest city and sprawls across the Aburrá valley, we have significant challenges in connecting micro-entrepreneurs both with each other and with mentors. For this reason, we work in several distinct locations in the city, as well as a municipality called Itagui, which is a suburb of Medellin. As a result, our full sample is actually composed of two groups: the Medellin group, whom we obtain from our connection with the microfinancier Banco de los Pobres, and the Itagui group, whom we obtain from a governmental entrepreneurial program in Itagui. It is possible that these groups differ in unobserved ways, so we complete our analysis on the full sample, as well as by group.

### *3.5 Participants*

We have strict participation criteria. Treatment candidates must be female, an entrepreneur, have less than 5 years of experience in their current business venture, and come from a social strata of 3 or below. For this last criterion we take advantage of Colombia's class stratification, which varies between 1-6, with 6 being the highest, and is assigned based on an extensive governmental household survey. Our mentors also must be female entrepreneurs, and additionally, they must have 5 or more years of experience in their current business, and come from a strata of 3 or above. There is a small number of individuals who participate, but who violated some portion of the participation criteria.

## **4. Hypothesis and Model**

Our experiment is composed of two components: intermediate and final outcomes. This study focuses on the intermediate outcomes of mentorship on female empowerment through its

impact on support, self-confidence, self-efficacy, locus of control, aspirations and positivity, while my colleagues estimate the impact on long-term outcomes indicated by business sales and profits. Intermediate and final outcomes interact in a positive feedback loop initiated by weekly mentoring sessions of mentors and mentees of a particular industry. We theorize that mentorship causes information cascades from mentor to mentee, leading to more effective business practices, increased empowerment, and finally, higher sales and profits. Increased sales and profits then lead to even higher levels of hope and bigger aspirations.

#### 4.1 Econometric Model

This experiment seeks to capture the impact of peer-mentoring among micro-entrepreneurs in Medellin, Colombia. The question of interest is whether 5 weekly, and 5 monthly peer mentor sessions affect female empowerment through impacts on support, self-confidence, self-efficacy, locus of control, aspirations, and positivity. We assume the null hypothesis where mentorship has no impact on any of our subjective indicators. Formally,

$$H_0: \beta = 0 \quad (1)$$

The alternative hypothesis is that mentorship has an impact on female empowerment through its impacts on support, self-confidence, self-efficacy, locus of control, aspirations, and positivity where

$$H_A: \beta \neq 0 \quad (2)$$

To test our hypothesis, we estimate the equation:

$$Y_{ijt} = \alpha + \beta_1 T_{i1} + \beta_2 T_{i2} + \eta X_i + \phi B_i + \gamma W_{i2} + \varphi Y_{i0} + \sigma M_i + \theta P_j + \varepsilon_{ijt} \quad (3)$$

Where the outcome variable  $Y_{it}$  is an indexed outcome variable of female empowerment, support, self-confidence, self-efficacy, locus of control, aspirations, and positivity, for individual  $i$  at time  $t$  where  $t = \{0,1,6\}$  months since the treatment began. The outcome variables represent standard deviation changes from the mean response, where the mean and standard deviation are standardized.  $T_{i1}$  is an interaction term of  $t=1$  and treatment. I interpret the coefficient on this variable as the impact of mentorship after one-month. Similarly,  $T_{i2}$  is an interaction that indicates treatment at  $t=6$  months. This variable yields the impact of mentorship after six-months.  $X_i$  is a vector of individual characteristics, measured at baseline. I also include a dummy variable  $B_i$ , that switches to 1 if the group is from Medellin, and 0 if it is from Itagüí.  $W_2$  is an

indicator for the second follow-up survey at  $t=1$  month. I use baseline values of the outcome variables as right-hand side regressors, represented by  $U_{i1}$ . An indicator for missing baseline outcome values are captured by  $M_i$ . Finally, I use a pair-level fixed effect, drawn from the pairs created during randomization and containing time-invariant characteristics. I cluster  $\varepsilon_{it}$  at the mentor group level, since outcomes are likely correlated at this level. Since control individuals do not have a mentor group, groups were artificially constructed by location and business type, as this is how a mentor group was determined for treatment participants.

I interpret the program impact as the impact of assignment to the treatment group, therefore following an intent to treat strategy. This may lead to a downward bias in estimation since non-compliance among the treatment group was high.

#### *4.2 Estimation Technique*

The random assignment of a mentor allows causal estimation of the treatment as it ensures treatment and control are balanced on both observable and unobservable characteristics. For this to be true, I rely on the following assumptions: the independence of individual observations, normality of the distribution, and heteroskedasticity. I use statistical tests to verify these assumptions in my dataset. Moreover, since the data is in a panel and attrition did occur, I assume that observations are missing at random. The failure of this assumption implies biased coefficients, although the direction of the bias would depend on which observations were missing non-randomly. For example, if attrition among treated individuals who did not participate in the program is statistically significant, I would expect the treatment effect to be biased upwards.

##### *4.2.1 ANCOVA Estimation*

Equation (3) is an ANCOVA estimation technique. This estimation strategy is chosen because it reduces variances and therefore increases the ability to reject a null hypothesis by including baseline values of the dependent variable (Tabachnick & Fidell, 2013). Moreover, in randomized studies where treatment is assigned at baseline, the literature indicates that ANCOVA is unbiased and has higher power than other estimators (Van Breukelen, 2006). Additionally, I prefer the ANCOVA estimation because it requires no additional assumptions beyond those mentioned in section 4.2.

#### *4.3 Main Variable Construction*

Outcome variables are mean-zero, standardized principle components of survey questions. Principle component analysis is a data-reduction tool that emphasizes strongly correlated data. As a result, highly variable data can be compressed, highlighting the over-arching pattern in the data (Jolliffe, 2011). In this dataset, the principle components find correlations between each set of survey questions and weighs the questions accordingly. All of the survey question responses were a number between one and five (where one signifies “strongly disagree” and 5 signifies “strongly agree”). Questions that were asked in the negative and require reverse-scoring were likewise reversed in the component. The support, self-confidence, self-efficacy, locus of control, aspirations, and positivity components were composed of 3-4 survey questions. The female empowerment component was constructed from all the survey questions in the aforementioned components.

#### *4.4 Alternative Variable Construction*

An alternative data-reduction tool is the construction of summary indices, such as Anderson or Kling indices. In many ways, Anderson indices reduce information in an opposite way than principle component analysis. The Anderson index weighs down highly correlated data through its use of the inverse of the covariance matrix, therefore preserving variability and eliminating redundancy (Anderson, 2008). As a result, the Anderson index serves as the perfect robustness check to the original variable construction. Indices are mean-zero and standardized, and individual questions are reversed-scored when necessary.

Conversely, the female empowerment summary index is constructed following Kling, 2007. I assume that the components of this index, self-confidence, self-efficacy, locus of control, aspirations, positivity, and support should have equal weight, as opposed to the disproportional weights assigned with Anderson indices.

