DOCTORAL THESIS

ESSAYS ON ENTREPRENEURSHIP IN ECUADOR: ASSESSING NON-PECUNIARY EFFECTS OF ACCESS TO CREDIT FOR HETEROGENEOUS ENTREPRENEURS

Cristina Nataly Cadena Palacios

INSTITUTO UNIVERSITARIO DE ESTUDOS E DESENVOLVEMENTO DE GALICIA (IDEGA)

SANTIAGO DE COMPOSTELA
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Ser autora da presente tese titulada "Essays on Entrepreneurship in Ecuador: Assessing non-pecuniary effects of access to credit for heterogeneous entrepreneurs", dirixida polos Doutores Manuel Fernández Grela e Georgina Mercedes Gómez, e que é presentada para optar ao grao de Doutora pola Universidade de Santiago de Compostela

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Como Directores da Tese de Doutoramento titulada

"Essays on Entrepreneurship in Ecuador: Assessing non-pecuniary effects of access to credit for heterogeneous entrepreneurs"

Presentada por Dna. Cristina Nataly Cadena Palacios,

Alumna do Programa de Doutoramento en Desenvolvemento Rexional e Integración Económica.

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ACKNOWLEDGMENTS

IN SPANISH

Se suponía que sería una corta estancia, solo un 'par de años' me dije cuando empecé el Máster en 2009 y así, más de siete años han pasado desde que llegué por primera vez a Galicia. A pesar de que nunca logré acostumbrarme al clima de Santiago, reconozco humildemente muchas características y virtudes de la Cultura Gallega que ahora forman parte de quién soy y que definitivamente extrañaré en la distancia.

Algunos años atrás, una buena amiga me dijo 'el doctorado es un camino muy solitario', y a pesar de que en muchos aspectos lo es, ahora que debo regresar en el tiempo y pensar en todas aquellas personas que me han acompañado durante todos estos años, debo reconocer que no ha sido tan solitario después de todo.

Mi gran y profundo agradecimiento a mi director de tesis, Manuel. A pesar de que venimos de dos mundos diferentes y tenemos perspectivas muy distintas sobre múltiples cosas, siempre ha estado dispuesto para soportar mi pensamiento divergente y disperso, mis momentos de pánico y mis largos (muy largos) correos y conversaciones. No me pude convertir en una persona neutral como en algún momento me sugirió, pero he aprendido a ser muy crítica, algo por lo que estaré siempre agradecida. Espero que, con el tiempo, pueda recuperarse de ser mi director y decida visitar Ecuador para reconocer alguna que otra locura que le he venido contado durante todos estos años.

A Georgina, quien me dio la oportunidad incluso sin conocerme, de realizar la estancia internacional en el *International Institute of Social Studies*, ser mi co-directora y permitirme descubrir nuevos horizontes en Holanda. Esa experiencia ha cambiado mi vida profesional y personalmente. Sus palabras de aliento siempre llegaron cuando más lo necesité y a pesar de no ser su estudiante directa, siempre me hizo sentir como parte de un equipo. Espero poder seguir trabajando con ella en aquello que todavía tenemos pendiente.

A mi grupo de investigación que me ha apoyado y colaborado para asistir a congresos y conferencias nacionales e internacionales. A mis profesores y compañeros del IDEGA: Melchor, Lola, Loli, Maribel, Nando, Diana, Alba y Harold, y a todos aquellos que a pesar de que ya no están ahí, compartimos camino durante esta travesía: André, Aizhan, Akmaral, Manuel, Salomat y Yolanda. Todos sus comentarios y sugerencias han enriquecido mi trabajo durante este tiempo.

Nunca hubiese considerado realizar un PhD si no fuese por la beca y financiamiento parcial de Secretaría de Educación Superior, Ciencia, Tecnología e Innovación (SENESCYT) ni el auspicio de Corporación Nacional de Finanzas Populares y Solidaras (CONAFIPS). Espero que con el tiempo realizar un doctorado pueda ser considerado como otro trabajo de investigación, y no un privilegio/sacrificio como lo es hasta ahora.

Ser investigadora, o al menos intentarlo, es un reto en cualquier parte, pero es particularmente difícil en países donde la información no se encuentra disponible y es necesario realizar muchos convenios de colaboración para tener acceso a ella. Mi gratitud a Red Financiera Rural (RFR), Cooperativa de Ahorro y Crédito Mujeres Unidas (CACMU) y la Universidad de Otavalo, que estuvieron dispuestos a participar en ésta investigación. En particular a Jessica Herrera y Javier Vaca de RFR, al Consejo de Administración, Gerente y a funcionarios de la Cooperativa CACMU (Janett, Jaime, Jeaneth, Silvia, Hipatia, Verónica, Romel, y tantos otros que no podría nombrar aquí), a los estudiantes universitarios y a todos aquellos microempresarios y microempresarias que participaron anónimamente e hicieron posible el trabajo de campo. Hemos logrado recoger mucha información, alguna utilizada en ésta investigación y otra que forma parte de mi lista de 'tareas pendientes' que espero poder realizar en el futuro.

Gracias a mis amigos y amigas de todos los lugares en los que he vivido. A Pamela, mi 'mejor amiga del final', quién siempre supo estar ahí y saber cómo me encontraba incluso cuando pasábamos periodos muy largos sin conversar. A tantos buenos amigos: Mari Carmen, Luisa, Iria, Irene, María Gabriela, Sue, Antonio, María Cristina, Nathaly, Lorena, Zoraida, Tania, Gaby, Marina y Sarah con quiénes he logrado mantener la amistad a pesar de mis constantes idas y venidas. A mis 'compañeros' de salsa: Isa, Soraya, Esther, Cristina, Ebel, Andrés y Raquel, con quiénes compartí el mismo estrés de ser doctoranda o ser amiga de doctorandos que creo en ocasiones incluso fue peor.

Finalmente, mil gracias a mi familia, ustedes me han enseñado que incluso en los momentos más duros y tristes permanecemos juntos, nos levantamos y seguimos viviendo sin importar lo duro que ha sido y sigue siendo. Todo lo que he logrado hacer y quién soy se los debo a ustedes. Las lecciones más importantes, difíciles y profundas las he aprendido junto a ustedes. No había necesidad de ningún estudio para saber que mi felicidad proviene de tenerlos junto a mí. Su apoyo constante y su ejemplo de trabajo tesonero han sido mi aliciente para terminar esta tesis, especialmente cuando pensé en darme por vencida. Todos los sacrificios que hemos realizado para terminar esta tesis han llegado a su fin.

En resumen, durante todos estos años puedo decir que he aprendido mucho, he hecho muy buenas amistadas y he descubierto nuevos lugares y mundos, pero también he perdido demasiado. Solo el tiempo podrá decir si ha valido la pena o no. Mientras tanto, ahora que emprendo un nuevo viaje y con algo de '*morriña'* puedo finalmente decir: '*marcho que teño que marchar'*.

IN ENGLISH

It was supposed to be a 'short' time, only a 'couple of years' I said to myself when I started my master in 2009 and so, more than seven years have passed since I first arrived to Galicia. Even though I was never able to get used to the climate of Santiago, I humbly recognize some many good characteristics of the Galician Culture that are now part of who I am and I will miss thousands of kilometers away from here.

A few years ago, a good friend of mine told me that doing a PhD was a lonely journey and although in some way it is, when I go back and look for all the people that I must be grateful during all these years I came to realized that maybe it was not so 'lonely' after all.

My deepest appreciation to Manuel, although we came from two different worlds and have different perspectives about many things, he was always willing to listen to me and pull up with all my mind-wondering, my 'panic moments' and long (very long) e-mails and conversations. I could not become neutral as he once suggested but I learned to be more critical and I will always be grateful for that. I hope that over time, he would 'recover' from being my supervisor and maybe will be willing to visit Ecuador to recognize all the crazy things I have said during all these years.

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To my research group who gave me support and allow me to attend to conferences and present the results of my research nationally and internationally. People from IDEGA: Melchor, Lola, Loli, Maribel, Nando, Diana and Alba and to those who are not there anymore but shared several paths during this time: André, Aizhan, Akmaral, Manuel, Iria, Salomat and Yolanda all your comments and suggestions have enriched my work during these long years.

I have never considered doing a PhD if it were not for the scholarship and partial funding of *Secretaría de Educación Superior, Ciencia, Tecnología e Innovación (SENESCYT)* and the sponsorship of *Corporación Nacional de Finanzas Populares y Solidaras (CONAFIPS)*. I hope that eventually pursuing a PhD can be considered as another research job in Ecuador and not a privilege/sacrifice as it is right now.

To be a researcher, or at least 'trying' to be one is quite challenging everywhere but it is particularly difficult when data is not always available and you have to find a way to have access to it. My gratitude to *Red Financiera Rural (RFR), Cooperativa de Ahorro y Crédito Mujeres Unidas (CACMU)* and

University of Otavalo. I also wish to convey my special thanks to the Board of directors, the manager and all staff members of CACMU (Janett, Jaime, Jeaneth, Silvia, Hipatia, Verónica, Romel, and so many others that I cannot even name here), to the students of Universidad de Otavalo and all anonymous entrepreneurs that collaborated to made fieldwork possible. We have managed to collect interesting data that aims to provide insights about entrepreneurship and access to credit, some of them used in this thesis and other that I include in my 'to do list' for further research.

To my friends everywhere, my oldest friend of all Pame who always knew how I was without even talking to each other. To my very good friends: Mari Carmen, Luisa, Iria, Irene, María Gabriela, Sue Antonio, María Cristina, Nathaly, Lorena, Zoraida, Tania, Gaby, Marina and Sarah, we manage to stay friends even with all the coming and going from one place to another. To my 'salsa-mates': Isa, Soraya, Esther, Cristina, Ebel, Andrés and Raquel who share the same stress of being PhD students or friends of them which sometimes I think was even worse.

Finally, to my family, they have thought to me that even in the sad and darkest moments we stay together, stand up and keep living, no matter how hard it is. Everything that I have done and who I am is thanks to you. The hardest, deepest and best lesions I have learned it from you. There was not need of any research to make me realized that my happiness comes from having you around, holding my back every step of the way specially when I thought I could not do it and almost gave up. All the sacrifices that we have made to finish this thesis have finally come to an end.

Looking back during all these years I can say that I have learned a lot, made very good friends and discovered new places and worlds, but I have also lost too much. Only time would tell if it was worth it or not. Until then, a new journey begins and with little "*morriña*" I can finally say: "*marcho que teño que marchar*".

In loving memory of my brother Jaime Andrés

"I've seen fire and I've seen rain
I've seen sunny days that I thought would never end
I've seen lonely times when I could not find a friend
But I always thought that I'd see you again"

- James Taylor -

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Essays on entrepreneurship in Ecuador: Assessing non-pecuniary effects of access to credit for heterogeneous entrepreneurs

RESUMO

O obxectivo desta investigación é prover evidencia empírica sobre a heteroxeneidade dos emprendemento e explorar en maior profundidade o concepto multidimensional de emprendemento en Ecuador. A tese inclúe catro capítulos empíricos como punto de partida para futuras investigacións no país. No primeiro capítulo proponse un marco empírico para probar a heteroxeneidade das empresas e atópase que as microempresas no Ecuador son altamente heteroxéneas e difiren principalmente na capacidade para xerar ingresos, o sector económico de actividade e a porcentaxe de empregados remunerados. No segundo capítulo explórase a posibilidade de *mission-drift* entre obxectivos sociais e financeiros das institucións de microfinanzas no Ecuador e evidénciase que as Cooperativas de Aforro e Crédito cambiaron de mercados enfocándose en mercados máis rendibles, as Organizacións non Gobernamentais teñen os mellores niveis de eficiencia pero a sustentabilidade non está garantida e os Bancos a pesar de ser os principais provedores de servizos financeiros non son os máis rendibles. O terceiro capítulo explora as diferenzas de xénero na toma de decisións na interface do traballo e a familia. Os nosos resultados suxiren que tanto homes e mulleres que posúen unha microempresa toman decisións autónomas e son máis propensos a compartir decisións sobre os recursos de asignación de fogares, pero as diferenzas de xénero aparecen na toma de decisións sobre a maternidade e a crianza dos fillos. Finalmente, o cuarto capítulo inclúe a estimación do efecto do microcrédito na satisfacción dos empresarios e empresarias en Ecuador e atópase que no contexto da exclusión financeira ter acceso a un crédito ten un efecto positivo pero modesto da escala de satisfacción pero a heteroxeneidade entre mulleres empresarias enmascara os efectos dos programas de microcrédito.

PALABRAS CHAVE

Emprendemento, microfinanzas, xénero, benestar, Ecuador

RESUMEN

El objetivo de esta investigación es proveer evidencia empírica sobre la heterogeneidad de microempresas y explorar en mayor profundidad el concepto multidimensional de emprendimiento en Ecuador. La tesis incluye cuatro capítulos empíricos como punto de partida para futuras investigaciones en el país. En el primer capítulo se propone un marco empírico para probar la heterogeneidad de las empresas y se encuentra que las microempresas en el Ecuador son altamente heterogéneas y difieren principalmente en la capacidad para generar ingresos, el sector económico de actividad y el porcentaje de empleados remunerados. En el segundo capítulo se explora la posibilidad de *mission-drift* entre objetivos sociales y financieros de las instituciones de microfinanzas en el Ecuador y se evidencia que las Cooperativas de Ahorro y Crédito han cambiado de mercados enfocándose en mercados más rentables, las Organizaciones no Gubernamentales tienen los mejores niveles de eficiencia pero la sostenibilidad no está garantizada y los Bancos a pesar de ser los principales proveedores de servicios financieros no son los más rentables. El tercer capítulo explora las diferencias de género en la toma de decisiones en la interfaz del trabajo y la familia. Nuestros resultados sugieren que tanto hombres y mujeres que poseen una microempresa toman decisiones autónomas y son más propensos a compartir decisiones sobre los recursos de asignación de hogares, pero las diferencias de género aparecen en la toma de decisiones sobre la maternidad y la crianza de los hijos. Finalmente, el cuarto capítulo incluye

la estimación del efecto del microcrédito en la satisfacción de los empresarios y empresarias en Ecuador y se encuentra que en el contexto de la exclusión financiera tener acceso a un crédito tiene un efecto positivo pero modesto de la escala de satisfacción, pero la heterogeneidad entre mujeres empresarias enmascara los efectos de los programas de microcrédito.

PALABRAS CLAVE

Emprendimiento, microfinanzas, género, bienestar, Ecuador

SUMMARY

This thesis aims to provide empirical evidence about heterogeneity among entrepreneurs and to explore more in depth the multidimensional concept of entrepreneurship in Ecuador. The thesis is structure in four empirical chapters from different perspective as starting point for further research in the country. Chapter I provides an empirical framework to explore heterogeneity among enterprises and shows that microenterprises in Ecuador are highly heterogeneous and differs mainly on its capacity to generate monthly income to satisfy their basic needs, the sector of economic activity and percentage of paid employees. Chapter II explore the presence of mission-drift and trade-offs between social and financial performance. The results of this chapter show that in a context of maximum interest rates and regulatory changes, Cooperatives and Credit Unions have moved up-market to segments that are more profitable, Non-profit Organization are more efficient in terms of outreach but sustainability is not ensure and Banks even though are the major providers of financial services are not the most efficient ones. Chapter III explores gender differences among female and male entrepreneurs in the work-family interface. This chapter shows that female and male entrepreneurs make mostly autonomous entrepreneurial decision-making and are more likely to share decisions about household allocation resources but gender differences appear in decision-making over childbearing and child-rearing. Finally, Chapter IV includes the effect of access to credit over the satisfaction with life of entrepreneurs. The main result of this chapter is that in the context of financial exclusion having access to a credit has a positive but modest effect of the life satisfaction of entrepreneurs but the effect is greater for male than for female entrepreneurs. Even more startling, is shown heterogeneity among female entrepreneurs mask the effects of microcredit programs.

KEYWORDS

Entrepreneurship, microfinance, gender, wellbeing, Ecuador

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ABBREVIATIONS

ATE	Average treatment effect
ATT	Average treatment effect on the treated
BEDE	Banco de Desarrollo del Ecuador
BEV	Banco Ecuatoriano de la Vivienda
BIC	Bayesian Information Criterion
BNF	Banco Nacional de Fomento
CACMU	Cooperativa de Ahorro y Crédito Mujeres Unidas - Tantanakushka Warmikunapac
CAN	Comunidad Andina de Naciones
CENEC	Censo Nacional Económico
CFA	Confirmatory factor analysis
CFI	Comparative Fit Index
CFN	Corporación Financiera Nacional
CRS	Constant returns to scale
CUC	Cooperative and Credit Unions
DEA	Data Envelopment Analysis
ECLAC	Economic Commission for Latin American and the Caribbean
EM	Expectation Maximization algorithm
ESS	Effective sample size after weighting
FIML	Full Information Maximum Likelihood
GBM	Gradient Boosting Models
GEM	Global Entrepreneurship Monitor
GLP	Gross loan portfolio
GNI	Gross National Income
GOF	Goodness-of-fit
ICT	Information and Communication Technology
IMR	Inverse Mills Ratio
INEC	Instituto Nacional de Estadísticas y Censos del Ecuador
INSS	Intendencia Nacional de Seguridad Social
IQR	Interquartile range
KMO	Kaiser-Meyer-Olkin
MENA	Middle East and North Africa region
MFI	Microfinance Institution
MIMIC	Multiple Indicator Multiple Cause Model
MIX	Microfinance Information eXchange
MLM	Maximum likelihood estimation with robust standard errors
NBFI	Non-bank financial institution

NGO	Non-governmental organization
OLS	Ordinary least squares
PSA	Propensity Score Analysis
PSW	Propensity Score Weighting
RCT	Randomized controlled trial
RFD	Red de Instituciones Financieras de Desarrollo
RFR	Red Financiera Rural
RMSEA	Root Mean Square Error of Approximation
ROSCAS	Rotating savings and credit association
SEM	Structural Equation Modeling
SEPS	Superintendencia de Economía Popular y Solidaria
SMD	Standardized Mean Difference
SRMR	Standardized Root Mean Square Residual
SWLS	Satisfaction With Life Scale
TLI	Tucker-Lewis Index
VRS	Variable returns to scale
WFI	Work-family interface
WLSMV	Robust Weighted Least Square

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INTRODUCTION

There is an extensive literature considering the evidence about the existence of a positive relationship between entrepreneurship and development in developed countries. On the contrary, in developing countries, there are many questions about whether entrepreneurship can bring about structural changes generating employment, income and growth. What can be found in the literature about developing countries are, on the one hand, an approach that understands entrepreneurship under a single homogenized profile of the entrepreneur and concludes that, on average, enterprises tend to be small-size, concentrated in saturated markets with low levels of productivity and little or no potential for employment generation (Bloom et al., 2010; CAF, 2011; Bateman, 2013). On the other hand, the approach that links entrepreneurship with the Informal Economy, argues that entrepreneurship in developing countries is characterized by a high degree of heterogeneity in terms of performance, legal status, type of activities, socioeconomic characteristics and personality traits of the owner (International Labour Office, 1972; Rogerson & Beavon, 1980; Mead & Morrisson, 1996; Mead & Liedholm, 1998; Boston & Boston, 2007; Chen, 2012). Hence, the 'average' profile of the entrepreneur may conceal the positive relationship between entrepreneurship and development.

The presence of homogeneity or heterogeneity in the entrepreneurial sector is relevant for entrepreneurship policy since it results in two completely different types of policy interventions. If there is only one type of entrepreneur, standardized policies could enhance the promotion and growth of the enterprises, while under the presence of heterogeneity, 'one size may not fit all' and it would be necessary to explore the characteristics and specific needs of the different types of enterprises to better target the design, implementation and evaluation of policies to promote entrepreneurship.

While exploring entrepreneurship in developing countries is of a great importance, the required national-level data are difficult to access or are entirely absent. Indeed, what has been observed so far is that enterprises are concentrated at both extremes and are either very small (microenterprises) or very large. The absence of small and medium enterprises was first described by Biggs & Oppenheim (1986) and is known as the "*missing middle"* problem that limits the growth and the job creation potential of entrepreneurship. This "*distributional anomaly"* in terms of Farbman & Lessik (1989) may be explained either by entry barriers and

the monopolistic behavior of large enterprises or because of the effects of certain inadequate policy interventions, market access restrictions, and specific characteristics of the entrepreneurs that encourage small enterprises to remain small even though they have growth potential.

In this thesis, we focus on the analysis of the 'very' small enterprises usually known as microenterprises, using Ecuador as an illustrative case. Ecuador is an interesting case of study to explore entrepreneurship and heterogeneity among microenterprises for several reasons. Information from the Global Entrepreneurship Monitor (GEM) for more than 60 countries around the world shows that Ecuador has among the highest rates of total business activity in the early stages and established business ownership categories (Kelley et al., 2016). Moreover, after thirty years without a National Economic Census,[1] in 2012 the National Bureau of Statistics of Ecuador (*Instituto Nacional de Estadísiticas y Censos del Ecuador*) released comprehensive statistics about business establishments and activities in the country. In the first phase, the Economic Census included data at a national level about all economic establishments, legal entities and self-employed units to determine their economic contribution to the national economy and to define the universe for the survey design and the implementation of in-depth follow-up questionnaires (INEC, 2010). Results from the first phase show that by the end of 2010 there were 511.130 enterprises of which microenterprises accounted for 93% of all the business in the country.

Microenterprises are defined by the Andean Community of Nations (*Comunidad Andina de Naciones*) as all economic establishments that employ less than 10 employees and have turnovers and/or annual balance sheet less than $US 100.000 per year (CAN, 2009). Although these enterprises are characterized mainly for being unipersonal enterprises with relatively low levels of productivity compared with other type of enterprises, its contribution to total income and employment creation is highly significant. In fact, microenterprises generate around 25% of total income and are the main source of employment for 44.24% of all employees in the country with women-owned microenterprises representing around 54% of all microenterprises (INEC, 2010).