## **5. Results**

### *5.1 Summary Statistics*

Our final sample consists of 107 female micro-entrepreneurs, 55 from the Medellin group (henceforth referred to as Banco de los Pobres group), and 52 from Itagui. In terms of demographics, the average woman in our sample is 40.01 years old, has 10.91 years of education, and has a social strata of 2.1. 35.9% of our sample considers themselves food

insecure. On average, a woman's business is 2.13 years old, participants work 4.95 days a week, 8.57 hours a day, and earn 201,821 COP (\$65.16) a week. 52.88% of our sample report they use accounting in the management of their business. Overall, the sample is modestly educated, marginally poor, and follow a relatively normal work schedule. All relevant micro-entrepreneur summary statistics are provided in table 1.

Our mentor sample consists of 9 mentors for the Banco de los Pobres group, and 9 mentors for the Itagui group, totaling 18 in all. The mentor sample skews older than the mentee sample, with the average age being 50.2. Mentors are also more educated than mentees, with an average of 13.6 years. The average strata is 3.2, making them solidly middle-class in Colombian society. They are highly experienced in business management (15.22 years of experience) and have 2.3 employees on average.

## *5.2 Balance Tests*

I perform ttests to check for balance of treatment and control after randomization. Testing on the key variables, age, education, strata, experience, age of business, type of business, profits and sales (with log transformations,) indicate that the groups are balanced at baseline (Table 2 ). Since I suspect that the Banco de los Pobres group may differ from the Itagui group, I perform balance tests on the same key variables by group. The results indicate that the groups are distinct in several ways, including level of education, business age, strata, and business type. I add a dummy variable called "banco" to control for these discrepancies in regression analysis.

## *5.3 Main Results with PCA Variables*

Table 3 reports ANCOVA regression results of all seven outcome variables on treatment. An analysis of the correlation between survey questions show that 3 questions are oppositely correlated in their component and in their alternative index variable construction. I remove these survey questions from their respective component and all further analyses because of this discrepancy.

The one-month results show the treatment was highly effective in increasing female-empowerment and its components (Figure 1). Receiving a mentor increases a woman's empowerment by .71 standard deviations from the mean score, (2.5 out of 5) and it is highly significant. Moreover, treatment significantly increases support, self-confidence and aspirations



by .68, .51, and .57 standard deviations, respectively. All other variables yield positive coefficients yet remain statistically insignificant.

Row two of table 3 reveals the six-month treatment effect on each outcome variable. The strong effect of mentorship in the short-run mostly disappears, as all variables lose significance at conventional levels and the magnitude of the coefficients diminish across all variables (Figure 2). However, all outcome variables maintain positive coefficients. This suggests that a small positive effect has remained, but is statistically undetectable given the sample size.

## 6. Moderation Analysis

Given positive and encouraging results, I would like to understand if there is a moderator through which mentorship works. It is of interest to identify which facet of the program drove increases in outcome variables, so this program can be replicated in other contexts with the expectation of similar results. In this section I add the outcomes business revenue and business profits to my analysis.

Since mentors are highly variable, I hypothesize that mentor quality is a main channel to the observed treatment effect. A preliminary analysis of difference in log profit from baseline by mentor-group shows a few outlier groups (3, 13, 15, & 19) with a large positive difference in profit from baseline (Figure 5). These mentor-group numbers correspond with mentors from Itagui. A scatterplot of difference in empowerment from baseline by group also indicates a heterogeneous treatment effect with outliers of large, positive differences in empowerment coming from Itagui (Figure 10).

### 6.1 *Mentor Quality by Group*

I hypothesize that mentors we sourced from the Camera de Comercio in Itagui are higher quality mentors than mentors from Banco de los Pobres. To understand this relationship, I construct a kling mentor-quality index using variables such as business experience, profits, and number of employees. Each mentor then ascertains a quality score as a mentor.

A scatterplot of mentor-quality by group shows that Itagui mentors have higher mentor-quality scores than Banco de los Pobres mentors (Figure 6). Moreover, a plot of mentor-quality and mentee revenue of just the Itagui group shows a strong positive

relationship (Figure 7). Similarly, there is positive relationship between Itagui mentor-quality and both profits and female-empowerment (Figures 8 & 9).

## 6.2 Mentor Quality Regressions

I run a regression of mentor-quality on mentee revenue, profits, empowerment, support, self-confidence, and aspirations. This subset of outcomes are chosen because I suspect them to be the most likely affected by mentor quality. Formally, I estimate:

$$Y_{ijt} = \alpha + \beta_1 T_{i1} + \eta X_i + \phi B_i + \varphi Y_{i0} + \sigma M_i + \varepsilon_{ijt} \quad (4)$$

Where  $Y_{it}$  are the outcome variables log revenue, log profit, and female-empowerment, support, self-confidence, and aspirations.  $T_{i1}$  is a mentor-quality index for mentor  $i$  at baseline. Using log interpretations of revenue and profit allows for an intuitive percent-change coefficient interpretation on these variables. The remaining variables are defined as in (3). I use robust standard errors because the number of clusters is small ( $N=19$ ), and clustered standard errors would be biased downward, increasing the likelihood of type I error.

A casual interpretation of this analysis hinges on the assumption that mentor-quality was randomly assigned among mentees. Indeed, the match of a mentor to a mentee group was made solely on business type and location. If mentor-quality is correlated with these characteristics, the assumption fails. Moreover, the regression applies to only a small subset of the original sample (since control and baseline observations are omitted,) which further complicates casual inference.

### 6.2.1 Mentor Quality Regressions

Table 5 reports ANCOVA regression using (4). Log profits and log revenue are statistically significant when regressed on mentor quality. A one-standard deviation increase in mentor-quality increases profits by 32% and revenue by 40%. The subjective indicators yield small, positive coefficients; however, none are statistically significant at conventional levels due to large standard errors and a small sample size. These results provide solid evidence that the mentor program is successful at increasing revenue and profits among participants with a high-quality mentor. It is interesting that the coefficient on empowerment is lower in this regression analysis than in (3). One interpretation of this result is that participants are empowered not only by their mentor, but by the peers in their mentor-group. Perhaps it is this peer-based

support group that drive the strong increase in female empowerment in table 4. Unfortunately, I cannot capture the peer-group effect with the mentor-quality index.

## 7. Robustness Checks

### 7.1 *Main Results with Indexed Variables*

Initial results with Anderson index variables show that treatment has a prolonged effect, even at the 6-month follow up, contrasting the 6-month results found using PCA variables. However, this discrepancy can be explained by the negative correlation between 3 survey questions and the index they pertain to. I believe these questions may not have accurately measured the desired indicator because they were abstract, out of context, and poorly translated into Spanish. When these questions are removed from their respective indices, results are generally conformable to those found in table 3.

Table 4 reports ANCOVA regression results using the alternative variable construction method with 3 survey questions omitted. One-month treatment effects are nearly identical in magnitude and statistical significance across all outcomes (Figure 3). Assignment to a mentor increases female-empowerment by .77 standard deviation and remains highly significant. Support and self-confidence also show a strong positive short-term effect of mentorship.