This thesis aims to provide empirical evidence about heterogeneity among entrepreneurs and to explore more in depth the multidimensional concept of entrepreneurship in Ecuador.

[1] The Andean Community encouraged country members to conduct an Economic Census to improve availability and quality of existing data about basic economic statistics necessary for the design, monitoring and policy evaluation on Small-Medium Enterprises development (CAN, 2009).

This thesis is structured in four empirical chapters grouped in two main parts:

FIRST PART: provides a general description of both microenterprises and specialized microfinance institutions in the Ecuador using secondary data and includes:

Chapter I: ***"Heterogeneous microenterprises in Ecuador: Testing a typology through a model-based cluster analysis"***

This chapter includes a simple empirical framework to explore heterogeneity among enterprises through a taxonomy analysis that can be replicated in other countries using Economic Census or Enterprise Surveys. We depart from the consolidated typology described by Berner et al. (2012) that recognize the existence of two different logics and rationalities of entrepreneurs (survival and growth-oriented) and acknowledge the possibility of multiple types or sub-groups of enterprises within both logics. We aim to empirically detect the number of clusters or types of enterprises and test whether we can find the same characteristics theorized in the typology of entrepreneurs described by Berner et al. (2012). To the best of our knowledge this is the first empirical application that implements model-based clustering for exploring heterogeneity among enterprises.

Chapter II: ***"Mission-drift or specialization: Determinants of Financial and Social Efficiency of Microfinance Institutions in Ecuador"***

In chapter II, we aim to analyze the factors and determinants that influence both financial and social performance of microfinance institutions (MFIs) in Ecuador using as unit of analysis institutions members of R*ed Financiera Rural* (RFR), a national network of such institutions, to explore the possibility of detecting mission drift. Mission-drift occurs when microfinance institutions (MFIs) are forced to increase the size of their loans to increase financial margins, which means that in the long run they move upmarket and start serving less poor clients that do not belong to the traditional microfinance targets.

The methodology applied in this chapter is a second-stage Data Envelopment Analysis (DEA) to measure efficiency in terms of sustainability and outreach using a balanced panel of 34 MFIs for the period 2009-2012. This analysis differs from previous studies (Cornée, 2007; Cull, Demirgüç-Kunt, & Morduch, 2007; Flückinger & Vassiliev, 2007; Gutiérrez-Nieto, Serrano-Cinca, & Mar Molinero, 2007) in (i) its focus on the role played by the lending methodology used by the MFIs, (ii) the exploration of the relationship between efficiency scores and traditional financial performance ratios, and (iii) the consideration of the context of

maximum legal interest rates and changes in regulation that have taken place in recent years in Ecuador.

SECOND PART: explores more in depth the multidimensional concept of entrepreneurship and focus on non-pecuniary effects of access to credit using primary data.

We create a dataset from a cross-sectional survey conducted to 783 microentrepreneurs from the northern region of Ecuador in 2013. The sample includes information about two different groups: a. Randomly selected members of a local cooperative (*Cooperativa de Ahorro y Crédito Mujeres Unidas –CACMU*)[2] who have a loan considered as a treatment group, and b. Microentrepreneurs living in geographical areas near the treatment group using random walk method as the control group. For the treatment group, we used a random sample from the list of beneficiaries and restricted the population in two ways: first we gathered information about all members that had an outstanding loan (microcredit) on December 31st of 2012 and second, we distinguished between old clients that became members of CACMU until December of 2011 and new clients that became members after that date. We excluded new clients because the exposure to the program was relatively low and no inferences of access to credit could have been made. Thus, the total population consisted of 908 clients[3] (68% female and 32% male entrepreneurs) and the sample (n)[4] was stratified by sex with replacement (nl) and distributed proportionally by geographical areas[5] where CACMU have the highest incidence[6] (number of clients). The final sample included 402 entrepreneurs, 66% of them female entrepreneurs.

We defined a treatment-to-control ratio of 1:1 and interviewed the same number of female and male entrepreneurs in the geographical areas selected for the treatment group. The control group consisted on entrepreneurs that had a business for more than one year, had less than ten employees and did not have an account in any financial institution.[7] We chose two different

[2] CACMU is a female-oriented microfinance institution that target poor women and their families in the northern region of Ecuador (CACMU, 2016)

[3] Total number of outstanding microcredit loans was 2601 but only 35% passed the selection criteria.

[4] We used the formula for finite sample $n = \frac{Z^2 pqN}{Z^2 pq + Ne^2}$, where n is the required sample size, N is the population size, p and q are the population proportions (set at 0.5), z is the value that specifies the level of confidence at a 95% level (1.96), and e is sampling error.

[5] Ecuador is administratively divided in: Regions, Provinces, Cantons and Parishes.

[6] CACMU work in the northern part of Ecuador in four Provinces: Carchi, Imbabura, Esmeraldas and Pichincha but the sample was distributed by parishes.

[7] We included some questions to detect if the respondents had a credit (formal or informal) in the questionnaire. However, since we could not verify their responses with external sources (credit bureaus), we rely on the trustworthiness of respondents.

strategies depending on whether the location corresponded to urban or rural areas. In urban areas, we identified different blocks and streets within parishes to avoid concentration of respondents in the most dynamic areas (concentration of commercial activities)[8] asked in the first day whether they passed selection criteria and interviewed the selected entrepreneurs in the following day. In rural areas, such strategy was not possible because of the large distances between each village so interviews were performed on market days[9] (usually on Thursdays and Saturdays) to increase the probability of having respondents from all over each rural parish.

Fieldwork was conducted from February to June of 2013 and the questionnaires for the treatment group were implemented mainly by staff members of CACMU[10] whilst for the control group we worked in collaboration with students from a local university. We could interview only 390 people for the treatment group and 393 people for the control group, therefore, the sampling error for the total sample is 3.75% (for the women sample is 5% and for the men sample is 5.4%).[11]

Although the following two empirical chapters use the same data, they correspond to two individual and independent analyses and include:

Chapter III: "*The role of perceptions over decision-making in the work-family interface of microentrepreneurs in Ecuador*"

Drawing upon the family embeddedness perspective to entrepreneurship that assume that the business and the family are two interrelated social institutions (Aldrich & Cliff, 2003; Dyer, 2003; Loscocco, 1997; Steier, Chua, & Chrisman, 2009), we make two contributions to the literature on gender and entrepreneurship. First, we use gender as a category and provide empirical evidence on gender differences between men's and women's perceptions about decision-making in the work-family interface. We use microenterprises as unit of analysis and explore the degree of similarity/dissimilarity of eleven questions about intra-household and entrepreneurial decision-making. This initial analysis is the basis for the second contribution of this chapter, where we analyze the factors and characteristics at the individual, household,

[8] Microentrepreneurs in those areas where more likely to have access to financial services and did not passed selection criteria.
[9] Market days refer to '*días de feria*' that take place in the town centre where people from all surrounding areas come to make purchases and sell their products.
[10] In the case of the treatment group, we ensured that neither of their corresponding loan officers would ask their own clients to avoid the risk of feeling 'too close' to revel real information.
[11] We used replacement sample after three unsuccessful visits for the treatment group. However, we were unable to locate people in San Lorenzo (rural area) because their productive activity required them to be working in the 'mountain' for a longer period than the scheduled time for fieldwork.

institutional and enterprise levels that differentially influence decision-making between male and female entrepreneurs.

Chapter IV: ***"Life satisfaction of microentrepreneurs in Ecuador: The role of financial inclusion"***

This chapter focus the analysis on the effect of access to credit over the Satisfaction With Life Scale (SWLS) developed by (Diener et al., 1985) as a proxy of well-being. Assessing the effect of credit on well-being of microentrepreneurs is particularly relevant in Ecuador, a country where, only 36.7% of adults had an account at a formal financial institution (banks, credit unions and microfinance institutions) and roughly 37% of entrepreneurs reported that the lack of access to financial services is one of the main obstacles to fostering and growing their businesses (Magill & Meyer, 2005).

Our empirical analysis includes the combination of the Multiple Indicator Multiple Cause (MIMIC) model and Propensity Score Weighting (PSW) to evaluate the effects of access to credit on the satisfaction with life of microentrepreneurs. Both methodologies have been widely used in observational and quasi-experimental designs but their combined use in empirical research is rather recent. The integration of the two analyses allows to simultaneously testing the hypothesized relations between the covariates and latent variable (SWLS) while controlling for selection bias on observed variables among different treatment conditions.

In order to estimate causal effects of microcredit over subjective well-being, we first explore determinants on the SWLS using a MIMIC model to identify the covariates that we will use on the second stage for the propensity score analysis. Once we have defined the reliability and validity of the construct as well as the goodness of fit of the hypothesized model we proceed to estimate the propensity scores using the covariates from the MIMIC analysis. We use propensity score weighting (PSW) using gradient boosting models (GBM) proposed by (McCaffrey et al., 2004) for estimating of the probability of assignment. Finally, after assessing the balance properties of the scores estimated, we use the propensity scores as weights on the outcome in a multivariate analysis on treatment and covariates using again MIMIC models as suggested by (Guo & Fraser, 2014). To the best of our knowledge this is amongst the first empirical application that implements the combination of both methodologies when estimating treatment effect on subjective constructs in observational studies.

Finally, we present a chapter with the **Concluding Remarks** that includes a summary of the main results and the contribution of this thesis, as well as policy implications based on our empirical results. We also include the limitations and suggestions for future lines of research.

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PART I:
Description of microenterprise and microfinance in Ecuador

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CHAPTER I:

Heterogeneous microenterprises in Ecuador: Testing a typology through a model-based clustering analysis

1.1 INTRODUCTION

Heterogeneity among enterprises and entrepreneurs in developing countries has been widely described over the past decades, for instance within the informal sector literature.[12] Exploring entrepreneurial heterogeneity is relevant for its policy implications because the presence of multiple types of enterprises would require specialized and differentiated policies and programs to better target specific needs of each type of firm. However, despite the increasing effort to conceptually identify types of enterprises, taxonomy classifications are rather scarce. A taxonomy classification differs from a typology classification in that the former is quantitatively based while the latter is based on a conceptually developed framework over empirical observations (Hambrick, 1984; Miller & Roth, 1994).[13]

In this chapter, we propose a simple empirical framework to explore heterogeneity among enterprises through a taxonomy analysis that can be replicated in other countries using Economic Census or Enterprise Surveys. We depart from the consolidated typology described by Berner et al. (2012) that recognize the existence of two different logics and rationalities of entrepreneurs (survival and growth-oriented) and acknowledge the possibility of multiple types or sub-groups of enterprises within both logics. We aim to empirically detect the number of clusters or type of enterprises and test whether we can find the same characteristics theorized in the typology of entrepreneurs described by Berner et al. (2012).

The typology identified by Berner et al. (2012) is relevant for our analysis since it provides a more flexible framework to explore heterogeneity among enterprises. First, they go beyond a

[12] The informal sector literature about heterogeneity in entrepreneurship has evolved from the initial dual framework that identified two distinctive groups of entrepreneurs ('formal', 'growth-oriented', 'opportunity-driven' versus 'informal-proletariat', 'survivalist', 'necessity-driven') to a more dynamic and diversified analysis that acknowledges the possibility of multiple types and sub-groups besides the dual framework. See among others (International Labour Office, 1972; Rogerson & Beavon, 1980; Mead & Morrisson, 1996; Mead & Liedholm, 1998; Boston & Boston, 2007; Chen, 2012). For a revisit of the literature about the differences among entrepreneurs see Berner et al. (2012).

[13] We use the term of taxonomy analysis defined by (Sokal & Sneath, 1963) as the classification using numerical methods to identified objective groups based on common characteristics and similarities among the individuals in each group.

strict duality among entrepreneurs and recognize that the two categories are *"not directly juxtaposed"* allowing the possibility of subcategories between a dual framework. Second, the authors incorporated the informal literature into their typology but do not see the formal-informal dichotomy as the main important feature to distinguish between the two categories. In fact, they emphasized that 'purely' formal or informal enterprises are difficult to find in practice since there are a lot of informal (formal) arrangements in formal (informal) enterprises. Third, the differences among survivalist and growth-oriented entrepreneurs are not based on quantitative characteristics such as size or the number of employees. Finally, this typology of entrepreneurs is appropriate when exploring heterogeneity among microenterprises since they argue that *"survival enterprise is not a direct synonym for microenterprise"* opening the possibility of finding growth-oriented enterprises among microenterprises.

Our empirical analysis includes a taxonomy classification in two stages to test the typology of entrepreneurs. We start our taxonomy analysis using model-based clustering to classify enterprises based on their economic contribution to the national economy through value added. Model-based clustering is then used to identify heterogeneous groups without knowing a priori the number of clusters or the composition of data (Fraley & Raftery, 1998). The advantage of using model-based clustering in the first stage compared with traditional hierarchical clustering (Ward's method, linkages methods) and iterative relocation methods (k-means) is that model-based clustering relies on statistical methods to estimate the number of clusters, while the others are heuristically identified. Furthermore, model-based clustering can handle outliers and the resulting number of clusters is not set to be spherical of the same size but respect data distribution.[14] In the second stage, after we have identified the groups or segments of enterprises, we use gradient boosting models (GBM) to explore the relative influence of other characteristics of the enterprise over the cluster distribution using as dependent variable the resulting classification from the first analysis.

To the best of our knowledge this is the first empirical application that implements model-based clustering for exploring heterogeneity among enterprises. Empirical applications using model-based clustering are fairly recent and have been used more frequently in biology studies for gene expression classification and species taxonomic analysis (Yeung et al., 2001; Anderson & Thompson, 2002; Dahl, 2006; Pan, 2006; McNicholas & Murphy, 2010). More recently, it

[14] For further discussion on clustering methods and the comparison with model-based clustering see (Zhong & Ghosh, 2003; Fraley & Raftery, 2002; Yeung et al., 2001; Fraley & Raftery, 1998).

has also been applied in behavioral research to explore heterogeneity among individual's behavior (Mun, von Eye et al., 2008; Mun, Windle et al., 2008) and social network analysis (Handcock et al., 2007).

We focus our taxonomy analysis on microenterprises in Ecuador. Ecuador is an interesting case of study to explore heterogeneity among microenterprises. As seen in the Figure 1.1 microenterprises represent the second type of enterprises to generate income to the national economy and the first type of enterprises of employment creation. Moreover, microenterprises are those that, in comparison with other types of enterprises, concentrate the greater part of female employment. In this context, the existence of heterogeneity among microenterprises would allow to identify different types of enterprises that better target policies and programs for entrepreneurship promotion, employment creation and/or poverty alleviation.

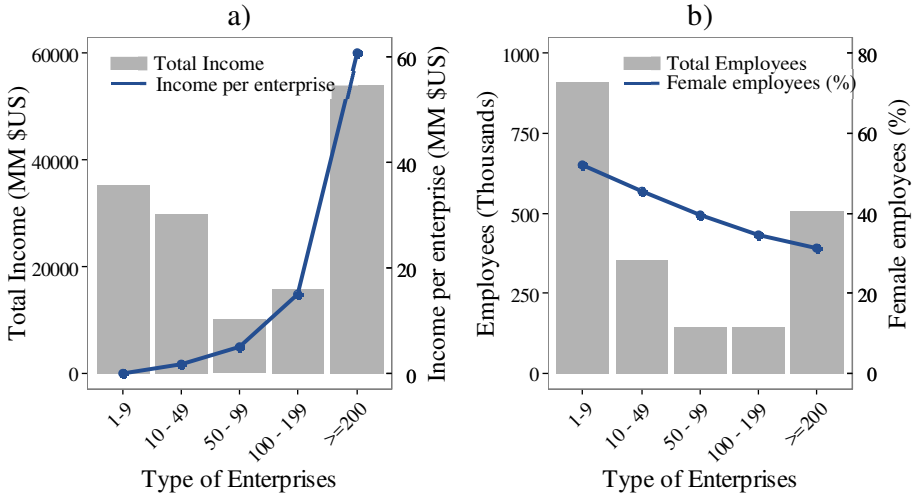

Figure 1.1 Distribution of income and employment generation by type of enterprises. Plot a) show the distribution of the income by type of enterprises and the income per enterprise where microenterprises represent the second type of enterprise of income generation. Plot b) presents the employment by type of enterprises and shows that microenterprises are the main source of employment compare with other types of enterprises, while they concentrate most of female employment. Authors' calculation based on data from National Economic Census – Phase I (2010).

Our empirical results confirm the high degree of heterogeneity among microenterprises within the two logics of entrepreneurs and the characteristics are in line of the typology of entrepreneurs described by Berner et al. (2012). The data structure shows six different segments of enterprises consistent with the two logics of entrepreneurs (survivalist and growth-oriented) using data from the second phase of the National Economic Census in Ecuador collected during

2013. Moreover, we find that the types of enterprises differ mainly on three characteristics: its capacity to generate monthly income to satisfy basic needs, the economic activity and the percentage of paid employees.

The remainder of this chapter is structured as follows. Section 1.2 presents a literature review and explains the typology of entrepreneurs defined by Berner et al., (2012) as well as a brief description of related work on taxonomy analysis of enterprises in developing countries. Section 1.3 explains in detail our empirical framework for the taxonomy analysis using model-based clustering and gradient boosting models. Section 1.4 describes the data and settings used in the empirical analysis. Section 1.5 presents the empirical results of the taxonomy analysis. Finally, section 1.6 presents the conclusions of this chapter.

1.2 LITERATURE REVIEW

As explained in the introduction of this thesis the presence of homogeneity or heterogeneity among entrepreneurs is relevant for policy implication for several reasons. If there is only one type of enterprises homogenized and standardize entrepreneurship promotion policies may be enough to ensure the growth potential of enterprises, while under the presence of heterogeneity, policymakers are forced to explore more in detail the characteristics and differences among entrepreneurs when designing, implementing and evaluating the effects of entrepreneurship promotion programs for job creation and economic growth. Therefore, it should be stressed that a single homogenized concept of the entrepreneur is not appropriate when exploring the relationship between entrepreneurship and economic growth. In fact, the analysis based on the 'average' profile of the entrepreneur described in the literature has failed to provide an accurate theoretical and empirical framework to explore the growth potential and limitations of entrepreneurship particularly when referring to microenterprises.

Exploring heterogeneity between enterprises is the first step to better understand the role of entrepreneurship for economic growth and development in developing countries. Despite the exploratory nature of this chapter and the relevance of the empirical framework proposed for the construction of theory based in the analysis of empirical data, we present in this section a brief overview of the different typologies of the entrepreneurs in developing countries that prevails within the Informal Sector literature. We emphasize that departing from the consolidated typology proposed by Berner et al. (2012) to develop an empirical framework would allow filling the gap between qualitative and quantitative characteristics to explore

heterogeneity among microenterprises. We argue that the consolidated typology described by the authors is the most flexible and suitable theoretical framework that would allow empirically showing the high degree of heterogeneity among microenterprises beyond the traditional duality prevailing in the literature. We also discussed the main characteristics of the typology chosen as the basis for our empirical proposal and conclude explaining in detail the three empirical papers that have been used to detect and test heterogeneity among enterprises in developing countries. The review of the empirical literature is relevant to compare the methodological approaches and limitations of the studies conducted so far allowing to emphasize the relevance of our empirical proposal described in Section 1.3.

1.2.1 Typology of Entrepreneurs

The literature about entrepreneurship that acknowledge the presence of heterogeneity among enterprises has evolved from the initial dual framework to a more dynamic and diversified analysis that recognized the existence of heterogeneity among entrepreneurs beyond the duality. According to Berner et al. (2012) in their important revisit of the literature on the differences among entrepreneurs in the last forty years, identified at least six types of independent conceptual categories of entrepreneurs: 'formal' versus 'informal', 'street economy' versus 'small-scale family enterprises', 'community of the poor' versus the 'intermediate sector', 'survivalist' versus 'growth-oriented', 'opportunity-driven' versus 'necessity-driven' and 'sub-subsistence' versus 'micro-accumulation' entrepreneurs. To avoid the risk of being repetitive of what has been already discussed in detail by Berner et al. (2012) in their thorough literature review about the different typologies of entrepreneurs, we provide a brief description of the typologies included in the literature but we focus only on explaining the disadvantages and limitations of previous typologies when addressing the term of microenterprises in their definitions.

The main and common limitation of the previous typologies described in the literature is that all of them explained the differences among entrepreneurs as a dichotomy under the assumption that there is a clear-cut distinction between the two identified categories in each typology. Starting with the description of the 'formal' versus 'informal' sectors by the International Labour Office (ILO) in (1972), the term has been widely used to explain the differences in employment in developing economies. This first definition included by the ILO fails to make specific mention of microenterprises in either category. Instead, the categorization

includes activities that belong to what they identified as informal or formal sector. Hence, the informal activities are mainly concentrated in markets that are ease to entry, depends on the use of local resources, includes family enterprises, labor-intensive activities that require low level of skills that are usually acquired outside the "formal" educational, are unregulated and highly competitive markets. On the contrary, the formal sector includes activities that are directly opposed to the ones defined as informal activities. It is worth notice that even though the report introduced the formal-informal dichotomy they recognized the existence of important linkages between them. However, the following literature use them as separated instead of interrelated sectors.

The following typology was introduced by Friedmann & Sullivan (1974) in their analysis of urban workers. The authors identified the 'street economy' consisting on mainly self-employed workers that are concentrated in non-specialized sectors and usually operates in the informality. The second category identified referred to the 'small-scale family enterprise' that have higher organization than the ones in the 'street economies', are able to employ both wage and unpaid family workers and are usually concentrated in the production of traditional commodities. In this typology, the author does not make any direct mention of microenterprises but since they include from one to nine employees we can expect that microenterprises would follow in either category. In the same vain, the typology described by House (1984) and House et al. (1993) does not identified microenterprises directly in either type: the 'community of the poor' and the 'intermediate sector'. However, they refer to the community of the poor as all those self-employed individuals that use entrepreneurial activities as an entry point while looking for a permanent job in the formal sector. Thus, have low growth potential and their sustainability is not ensured. On the contrary, the 'intermediate sector' includes more dynamic enterprises that seek for a more permanent way of generating income in the long-run and usually involved the whole family member in their enterprise.