Six-month treatment effects indicate mentorship's effectiveness diminishes in the long-run, but not as much as indicated in table 3 (Figure 4). The magnitude and significance of outcome variables largely decrease from one-month levels. Notably, empowerment continues to yield a large and significant positive coefficient, as does self-confidence in the 6-month follow-up.

The few discrepancies between PCA variables and Anderson index variables in the six-month regression may be due to their contrasting data-reduction processes. However, coefficient signs and magnitudes follow similar trends, and I interpret this to mean regression results are robust to alternative variable construction.

### 7.2 *Random Inference*

While treatment was assigned individually, treated outcomes are likely correlated since treated participants met with other treated participants in their assigned mentor-group. Thus, all regressions used clustered standard errors at the mentor-group level, which were artificially constructed based on location and business type for control participants. However, the number

of actual treated mentor-group clusters remains small ( $N=19$ ). A small number of clusters may artificially decrease standard errors and result in type 1 error. Random inference resamples the treatment variable 1000 times while respecting the clustered nature of the data. This procedure ensures that the clusters themselves are not driving outcomes. I run random inference regressions on all seven PCA-constructed outcomes of interest. All treatment coefficients are similar in magnitude and standard errors to those in tables 3 and 4.

## 8. Conclusion

This paper investigates the causal relationship between mentorship and female-empowerment, as measured by support, self-confidence, self-efficacy, locus of control, aspirations, and positivity. To examine this relationship, we implemented a six-month randomized experiment among female micro-entrepreneurs in Medellin, Colombia. Using an ANCOVA model, I find significant short-run gains in empowerment, as well as support, self-confidence, and aspirations. Results all but disappear by the 6<sup>th</sup> month and the conclusion of the experiment.

Moderation analysis suggests that mentorship is most effective when participants are paired with high-quality mentors. Regression of outcomes on mentor-quality indicate revenue and profit are strongly correlated with mentor-quality. There also appears to be a small, positive correlation between mentor quality and the subjective outcomes: female empowerment, self-confidence, aspirations and support. The analysis also uncovered that Itagui mentors were of higher-quality than those from Banco de los Pobres. To this point, there is a stronger, positive relationship between Itagui mentor quality and Itagui mentee revenue, profit and empowerment, than in the full sample. It appears that the program was more effective in this subset of the sample, however the relationship between mentor-quality and outcomes is endogenous so I am cautious in making this claim. Perhaps the omitted variable in this equation is location; Itagui has higher-quality mentors, but it may also have higher-quality mentees, and their quality may be correlated with the fact they are from Itagui.

Taken together, results suggest that mentorship can be a powerful tool in empowering women and alleviating poverty. Yet, much like micro-finance, it appears that mentorship requires a variety of factors to interact in order to be effective. Policy-makers should consider the frequency of mentor-meetings, program length, and mentor-quality when implementing a

mentorship program. This analysis suggests a high-frequency, long-lasting mentoring program and high-quality mentors is important to the success of a mentoring program.

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## Appendix

**Table 1: Summary Statistics**

	<b>Total Sample</b>	<b>Banco</b>	<b>Itagui</b>
Age	40.01 (11.20)	40.89 (11.35)	39.08 (11.06)
Education	10.91 (3.29)	9.25 (3.10)	12.66 (2.50)
Strata	2.10 (0.73)	1.67 (0.58)	2.56 (0.57)
Lrevenue	12.49 (1.33)	12.60 (1.38)	12.38 (1.28)
Lprofit	11.58 (1.57)	11.63 (1.73)	11.53 (1.40)
Experience	5.55 (6.45)	5.87 (6.51)	5.20 (6.43)
Business age	2.13 (1.47)	2.47 (1.59)	1.78 (1.26)
Days	4.97 (2.13)	5.53 (1.86)	4.36 (2.26)
Hours	8.54 (3.14)	9.55 (2.43)	7.42 (3.48)
N	107	55	52

mean coefficients; sd in parentheses

\* p&lt;0.05, \*\* p&lt;0.01, \*\*\* p&lt;0.001

**Table 2: Balance Test**

	Treatment		Group	
	b	t	b	t
Age	-0.10	-0.75	-1.15	-0.87
Education	-0.20	-0.53	3.08***	9.20
Strata	0.07	0.73	0.89***	12.46
Experience	0.03	0.05	-0.31	-0.42
Business age	0.14	0.60	-0.73***	-3.09
Businesstype	-0.04	-0.20	2.20***	14.10
Lnrevenue	0.07	0.47	-0.15	-1.05
Lnprofit	0.12	0.74	-0.07	-0.40
N	260		260	

**Table 3: ANCOVA Regression with PCA Variables**

	Support	Self-Confidence	Self-Efficacy	Locus of Control	Aspirations	Positivity	Empowerment
Treatment_1mo	0.68*** (0.17)	0.72*** (0.22)	0.22 (0.23)	0.12 (0.15)	0.45* (0.26)	0.14 (0.18)	0.71*** (0.19)
Treatment_6mo	0.35* (0.21)	0.12 (0.20)	0.06 (0.21)	0.24 (0.18)	0.34* (0.20)	0.28 (0.20)	0.32* (0.18)
Follow_up2	0.29 (0.23)	0.35 (0.24)	0.46* (0.24)	0.22 (0.16)	0.50** (0.20)	0.00 (0.25)	0.49** (0.23)
Age	0.01 (0.01)	0.00 (0.01)	0.01 (0.01)	0.00 (0.01)	0.00 (0.01)	-0.01 (0.01)	0.00 (0.01)
Strata	0.46* (0.24)	0.41** (0.19)	-0.10 (0.22)	0.08 (0.19)	-0.21 (0.17)	0.28* (0.15)	0.25* (0.15)
Banco	0.81 (0.64)	1.38** (0.67)	0.03 (1.27)	-0.16 (0.43)	-0.09 (0.46)	-0.02 (0.45)	0.84 (0.46)
_cons	-1.51* (0.87)	-1.69** (0.77)	-0.30 (0.79)	-0.25 (0.67)	0.48 (0.63)	-0.75 (0.52)	-1.21** (0.54)
Pair FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Baseline Value	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	153	153	153	153	153	153	153

Notes: All values rounded to second decimal point. Standard errors are clustered at the mentor-group level.