The next group of typologies share some characteristics: they include the gender as an important and the reason to start a business as the main characteristics that differentiates entrepreneurs. Rogerson & Beavon (1980) were the first to introduce the gender perspective as an important characteristic that differentiate between 'survivalist enterprises' and 'microenterprises'. The first group are mainly run by women that use entrepreneurship to secure a 'regular' wage or to "*access to an economic sector of their choice*". These entrepreneurs fall short or even to generate a minimum standard income with little capital and

skills requirement that limits their growth potential. Whereas, microenterprises are considered as a synonym of growth-oriented enterprises that include very small enterprises, often self-employed and rely on family members but usually lacks many sort of formality but have the potential to graduate and become larger enterprises.[15]

Tellegen (1997) also describe the typology of entrepreneurs based on the motivation to start a business. The author distinguishes between 'necessity-driven' and 'opportunity-driven' entrepreneurs. Necessity-driven entrepreneurs as well as the group of survivalists describe by Rogerson & Beavon (1980) start a business to satisfy at least part of the basic needs of their household. Whereas, the opportunity-driven start their business seeking to growth as wells as satisfying the basic need of their households. In this typology, there is no mention of the microenterprises directly liked to any of the two groups identified in the typology. In similar fashion, Mead (1994) and Mead & Liedholm (1998) identified that the engagement in small enterprises as a survival strategy (mainly for women) until something else (preferably a paid work) is available to them. The authors argue that that is probably why women engage in entrepreneurial activities and identify this entrepreneurship as 'supply-driven'. On the contrary, entrepreneurship may also emerge to respond to market opportunities therefore consider as 'demand-driven'.

Finally, Portes & Hoffman (2003) defined a new typology based on the analysis of informal economy in Latin American countries. The authors identified between the 'petty bourgeoise' and the 'informal proletariat'. The former group refers all microenterprises that have less than five employees, are self-employed with professional and technical training. This group use entrepreneurship as a "*refugee for professionals and skill workers displaced from the formal sector employment"*. While the latter is defined as a 'residual' of the first group and includes all self-employees (excluding professionals and technicians) and includes all the unpaid family workers in microenterprises, domestic servants wage workers without social security.

This brief revision of the typology of enterprises have pointed out the absence of a common theoretical framework to explore differences among entrepreneurs limiting the understanding of the logics and needs of the entrepreneurs. We share the point of view of Berner et al. (2012) that argue that the variety of typologies and different classifications of the entrepreneurs have *"fail to establish a coherent tradition and consistent, informative terminology"* that is relevant

[15] It should be stressed that according to Gomez (2008), graduation of microenterprises hardly exists and only a small number of microenterprises are able to move up to the next category to following category.

when exploring heterogeneity among microenterprises. Consequently, the authors propose a consolidated typology of entrepreneurs as an attempt to provide a clear distinctive theoretical framework about the key characteristics that differentiate entrepreneurs. In fact, they recognized the existence of two different logics and rationalities of entrepreneurs: survivalist and growth-oriented but acknowledge the possibility of multiple types and sub-groups of enterprises within both logics. Their recognition of multiple types of enterprises within the both logics is the main theoretical contribution of the authors since it is the only typology that goes beyond a traditional duality providing a more flexible framework to explore heterogeneity among enterprises. More specifically, the authors propose the two logics and rationalities of entrepreneurs based on mainly qualitative differences as shown in Table 1.1.

Table 1.1 Characteristics of survival and growth-oriented enterprises

Survival(ist)	*Growth(-oriented)*
(Street economy, community of the poor, [Microenterprise], necessity-driven, informal own-account proletariat, sub-subsistence]	[Small-scale family enterprise, intermediate sector, [Microenterprise], opportunity-driven, petty bourgeoisie, micro-accumulation
Easy of entry, low capital requirements, skills and technology	Barriers to entry
Female majority	Male majority
Maximizing security, smoothing consumption	Willingness to take risk
Part of identification strategy, often run by idle labor, with interruptions, and/or part-time	Specialization
Embedded in networks of family and kin	Embedded in business networks
Obligation to share income generated	Ability to accumulate part of the income generated

Note. Consolidated typology of entrepreneurs. Source and elaboration by Berner et al. (2012).

We now explain in detail the most relevant characteristics that differentiate enterprises in the consolidated typology summarized in table 1.1. The characteristics described in the table are the basis of the hypothesized relationship included in our empirical proposal described in section 1.3.2. First, we observed that microenterprises may be both survival(is) or growth-oriented, which opens the discussion to explore heterogeneity among microenterprises in a broader sense that is particularly relevant in the Ecuadorian context where microenterprises prevail over other types of enterprises. More interestingly, the authors did not recognize the formality as one on the mean feature that distinguishes among the two logics. Hence,

acknowledging the complexities and difficulties of identifying purely formal or informal enterprises in developing countries.

On the other hand, the authors argue that survival(ist) entrepreneurs are concentrated in sectors that are is easy of entry, with low capital requirements, skills and technology. These characteristics may help to explain the concentration of survival(is) entrepreneurs in certain sectors such as grocery stores and retail and basic manufacturing enterprises. Whereas, growth-oriented entrepreneurs may be found in more specialized sectors facing entry barriers with higher levels of capital, skills and technology requirements.

One characteristics that was described in previous typologies and that is also capture in the consolidate typology is the sex of the owner. As observed in the Table 1.1, survival(ist) entrepreneurs are characterized from being mainly run by female entrepreneurs while growth-oriented entrepreneurs by male entrepreneurs. The inclusion of the sex of the owner as a relevant characteristic between the two logics have important theoretical and policy implication. If most female entrepreneurs start their businesses under the logic of survival(ist) this may reinforce the 'under-performance' hypothesis (Du Rietz & Henrekson, 2000) that had been describe in the literature of entrepreneurship and gender. The 'under-performance' hypothesis emphasizes that female entrepreneurs have lower entrepreneurial orientation, skills and potential that may explain the lower levels of performance compared with male entrepreneurs. On the contrary, if the sex of the owner is not amongst the principal characteristics that identified entrepreneurs between the two logics, it may indicate that the gender division of labor rather than the sex of the owner is the most important factor to explain the differences in performance among male and female entrepreneurs.[16]

Following with the expositions of the characteristics describe in the typology of entrepreneurs we may observed that survival(is) entrepreneurs use their enterprise for smoothing consumption while the growth-oriented entrepreneurs are willing to take risks since they meet their basic needs and consumption requirements. Therefore, it is important to explore if survival(is) entrepreneurs may generate enough income to meet their basic needs and food requirement and the differences among growth-oriented entrepreneurs. In addition, there is the characteristic of survivalist entrepreneurs that use part-time labor while growth-oriented use

[16] We provide a widely literature review as wells as empirical evidence of the role of perceptions using gender as a category to show how the gender division of labor influence the decision-making in the work-family interface of entrepreneurs in the third chapter of the thesis. The results of the third chapter points towards a gender division of labor instead of the differences of the sex of the owner as an important characteristic to explain the differences in decision-making in the work-family interface among female and male entrepreneurs.

specialized workers that may also be reflected in the sector and type of activities of the enterprises as well as in the percentage of paid workers.

Another difference between survivalist and growth-oriented logics is the embeddedness in family networks and kind or in business networks. This characteristic may be captured by the proximity of the enterprise to their household. Linked to the previous characteristic, survivalist entrepreneurs fill the obligation to share the income generated, either through direct transfers or through hiring family members that may or may not be able to perform specialized tasks within the enterprise while growth-oriented can accumulate part of their generated income.

1.2.2 Taxonomy of enterprises

Taxonomy analyses to classify enterprises are not frequent in developing countries since representative data at a national level is not usually available.[17] Notable exceptions include the work by Cunningham & Maloney (1998), Grimm et al. (2012), and Calderon et al. (2016). Cunningham & Maloney (1998) explore heterogeneity among 11,000 Mexican microenterprises using data from the 1992 National Micro-Enterprise survey. The authors identified six different types of enterprises using factor and cluster analysis over a set of variables including characteristics of the entrepreneur, characteristics of the firm, entrepreneurial dynamics and participation in formal market and legal institutions. As explained in the introduction of this chapter the main limitation of traditional cluster analysis is the heuristic nature of the methods. Traditional cluster methods rely on the identification a priori of the number of clusters without any statistical analysis and aside the consideration of data distribution (Dasgupta & Raftery, 1998). Moreover, the distribution within each type of enterprise is set to be spherical of the same size, volume and shape, which means that each group of enterprises have roughly the same number of enterprises limiting the discriminatory power of the clusterization that is relevant when designing policies and targeting specific types of enterprises.

On the other hand, Grimm et al. (2012) used data of 6,558 enterprises from a national representative sample of seven capital cities in francophone West Africa and identified three types of enterprises: top-performers, constrained gazelles and survivalist. They empirically

[17] Taxonomy analysis have long trajectory on the manufacture sector (see, e.g. (Miller & Roth, 1994b; Frohlich & Dixon, 2001; McMahon, 2001; Andersén, 2012; Grant et al., 2013) and between small and medium enterprises (see among others, Sum et al., 2004; De Jong & Marsili, 2006; Heilbrunn et al., 2011; Swoboda & Olejnik, 2013).

defined the group of top-performers based on their size and productivity.[18] They subsequently identify the characteristics that correlate to the performance measures to predict the probability of being a top-performer and defined constrained gazelles as those entrepreneurs who have high probability of being top-performers given the observable characteristics but were not successful yet. Despite the interesting and remarkable characteristics of their empirical proposal there are two main limitations when exploring heterogeneity among enterprises. First, the authors defined the group of top-performers as the top 10% of the distribution which is an arbitrary number. Although, job creation and growth are concentrated only on few number of enterprises (Mead, 1994; Mead & Liedholm, 1998) there is no literature or strong empirical evidence the support that the 10% is an accurate cutoff to define the group of top-performers among enterprises. What would had happened if the authors would have defined the top-performers using a cutoff of 9% or 15% instead? Would their results have been different under different cutoffs in the definition of the top-performers? The answers are unknown. The second disadvantage of this approach is the characteristics identified to estimate the probability of being a top-performer depend mainly on the survey design and the data used in the analysis.

Finally, Calderon et al. (2016) provide evidence of differences among necessity and opportunity driven entrepreneurs. They used data from a survey that was a part of a randomized-controlled trial to evaluate the impacts of large business training program over 10,000 female microentrepreneurs in eight urban areas in Mexico. The authors first identified necessity from opportunity-driven entrepreneurs according to the reason to start a business and found a large heterogeneity within the group of necessity-driven entrepreneurs. They used a discriminant analysis and found that about a third of the group of necessity-driven entrepreneurs share the same observable characteristics as the opportunity-driven group. In addition, they used an instrumental variable approach to estimate causal effects of the type of entrepreneurs over profitability and management performance and confirmed that businesses run by opportunity driven entrepreneurs performed better and were better managed than the ones run by necessity driven entrepreneurs. Although, this approach solves the problem of identification of the necessity-driven versus opportunity-driven enterprises through subjective measures, the authors only consider the possibility of heterogeneity among enterprises within the dichotomy

[18] Grimm et al. (2012) define productivity based on used physical capital and generated value added. First, they selected those entrepreneurs that concentrate 25% of the physical capital and then select among them, the 40% that have the highest added value per unit of physical capital.

framework (necessity vs. opportunity-driven) through another heuristic method such as discriminant analysis.

In the three cases, the empirical analyzes is limited to specific survey data that are difficult to replicate in practice. Moreover, they show no consensus on either the number or types of enterprises or the methodology to empirically test heterogeneity. The review of empirical literature also reveals the absence of a common empirical framework, thus reinforcing the limited understanding of entrepreneurship in developing countries. In the next section, we provide an empirical framework to identify heterogeneity among microenterprises through a taxonomy analysis that may be replicated using Economic Census or Enterprise Surveys. We aim to link the consolidated typology of entrepreneurs described by Berner et al. (2012) to taxonomy analysis through model-based clustering to provide a unified framework to test heterogeneity among microenterprises.

1.3 EMPIRICAL MODEL

The estimation used in this chapter includes a taxonomy analysis for identifying heterogeneity among microenterprises in Ecuador in two stages. In the first stage, we use model-based clustering to identify the number of clusters and groups of microenterprises. Model-based clustering is a statistical method proposed by (Fraley & Raftery, 1998; Fraley & Raftery, 2002) that combines results from the hierarchical clustering into the expectation maximization (EM) algorithm to classify data based on probabilistic models where each component corresponds to a different cluster or group. In the presence of outliers, model-based clustering adds one or more components to represent a different distribution from the complete data. Compared to other classification techniques, model-based clustering involves a comparison of nested models based on different numbers of clusters that allows identifying the optimal number of partitions that best fit the distribution and composition of data (Dasgupta & Raftery, 1998). Using Bayes factors, the optimal number of clusters is chosen based on the model that maximizes the Bayesian Information Criterion (BIC).

Once we have identified different types of enterprises we compare the resulting clusters to other characteristics of the enterprise using, in a second stage, gradient boosting classification. Gradient boosting models (GBM) are a multivariate non-parametric techniques proposed by (J. Friedman et al., 2000; J. H. Friedman, 2001) that allow estimating non-linear relationship

between input variables (enterprise characteristics) and a given response variable (clusters) [19]. Based on the idea of classification and regression trees[20], GBM algorithm is an iterative process of splitting data that optimizes the predictive performance information until convergence is achieved. GBM allows exploring the relative influence of the most relevant variables as well as the effect of each variable on the response after controlling for the average effects of all other variables in the model.[21] In the remainder of this section we present the hypothesized taxonomy analysis for exploring heterogeneity among enterprises. The section includes the model-based clustering methodology and concludes by explaining the generalized boosted model to explore the relevant characteristics of the enterprise that influence the typology of enterprises.

1.2.3 Identifying groups of enterprises using Model-based clustering

Consider a dual framework (G=2), where all the enterprises $i = 1, \dots, N$ can be classified into two groups: growth-oriented and survivalist. Let x_i represents the data by each enterprise $x_i = (x_1, \dots, x_N)$ and τ_k corresponds to the probability that an observation x_i belongs to kth cluster ($\tau_k \geq 0,\ \sum_{k=1}^{G} \tau_k = 1$). For each enterprise, let $\tau_k = 1$ if the observation belongs to the growth-oriented cluster and $\tau_k = 0$ if the observation belongs to the survivalist cluster instead. Suppose that x_i is equal to the value added[22] generated by each enterprise where higher values of x_i corresponds to a higher probability of belonging to the growth-oriented group ($\tau_k \to 1$). The Figure 1.2 shows the density function $f_k(x_i)$ of an observation x_i from the kth cluster where all enterprises that belong to the growth-oriented would be in the right tail of the distribution and all survivalist enterprises would be at the left tail of the distribution.

[19] We also explore the possibility of implementing a parametric approach (ordered logit) but the proportional odds assumption did not hold since the resulting number of clusters from the model-based clustering are not set to be spherical (same orientation, shape and volume) and a generalized approach may be more appropriate (Cameron & Trivedi, 2009).

[20] Trees classification models relate a dependent variable (response) to other independent variable (predictors) by recursive binary splits (Elith et al., 2008a). The model starts partitioning a complete dataset into two mutually exclusive regions based on the value of a single predictor and continues adding other predictors and splitting data into further new regions reflecting more homogeneous groups. The process continues until the tree includes enough splits reflecting the complexity of the model. For a detail description on classification and regression trees see (Breiman et al., 1984).

[21] Interpretation cannot be made in the same fashion as regression analysis but GBM uses visualization as the most illustrative way of showing the dependence relationship between the input and response variables (J. H. Friedman, 2001; Elith et al., 2008b; Hastie et al., 2009).

[22] The value added is measured as turnovers minus the cost of intermediate consumption.

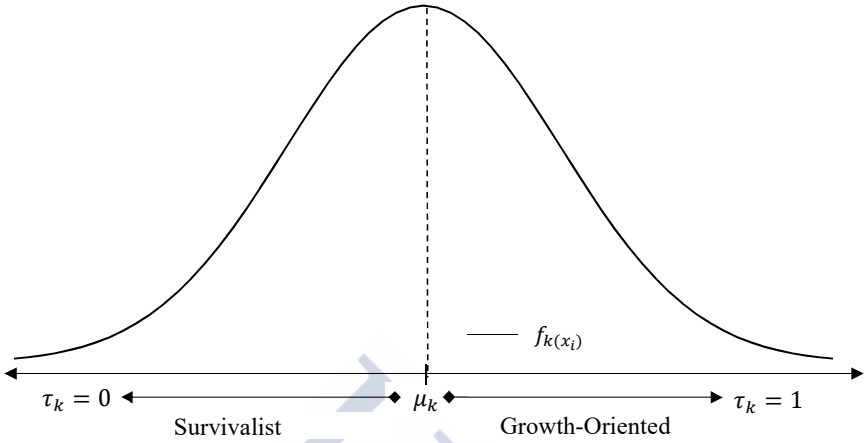

Figure 1.2. Distribution of the enterprises and the density plot for x_i. The figure shows the distribution of x_i that includes the value added of all enterprises. The plot includes the probability from the highest values corresponding to growth-oriented enterprises and lowest values to survivalist enterprises.

In practice, however, G is unknown and the number of clusters is estimated using model-based clustering. Drawing from (Fraley & Raftery, 1998; Dasgupta & Raftery, 1998), x_i is assumed to be generated by a mixture model with G components that maximizes:

$$\prod_{i=1}^{n}\sum_{k=1}^{G}\tau_k f_k(x_i|\theta_k), \qquad (1.1)$$

where $f_k(x_i|\theta_k)$, is a probability distribution with parameters θ_k and τ_k is the probability than an observation belongs to the *k*th component. If $f_k(x_i|\theta_k)$ is multivariate normal (Gaussian) parameterized by a mean vector μ_k and a covariance matrix Σ_k, then $\theta_k = (\mu_k, \Sigma_k)$ and the density function can be defined as:

$$f_k(x_i|\theta_k) = \phi(x_i|\mu_k, \Sigma_k) = \frac{exp\left\{-\frac{1}{2}(x_i-\mu_k)^T\sum_k^{-1}(x_i-\mu_k)\right\}}{(2\pi)^{p/2}|\Sigma_k|^{1/2}}. \qquad (1.2)$$

The parameters of the model are estimated by maximum likelihood using the expectation-maximization (EM) algorithm. EM consists of two iterative steps: The M-step that computes the maximum-likelihood parameter estimates $\hat{\tau}_{k,j}$, $\hat{\theta}_{k,j}$ given the conditional probability z_{ik} that an enterprise i belongs to the cluster *k* considered, and the E-step that computes the probability z_{ik} given the parameter estimates from the M-step such as:

$$\hat{z}_{ik} \leftarrow \frac{\hat{\tau}_k f_k(x_i|\widehat{\theta}_k)}{\sum_{j=1}^{G} \hat{\tau}_j f_j(x_i|\widehat{\theta}_j)}. \quad (1.3)$$

The initial variables for M-step corresponds to model-based hierarchical agglomeration and the algorithm stops when each observation is assigned to the cluster corresponding to the highest conditional or posterior probability. Combined with Bayes factor, the method computes BIC for the mixture likelihood from EM algorithm for $G_{min}, \dots, G_{max}$ and chooses the number of clusters that maximizes BIC.

Multivariate normal mixtures are parameterized from the eigenvalue decomposition developed by (Banfield & Raftery, 1993) based on the covariance matrix Σ_k for the *k*th cluster defined as:

$$\sum_k = \lambda_k D_k A_k D_k^T, \quad (1.4)$$

where D_k is the orthogonal matrix of eigenvalues determining orientation, A_k is a diagonal matrix proportional to the eigenvalues of Σ_k determining shape, and λ_k is a scalar representing the volume of the cluster. The EM algorithm uses as starting value the resulting partitions from the model with an unconstrained covariance where λ_k, D_k, A_k are estimated from the data and may vary between clusters. The model-based clustering analysis is finalized when we generate a variable Y that represents the classification of all the enterprises in different groups such as $Y = Y_1, \dots, Y_k$.

1.2.4 Testing the typology of entrepreneurs through Gradient Boosting Models

Following the exposition in Natekin & Knoll (2013) we define a given dataset $(X, Y)_{i=1}^{N}$, where $X = (X_1, \dots, X_d)$ are all exploratory input variables reflecting the enterprise characteristics[23] and Y is the dependent variable corresponding to the classification of the enterprises $Y = Y_1, \dots, Y_k$. The enterprise characteristics[24] (X) included in this analysis are: a variable on whether the enterprises have accounting records, a dummy variable to capture whether the firm has a fixed location separated from the household, the economic sector of the enterprise according to the Standard Industrial Classification, a dummy variable on whether the

[23] We use the characteristics of the enterprise that were available in the second phase of the National Economic Census in Ecuador. However, the analysis is not restricted to the variables included in this description. This stage is open to the inclusion of other characteristics about the enterprise or the entrepreneur that may be available in other databases.

[24] A detail description with the definition of all the variables and the construction of the index are included in the Table A1.1 in appendix of the chapter.

enterprise is able to accumulate capital, a categorical variable that compares the ability to generate a monthly income to meet at least a minimum wage or the national food basket, the age and size of the establishment, an indicator on the use of information and communication technology (ICT), the percentage of paid employees and the percentage of female employees. Building upon the typology described by Berner et al. (2012) and data availability we hypothesized the possible associations between the types of enterprises and the characteristics of the enterprises for the two logics of entrepreneurs described in table 1.2.