\* p<.10    \*\* p<.05    \*\*\* p<.01

**Table 4: ANCOVA Regression with Indexed Variables**

	Support	Self-Confidence	Self-Efficacy	Locus of Control	Aspirations	Positivity	Empowerment
Treatment_1mo	0.69*** (0.18)	0.69*** (0.18)	0.16 (0.24)	0.12 (0.15)	0.46* (0.27)	0.31* (0.18)	0.77*** (0.19)
Treatment_6mo	0.45** (0.22)	0.27 (0.19)	0.05 (0.26)	0.24 (0.18)	0.35* (0.20)	0.34 (0.23)	0.51** (0.23)
Follow_up2	0.21 (0.21)	0.26 (0.20)	0.44* (0.27)	0.22 (0.16)	0.47* (0.25)	0.05 (0.21)	0.52* (0.27)
Age	0.01 (0.01)	0.00 (0.01)	0.01* (0.01)	0.00 (0.01)	0.00 (0.01)	-0.01 (0.01)	0.00 (0.01)
Strata	0.51* (0.28)	0.51** (0.19)	-0.01 (0.20)	0.09 (0.19)	-0.22 (0.17)	0.28*** (0.12)	0.50*** (0.17)
Banco	0.73 (0.67)	1.82*** (0.64)	-0.39 (1.37)	-0.17 (0.43)	-0.14 (0.49)	0.39 (0.50)	1.12 (0.70)
_cons	-1.66* (0.99)	-2.16*** (0.79)	-0.41 (0.79)	-0.25 (0.66)	0.51 (0.65)	-0.75 (0.60)	-1.93*** (0.55)
Pair FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Baseline Value	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	153	153	153	153	153	153	153

Notes: All values rounded to second decimal point. Standard errors are clustered at the mentor-group level. Female empowerment is constructed as a Kling index. All other variables are Anderson indices.