Table 1.2 Hypothesized characteristics of survival and growth-oriented enterprises

Characteristics (X_i)	*Survival(ist) ($\tau_k = 0$)*	*Growth(-oriented) ($\tau_k = 1$)*
Accounting Records	Low(er)	High(er)
Location	In household	Separated from household
Economic Sector	Majority in Commerce	Majority in Service & Manufacture
Capital Formation	Low or non-existent	High(er)
Monthly income to meet basic needs	Struggle to generate enough monthly income to cover basic needs	Generates enough monthly income to meet basic needs
Surface	Small(er)	Large(er)
Age	Not necessarily younger enterprises	Old(er)
Percentage of female workers	High(er)	Low(er)
Percentage of paid workers	Low(er)	High(er)
Use of ICT	Low or non-existent	High(er)

Note. Hypothesized characteristics of the enterprises based on the typology described by Berner et al. (2012) and data available from National Economic Census – Phase II (2011).

We used gradient boosting models to identify the most relevant characteristics among those described in table 1.2 that differentiate the clusters identified in the first stage. Following (J. Friedman et al., 2000; J. H. Friedman, 2001; Natekin & Knoll, 2013) the unknown functional dependence $X \xrightarrow{f} Y$ may be estimated $\hat{f}(X)$, such that some loss function $\Psi(Y, f(X))$ is minimized:

$$\hat{f}(X) = arg \min_{f(X)} \Psi(Y, f(X)) = arg \min_{f(X)} E_X[E_Y(\Psi[Y, f(X)])|X]. \quad (1.5)$$

Since the response variable Y is a cluster identity vector that comes from a multinomial distribution $Y \in \{1, \dots, K\}$ then $\Psi(Y, f(X))$ corresponds to a multinomial deviance loss function. Drawing from (Hastie et al., 2009), with a *k*-class classification, the number of clusters

Y, takes value from a set $G = \{G_1, \dots, G_k\}$. Given the conditional probability of $p_k(X) = Pr(Y = G_k|X)$, where $k = 1,2, \dots, K$, then the Bayes classifier is:

$$G(X) = G_k \text{ where } k = \arg\max_l p_l(X), \quad (1.6)$$

where $p_l(X)$ is the class probability, for $l = 1,2, \dots, K$, and the logistic model generalized to K classes is:

$$p_k(X) = \frac{e^{f_k(X)}}{\sum_{l=1}^{K} e^{f_l(X)}}, \quad (1.7)$$

where $p_k \geq 0$, $\sum_{k=1}^{G} p_k = 1$. The multinomial deviance loss function penalizes increasing negative margin values more heavily than they reward increasing positive values, and can be defined as:

$$\Psi(Y, f(X)) = -\sum_{k=1}^{K} I(Y = G_k) f_k(X) + log\left(\sum_{l=1}^{K} e^{f_l(X)}\right). \quad (1.8)$$

The function is estimated using a gradient boost algorithm where optimization is held out of the function space (J. H. Friedman, 2001). Let ρ_t be the optimal step-size, $h(X, \theta_t)$ is the custom "base-learner" function and $\hat{f}$ be the function estimate in additive functional form $\hat{f}_t = \sum_{i=0}^{M} \hat{f}_i(X)$, then the optimization rule can be defined as:

$$\hat{f}_t \leftarrow \hat{f}_{t-1} + \rho_t h(X, \theta_t), \quad (1.9)$$

$$(\rho_t, \theta_t) = \arg\min_{\rho,\theta} \sum_{i=1}^{N} \Psi(Y_i, \hat{f}_{t-1}) + \rho_t h(X, \theta_t) \quad (1.10)$$

The form of the algorithm would depend on $h(X, \theta_t)$ and the multinomial deviance loss function $\Psi(Y, f(X))$. In order to avoid the risk of overfitting the model, the regularization of the model includes a subsampling, shrinkage option and early stopping rules in the estimation to reduce the impact of each additional fitted based-learner and potentially unstable regression coefficients (Ridgeway, 2007; Elith et al., 2008b).

Finally, the relative influence (I_{lk}) of an explanatory variable X_l in separating the cluster k from other clusters is obtained by the average of the influence over all of the clusters such as:

$$I_l^2 = \frac{1}{K}\sum_{k=1}^{K} I_{lk}^2. \quad (1.11)$$

The influences are further standardized to sum up to 100% to identify the variables that are more important to explaining differences among clusters. Once the most relevant variables are identified, we explore how the variable affects the modeled response after controlling for other explanatory variables using partial dependence plots.

1.4 DATA AND SETTINGS

We used data from a national representative survey of microenterprises from the second phase of the National Economic Census. The survey was conducted during 2013 and aims to account for the economic contribution of all types of microenterprises to the national economy in 2011.[25] The data originally included information about 22,919 microenterprises based on the number of employees (from 1 to 9 employees). However, we only included those microenterprises that met both criteria defined by CAN (2009): having less than 9 employees and have turnovers and/or balance sheet of less than US $100.000.[26] Therefore, we excluded 6.39% of the sample that have turnovers higher than US $100.000 and ended with a valid sample of 21.413 enterprises. After outlier deletion[27] the final sample included 20.853 establishments representative of 363.479 microenterprises in the country. Based on the design of the survey and objective of this chapter we selected value added as the input variable for model-based clustering. Value added is measured as turnover minus the cost of intermediate consumption. Figure 1.3 shows a bimodal distribution on the normalized value added for each microenterprise.

[25] The survey called *Encuesta Exhaustiva* includes information about enterprises and microenterprises in Ecuador using two different sample designs and separated questionnaires. Therefore, we could not include homogenized information of the two databases and focus only on microenterprises.

[26] Although most of the analysis about microenterprises are usually made based only on the number of employees, when it comes to certain policies like defining microcredit thresholds, setting interest rates or designing projects for entrepreneurship promotion the segmentation of enterprises using thresholds for the value of turnovers prevails over the number of employees (see e.g. CAN (2009)).

[27] Evans et al. (2015) proposed to identify the cluster of outliers based on the cluster that accounts for the minimal distribution or the cluster that have the greatest variance with and without observations. Since there was evidence of the presence of outliers, we lose one cluster in "cleaning" the data for consistency that represented 3.21% of the valid sample.

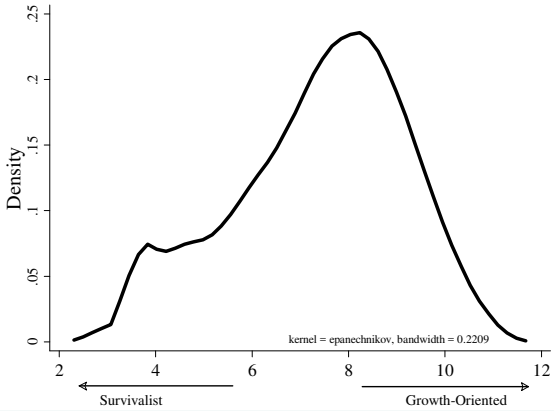

Figure 1.3. Density plot for the value added for the microenterprises in Ecuador. The variable was normalized using ln(x+1) transformation and show a bimodal distribution. Authors' calculation based on data from National Economic Census – Phase II (2014).

Descriptive statistics about the characteristics of the microenterprises used in the second stage of our taxonomy analysis are reported in Table 1.3. As seen in the table, the characteristics included provide an overview of the 'average' microenterprise in the country. On the one hand, microenterprises are concentrated in the commercial (wholesale and retail) and, to a lesser extent, services sectors. They lack basic accounting records and the use of information and telecommunications technologies is almost non-existent. They have been running for more than eight years and are mostly located at a fixed place separate from the entrepreneur's household. Regarding employment variables, most microenterprises generate female employment[28] and only very few of them are able to paid their employees relying mainly on self-employment and unpaid labor of family members.

On the other hand, approximately 60% of all microenterprises can generate monthly income to purchase a basic food basket to satisfy the needs of the entrepreneurs' families[29], around 19% are not even able to generate monthly income equivalent to the minimum wage[30],

[28] The survey does not provide information about the sex of the owners to guarantee the confidentiality of the information (INEC,2014). However, since most of microenterprises are unipersonal we can assume that the percentage of female employees would reflect the sex of the owner. In fact, information about the first phase of the National Economic Census show that microenterprises led by women represent around 55% of all the microenterprises in the country which correspond to the same percentage of female employees described in the second phase of the National Economic Census.

[29] The basic food basket (or Standard Food Basket) is a concept widely extended in Latin America developed by the Economic Commission for Latin America and the Caribbean (ECLAC-CEPAL). It refers to the amount of money that allows to buy a minimum set of goods and services to meet the basic needs and satisfy nutritional requirements of an average household (CEPAL., 1990; Altimir, 2008). In Ecuador, the basic food basket is of estimated for a household of 4 members with 1.6 members receiving a minimum wage. The National Basic Food Basket was US $578.04 at December of 2011 (INEC, 2011).

[30] The Minimum Wage was US $264 at December of 2011 (INEC, 2011).

and the remaining 20% generate monthly income greater than the minimum wage but not enough to buy a basic food basket. Moreover, only a quarter of all used physical capital.

Table 1.3 Descriptive statistics of explanatory variables

	(%/Mean)	[95% CI]
Categorical Variables (%)		
Economic Sector		
Manufacture	13.25	[12.6-13.9]
Commerce	51.98	[51.1-52.9]
Service	34.78	[33.9-35.6]
Accounting records (= Yes)	6.37	[6.0-6.8]
Fixed location separated from household	64.33	[63.4-65.2]
Income to meet basic needs[(a)]		
< 1 Minimum Wage	18.8	[18.0-19.6]
>= 1 Minimum Wage & < 1 Basic Food Basket	20.05	[19.3-20.8]
1<=Basic Food Basket <2	23.52	[22.8-24.3]
Basic Food Basket >=2	37.63	[36.8-38.5]
Used physical capital (= Yes)	24.88	[24.1-25.7]
Continuous Variables (Mean)		
Female employees (percentage)	54.92	[54.14-55.70]
Paid employees (percentage)	13.46	[12.99-13.93]
Age of establishment	8.29	[8.09-8.48]
Surface (squared meters)	69.07	[63.68-74.45]
ICT Index	6.09	[5.83-6.36]
N	**363,479**	

Note. Values are weighted for estimated Population at a National Level using expansion factor. [(a)] Minimum Wage in 2012 was US $264 and National Basic Food Basket was US $595.70.
Authors calculations based on National Economic Census – Phase II, 2014

1.5 RESULTS

In this section, we report the results of our empirical analysis. We start identifying the number of clusters resulting from the model-based clustering analysis, which indicates a typology of enterprises. We also describe the main characteristics of the enterprises by using significance test and the average standardized mean difference of all the explanatory variables. We intend to provide some descriptive evidence of the heterogeneity among microenterprises and the characteristics of the types of enterprises hypothesized in Table 1.2. Finally, we conclude this section presenting the results of our multivariate analysis using gradient boosting models to identify the most relevant characteristics that differentiate the types of enterprises and the marginal effect of these variables over the cluster distribution.