\* p<.10    \*\* p<.05    \*\*\* p<.01

Figure 1: ANCOVA 1-month Results with PCA

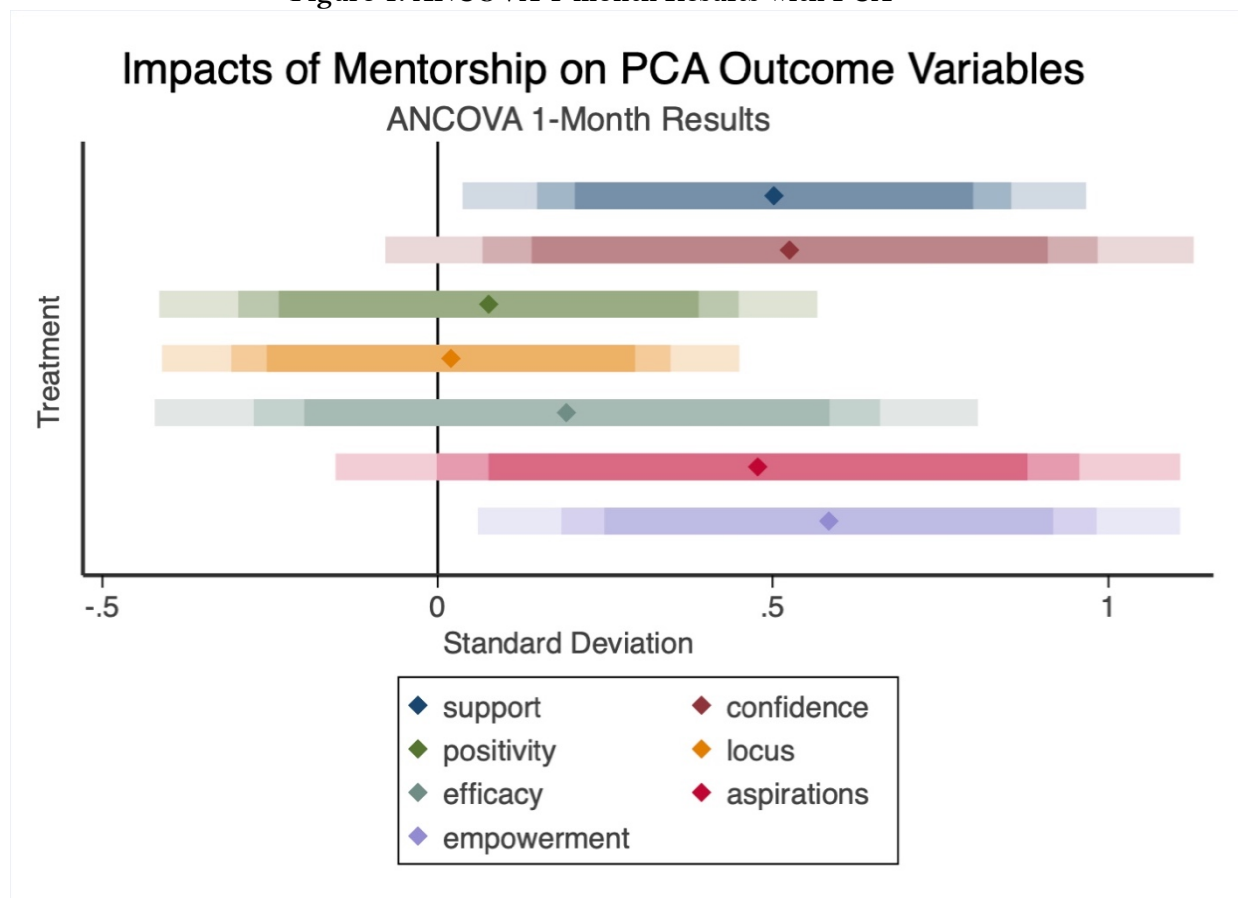


Figure 2: ANCOVA 6-month Results with PCA

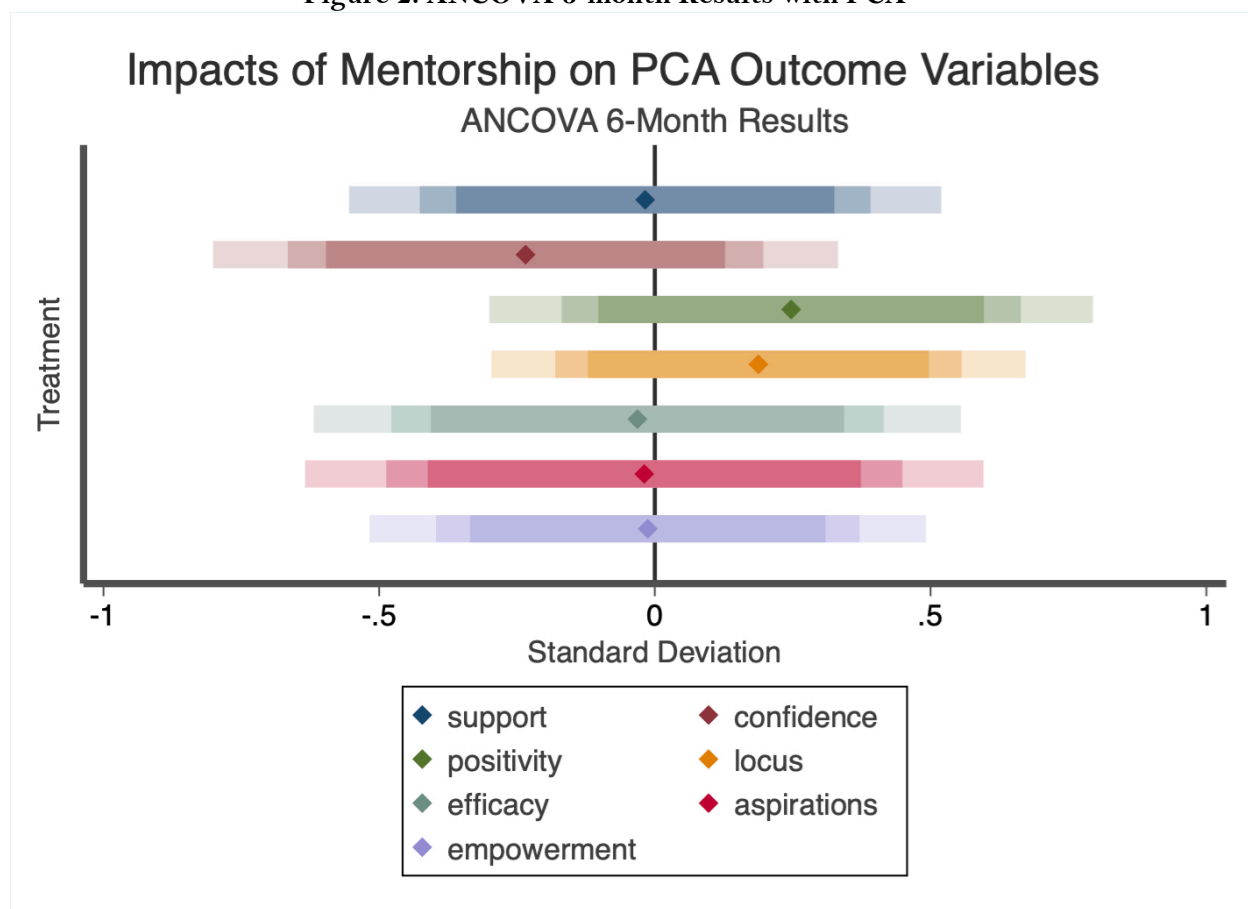


Figure 3: ANCOVA 1-month Results with Indices

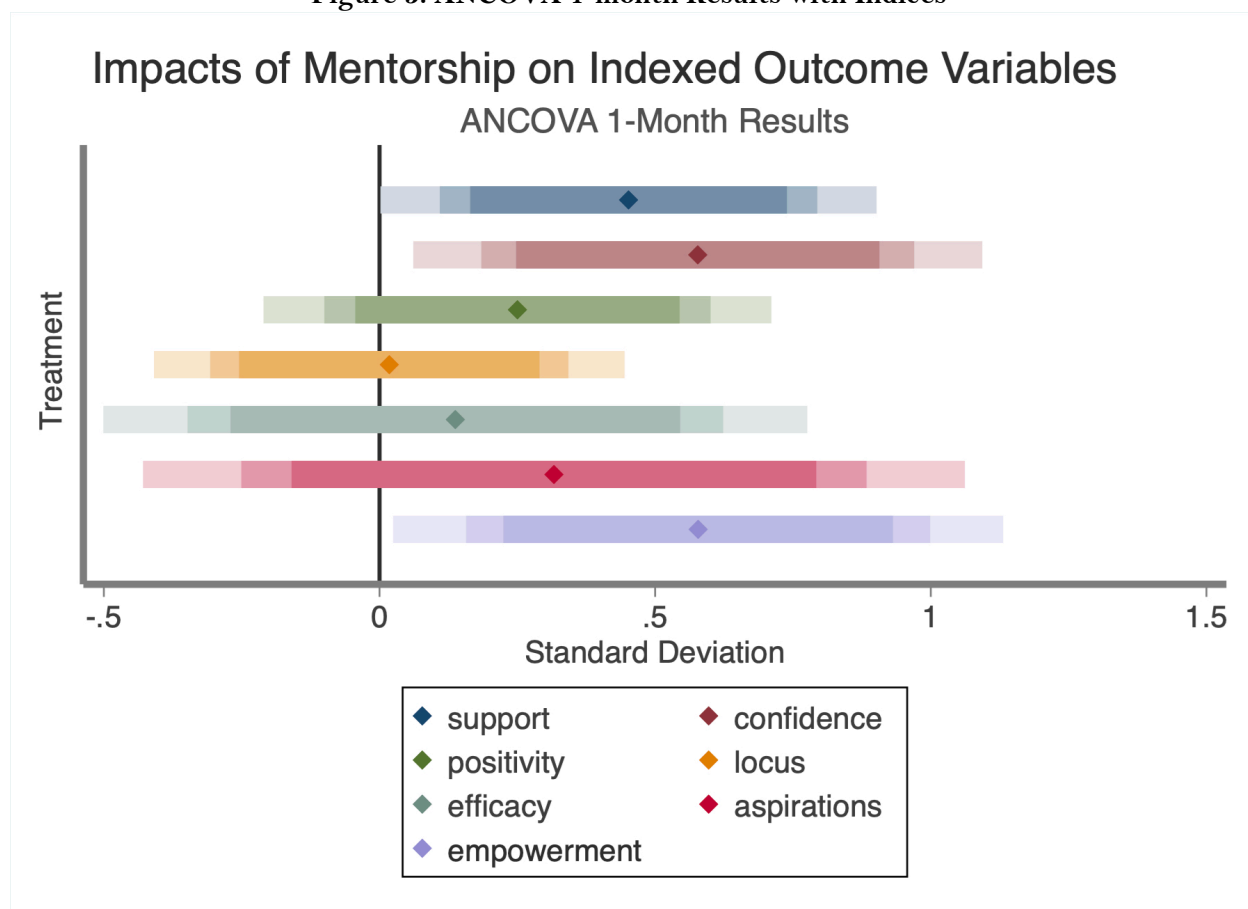




Figure 4: ANCOVA 6-month Results with Indices

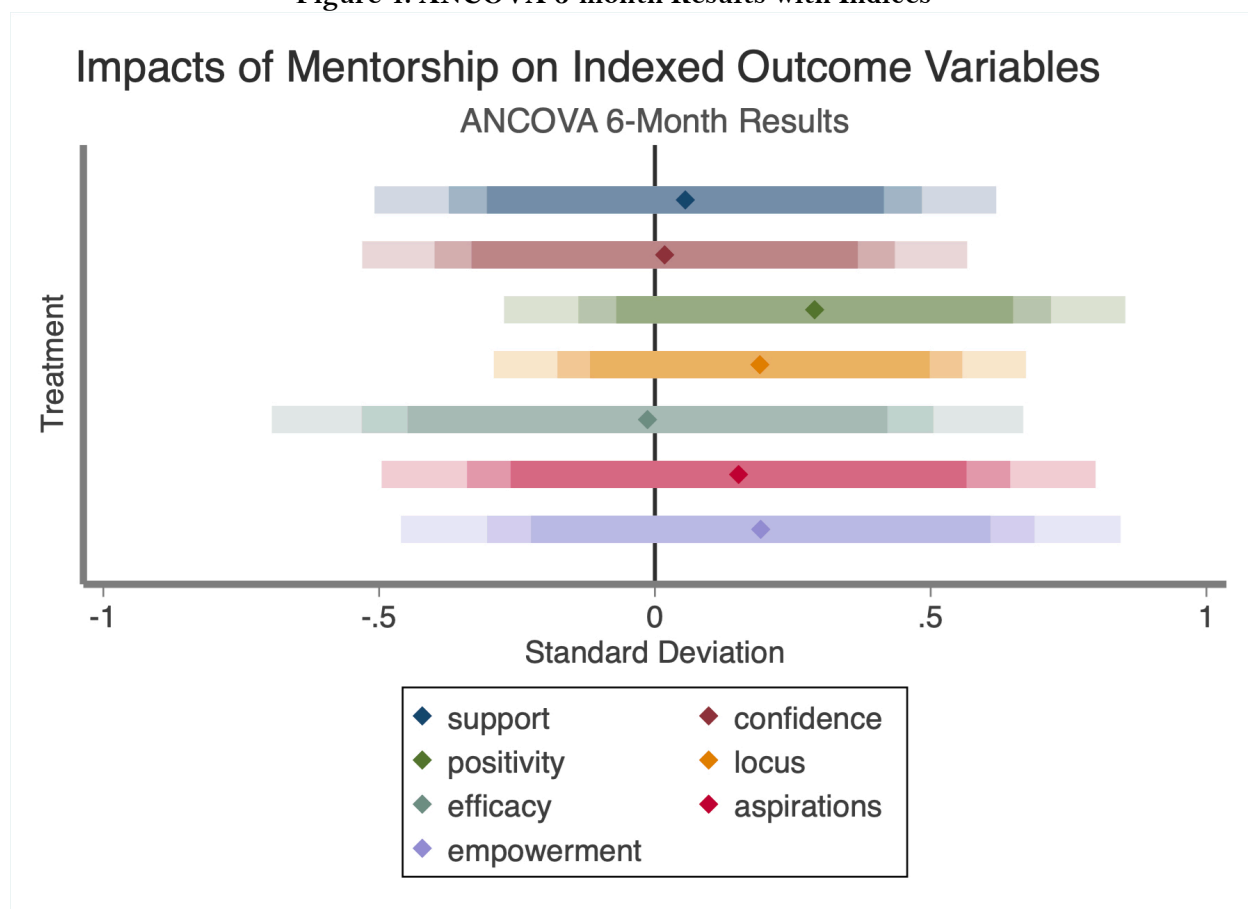


Figure 5: Scatterplot of Difference in Profits and Mentor-group

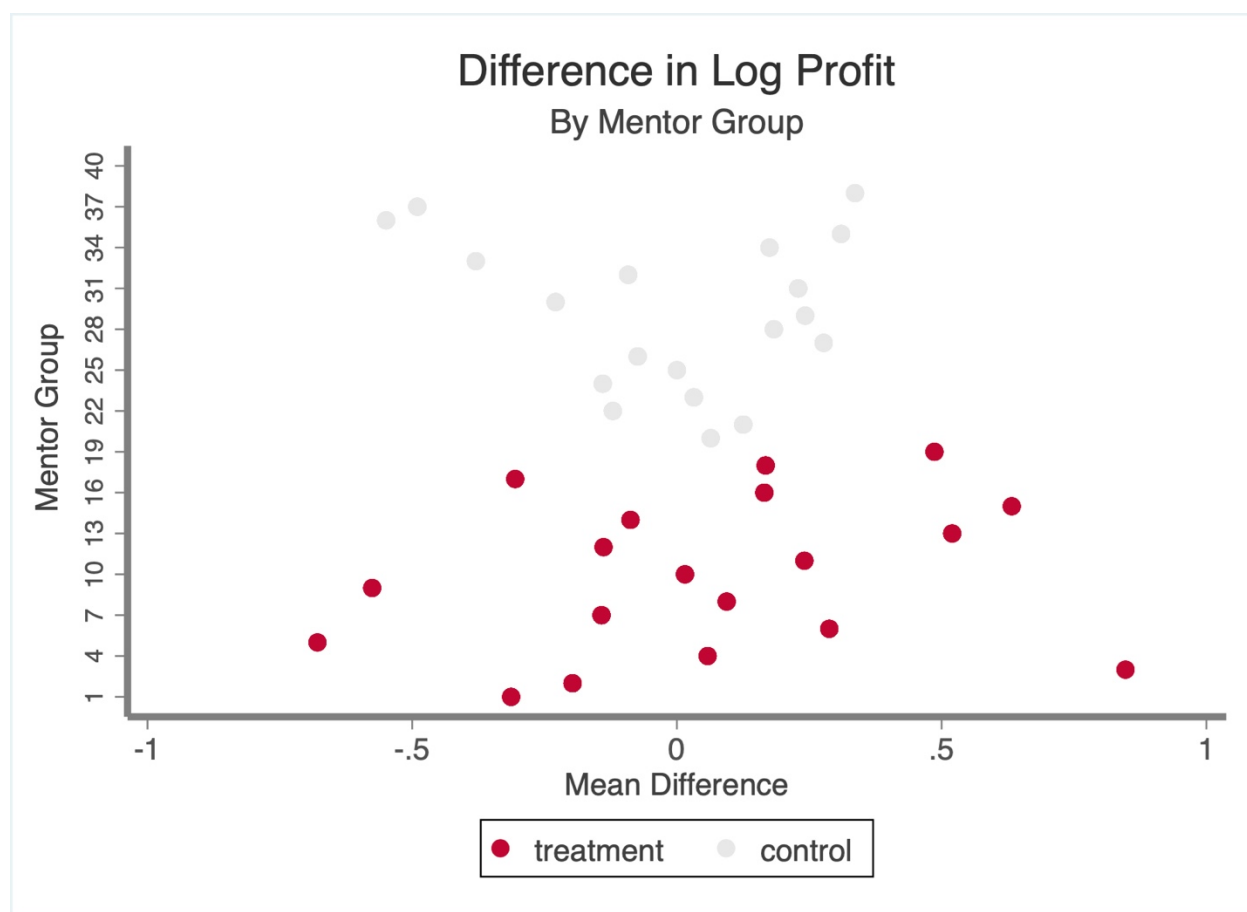


Figure 6: Scatterplot of Mentor Quality Index by Group

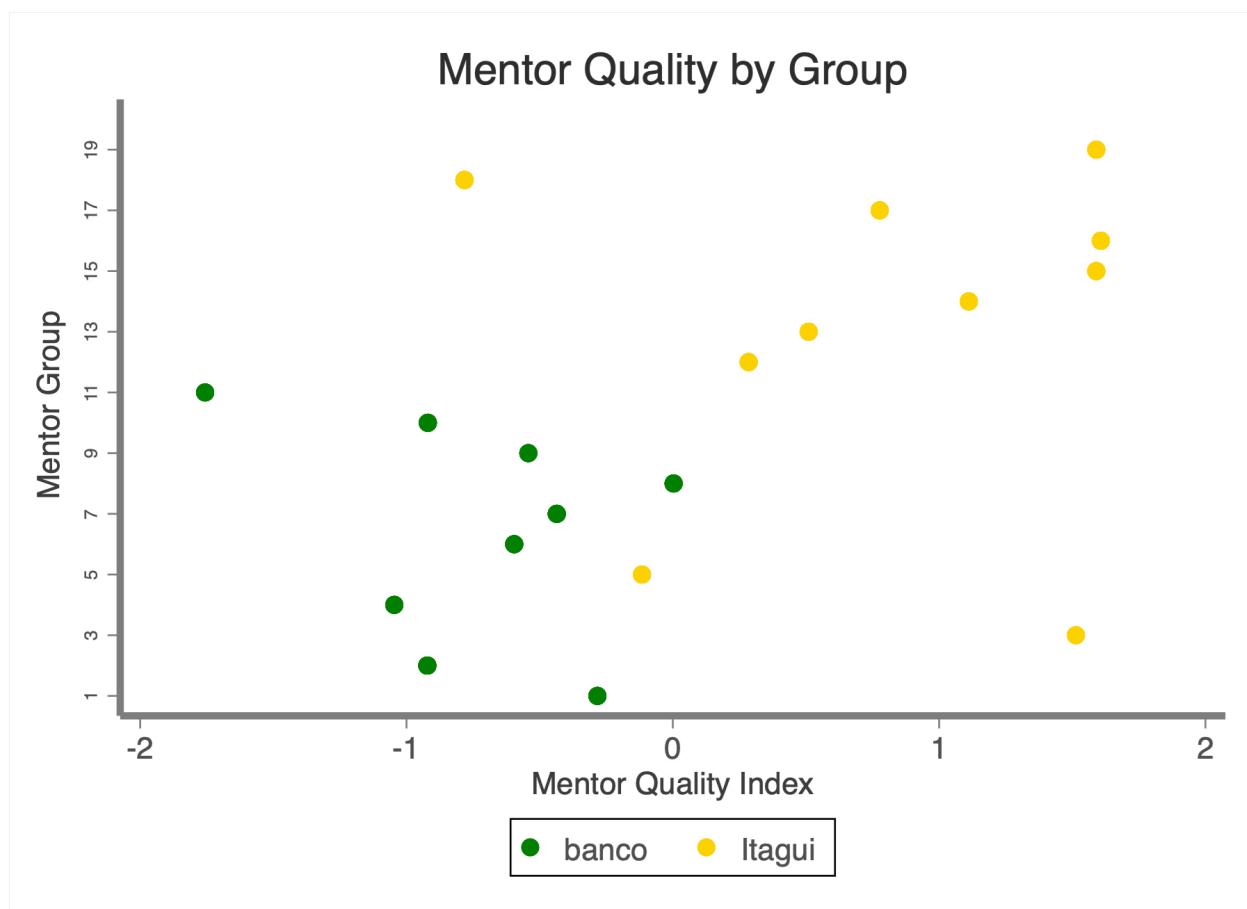


Figure 7: Scatterplot of Itagui Mentor Quality Index and Revenue

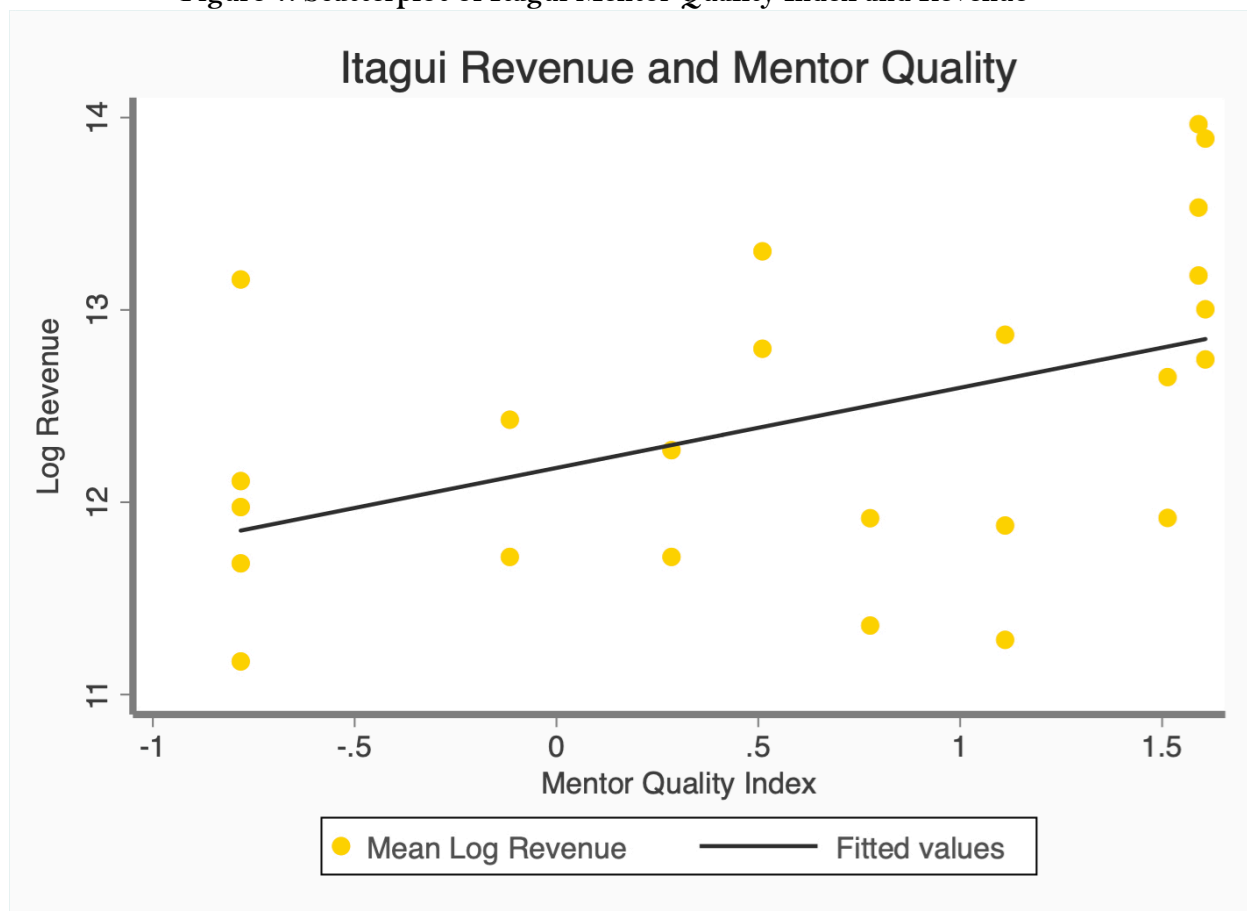


Figure 8: Scatterplot of Itagui Mentor Quality Index and Profit

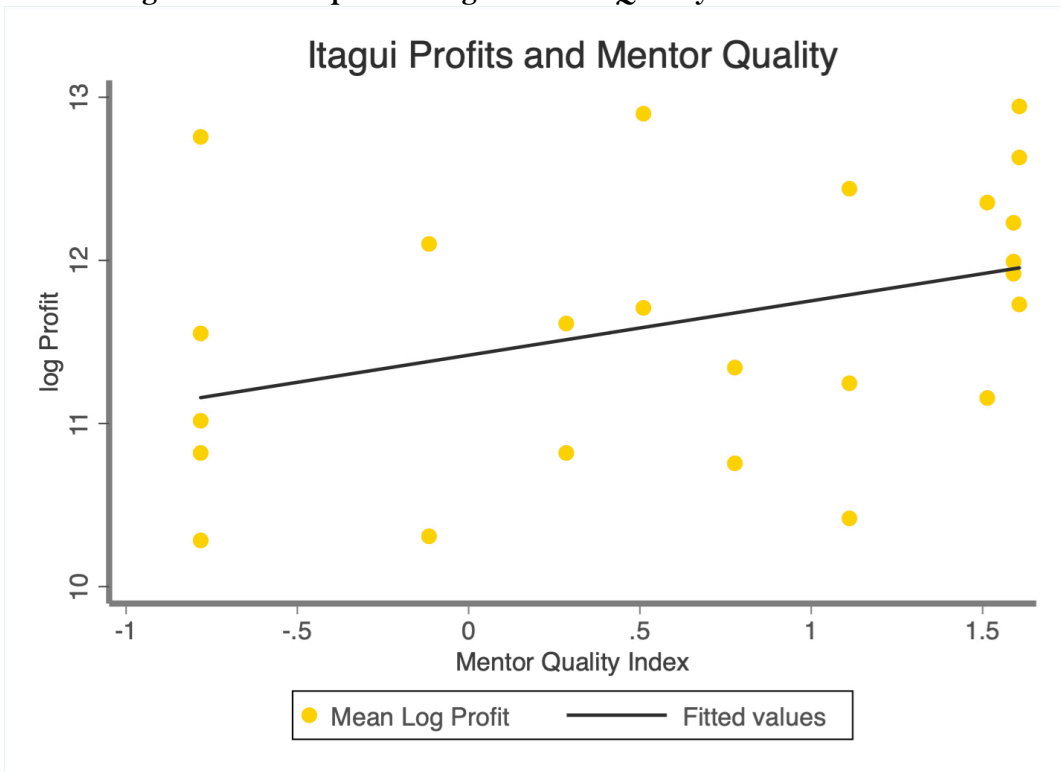
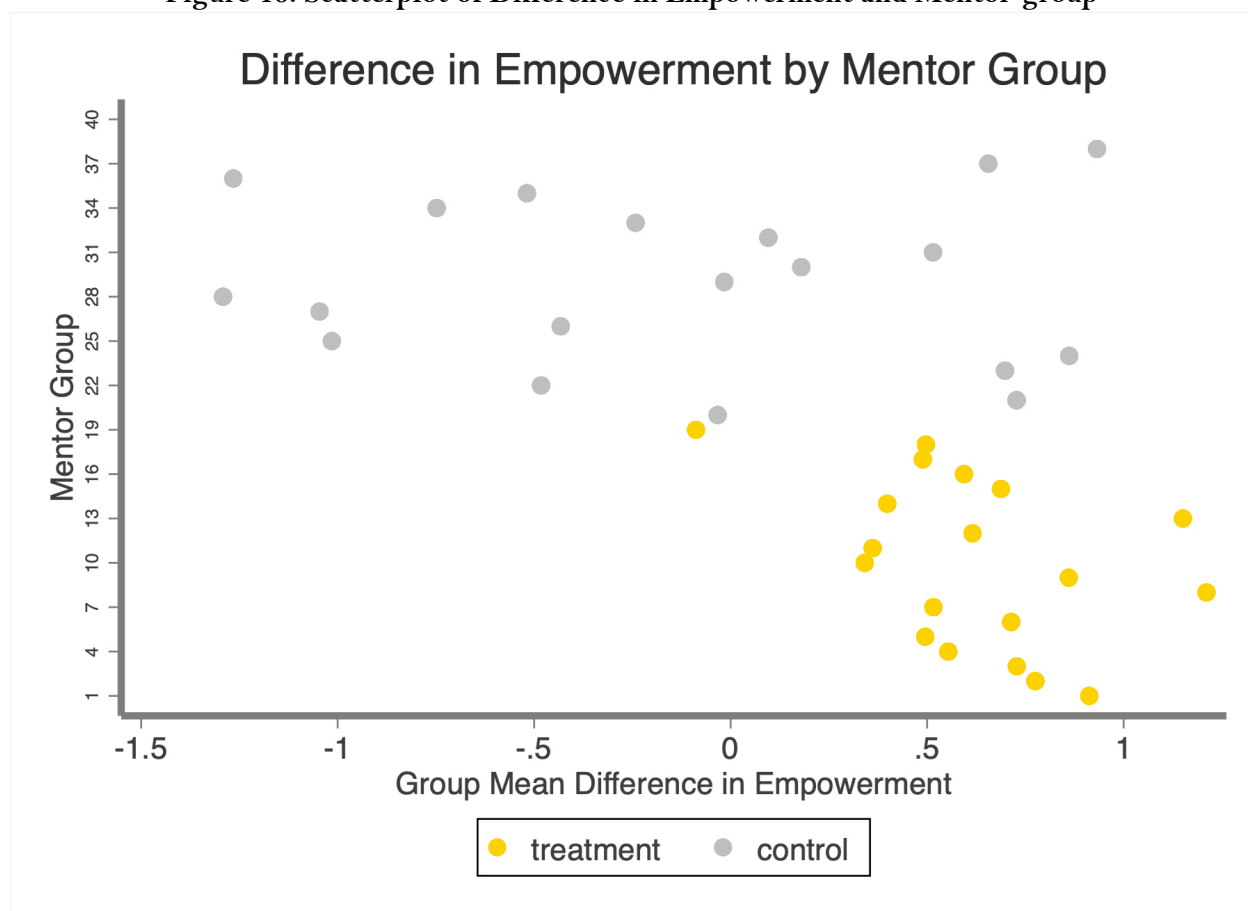


Figure 9: Scatterplot of Itagui Mentor Quality Index and Empowerment



Figure 10: Scatterplot of Difference in Empowerment and Mentor-group



**Table 5: Mediation Analysis Regression with Robust SE**

	Profit	Revenue	Empowerment	Support	Self Confidence	Aspirations
Mentor Quality Index	0.32* (0.18)	0.40*** (0.12)	0.11 (0.18)	0.11 (0.13)	0.08 (0.11)	0.19 (0.16)
Banco	0.48 (0.42)	0.45 (0.29)	0.33 (0.35)	0.61** (0.30)	0.21 (0.32)	0.40 (0.29)
Strata	-0.16 (0.18)	-0.32** (0.14)	0.04 (0.16)	0.12 (0.16)	0.05 (0.16)	0.01 (0.15)
_cons	8.92*** (0.97)	8.57*** (1.36)	0.24 (0.42)	-0.06 (0.45)	-0.05 (0.42)	0.06 (0.37)
N	70	74	81	81	81	81

All values rounded to the second decimal place. Robust standard errors are used.

\* p<.10    \*\* p<.05    \*\*\* p<.01