1.2.5 Identifying groups of enterprises using Model-based clustering

The results of the model-based clustering show the existence of six types of microenterprises, as seen in table 1.4.[31] According to the typology described in section 1.3.1, we identify at one end of the distribution that 14% of all microenterprises in Ecuador are purely survival(ist) while at the other end we can find that 10% may be considered as purely growth-oriented. More interesting is to focus on the intermediate categories; we find four sub-groups between the two ideal type entrepreneurship logics. There is a considerable heterogeneity among the six types of enterprises as seen in the last two columns of the table. The survivalist group of microenterprises (cluster 1) generates on average only US $67.5 while the growth-oriented group (cluster 6) generates on average US$ 26,438.4. We also observe that cluster 4 microenterprises generate average added value equivalent to a minimum yearly wage.[32] In fact, cluster 5 concentrates the largest number of microenterprises that exceed the per capita Gross National Income.[33] This heterogeneity would not be evident if we would assume an "average" profile of microenterprises as the one described in section 1.4.

Table 1.4 Model-based clustering results

Cluster	Frequency			Value added	
	No.	Col %	95% CI	M (SD)	95% CI
1	50,087	13.78	[13.0-14.6]	67.5 (34.1)	[65.4-69.6]
2	59,665	16.41	[15.7-17.1]	361.9 (145.0)	[355.4-368.5]
3	80,791	22.23	[21.5-23.0]	1,299.0 (423.1)	[1,281.8-1,316.2]
4	52,182	14.36	[13.8-15.0]	2,933.5 (532.1)	[2,910.4-2,956.7]
5	84,974	23.38	[22.7-24.1]	7,385.2 (2,665.1)	[7,296.1-7,474.4]
6	35,782	9.84	[9.4-10.3]	26,438.4 (13,404.4)	[25,792.9-27,084.0]
Total	363,479	100		5,107.8 (8,748.3)	[4,968.5-5,247.0]

Note. Model-based cluster analysis using *mclust* package in R (Fraley & Raftery, 2006; Fraley, Raftery, Murphy, & Scrucca, 2012). The variable was normalized using ln(x+1) transformation and the values are weighted for estimated Population at a National Level using expansion factor. Author's elaboration based on information of the National Economic Census – Phase II (2014).

[31] Model-based clustering assumes a Gaussian distribution of the data. Therefore, the variable was normalized using ln(x+1) transformation. The complete results of our model-based clustering analysis are included in the Figure A1.1 in the appendix of the chapter. We also use Box-Cox power transformation (Box & Cox, 1964; Sakia, 1992) and find the same number of clusters with similar distribution. Results are shown in Table A1.2 in the appendix of the chapter.

[32] The annual value equivalent to earning a minimum wage during 2011 is US$ 3,168 (INEC, 2011)

[33] The gross national income (GNI) per capita in Ecuador in 2011 was US$ 4,900 (World Bank, 2011)

1.2.6 Descriptive evidence of heterogeneity among microenterprises

Once we have identified the types of microenterprises we proceed to test the characteristics defined in Table 1.2 of our empirical model. We start providing descriptive evidence of heterogeneity among the six types of microenterprises using significance tests. As seen in table 1.5, we find statistically significant differences ($p<.001$) between he six types of microenterprises in all the characteristics analyzed. We observe that microenterprises are highly heterogeneous and confirm the characteristics defined in the typology of entrepreneurs proposed by Berner et al. (2012) and hypothesized in Table 1.2. However, our method allows us to distinguish degrees and nuances that characterize each cluster.

On the one hand, purely survivalist enterprises (cluster 1) lack accounting records and do not use communication technologies. This group of enterprises are mostly located next to or in the household, are concentrated in commercial activities and around half of them cannot generate enough monthly income equivalent to earning a minimum wage. In addition, only 17% of them are able to accumulate some capital. They have been running for a shorter period and are smaller in size compared to the other groups or types of enterprises. Nearly three-quarters of them occupy only female workers and depend entirely on unpaid employment.

The group of growth-oriented enterprises (cluster 6), despite their low levels in the use of accounting records and information and communication technologies, show relatively higher values compared with survivalist entrepreneurs. These enterprises are mainly concentrated in the service sector (particularly tourism-related activities) and show the highest percentage of microenterprises in the manufacturing sector when compared to the other types of enterprises. Almost all growth-oriented enterprises generate monthly income to satisfy the needs of their families and at least guarantee the survival of two households, the owner and an employee. In addition, approximately 40% have physical capital. Growth-oriented enterprises are larger in surface and have been running for a longer time than survivalist enterprises. Finally, although the majority of employees are male, the percentage of female employees within this group reaches 44%, reflecting a greater heterogeneity among female entrepreneurs.

Based on the descriptive characteristics of survivalist and growth-oriented enterprises we observe that cluster 2 and 3 are closer to the logic of the survivalist entrepreneur and would be subgroups of this logic, while cluster 5 would be a sub-group of growth-oriented entrepreneurial logic. In between, cluster 4 shares some characteristics of both survivalist and growth-oriented enterprises. This group of enterprises resembles survivalist enterprises in the percentage of

enterprises with no accounting records, use of ICT, size and percentage of paid employees, but they also resemble growth-oriented enterprises in terms of the location of the enterprise, used physical capital and the percentage of female employees. Regarding the economic sector, enterprises within this cluster are distributed among commercial and service activities. Finally, although half of them can generate sufficient monthly income to meet the basic needs of a typical family, only 33% have employment creation potential.

Table 1.5 Descriptive statistics of explanatory variables by clusters

	1 (Survivalist)	2	3	4	5	6 (Growth-oriented)	$p^{(a)}$
Categorical Variables (% (SE))							
Accounting records	2.61 (0.53)	2.56 (0.27)	3.51 (0.39)	4.38 (0.39)	9.02 (0.45)	21.01 (1.00)	<.001
Fixed location separated from household	44.59 (1.64)	50.39 (1.21)	61.56 (0.97)	69.7 (1.00)	76.94 (0.76)	83.68 (0.85)	<.001
Economic Sector							<.001
Manufacture	9.36 (0.94)	6.35 (0.57)	11.36 (0.71)	13.53 (0.78)	17.94 (0.66)	22.89 (0.99)	
Commerce	77.69 (1.30)	74.95 (1.03)	56.27 (1.01)	42.51 (1.10)	36.13 (0.84)	19.42 (1.08)	
Service	12.95 (1.00)	18.7 (0.93)	32.37 (0.96)	43.96 (1.15)	45.93 (0.85)	57.69 (1.25)	
Used physical capital (= Yes)	17.12 (1.38)	17.31 (0.96)	20.13 (0.81)	27.4 (1.14)	31.62 (0.82)	39.42 (1.25)	<.001
Monthly income to satisfy basic needs[(a)]							<.001
< 1 MW	46.49 (1.65)	37.87 (1.20)	21.32 (0.86)	5.67 (0.46)	2.02 (0.21)	1.61 (0.30)	
>= 1 MW & < 1 BFB	23.33 (1.41)	28.02 (1.11)	27.16 (0.88)	32.72 (1.09)	6.19 (0.38)	0.5 (0.17)	
1>=BFB <2	19.84 (1.35)	21.26 (0.91)	26.07 (0.86)	28.17 (1.02)	31.11 (0.81)	1.86 (0.37)	
BFB >=2	10.34 (0.77)	12.84 (0.78)	25.45 (0.87)	33.44 (1.06)	60.67 (0.84)	96.02 (0.50)	
Continuous Variables (Mean (SE))							
Surface – square meters	28.61 (2.69)	31.65 (1.43)	44.4 (3.89)	57.78 (3.89)	101.81 (9.41)	182.5 (15.71)	<.001
Age in years	6.79 (0.16)	7.36 (0.19)	7.94 (0.13)	8.74 (0.32)	8.93 (0.16)	10.49 (0.44)	<.001
Female employees (percentage)	71.47 (0.76)	66.59 (0.69)	57.16 (0.62)	47.88 (0.77)	43.84 (0.55)	43.78 (0.76)	<.001
Paid employees (percentage)	2.34 (0.26)	2.76 (0.22)	4.82 (0.25)	9.24 (0.4)	22.98 (0.43)	49.91 (0.77)	<.001
ICT Index	1.94 (0.17)	2.6 (0.17)	3.88 (0.17)	6.29 (0.27)	8.36 (0.24)	17.08 (0.5)	<.001
N	50,087	59,665	80,791	52,182	84,974	35,782	

Note. The values are weighted for estimated Population at a National Level using expansion factor. MW= Minimum Wage (US $264), BFB= National Basic Food Basket (US $578.04), ICT = Information and communication technology. [a)] Probability correspond to Chi-square test for categorical variables.

In order to better understand the differences among the types of microenterprises we include information about the average standardized mean difference for all the characteristics included in our analysis.[34] We use the standardized mean difference besides the tests of statistical significance presented in Table 1.5 to give a complete picture of the size of the differences in the characteristics among microenterprises. On the one hand, standardized mean difference is scale free and is independent to the sample size in comparison to test statistics (*p-value*) that consider both effect size and sample size (Flury & Riedwyl, 1986; Coe, 2002; Sullivan & Feinn, 2012). On the other hand, the standardized mean difference does not depend on the unit of measurement allowing comparisons among any type of variables (Flury & Riedwyl, 1986). Therefore, we must explore if the differences found in Table 1.5 are due to large differences between the types of microenterprises (and not to the large sample size), as well as to analyze which are the characteristics that most differentiate them.

Figure 1.4 shows the average standardized mean differences among the cluster distribution of all the characteristic of the microenterprises included in our analysis. [35] We use the cutoffs proposed by Cohen (1992) for the effect size to determine the differences among types of microenterprises.[36] As seen in the figure, we can observe that some of the statistically significant differences found in Table 1.5, such as age and business size, are the result of sample size rather than differences between groups. Small differences among the six groups include characteristics such as the location of the enterprise, the use of accounting records and ICT or the percentage of female employees. It is worth noticing that even though female employees are concentrated in the survivalist group, this variable is not among the most relevant characteristics that differentiate the types of microenterprises reflecting some heterogeneity among female microenterprises. Moreover, we find that the types of enterprises differ mainly on three characteristics: its capacity to generate monthly income to satisfy their basic needs, percentage of paid employees and the sector of economic activity.

[34] As stated by Flury & Riedwyl (1986) the standardized mean difference can be interpreted as the mean difference in units of standard deviations allowing comparisons among any type of variable. The standardize mean difference is most commonly used on meta-analysis and comparisons of the balance properties among treatment and control groups when estimating treatment effects in observational studies (Coe, 2002; Sullivan & Feinn, 2012). However, we recognize the relevance of including the effect size as a part of any descriptive analysis when exploring differences among groups.

[35] The results of the average standardize mean differences for weighted data are calculated using the *tableone* package in R. For multinomial variables, the package use the Mahalanobis distance and treats the variable as "*multiple non-redundant dichotomous variables"* (Yoshida et al., 2015). We also include the plots of all pairwise standardize mean differences for each cluster in the figures A1.2 and A1.3 in the appendix of this chapter.

[36] Cohen (1992) identified three thresholds corresponding to small, medium and large differences (d=.20, .50, .80, respectively). Cohen (1992) and Coe (2002) argue that these cutoffs are not are not rules of thumb and should be taken with caution since small differences may be relevant for policy design, implementation and evaluation of treatment effects. However, we use them as guide to determine the differences among types of enterprises.

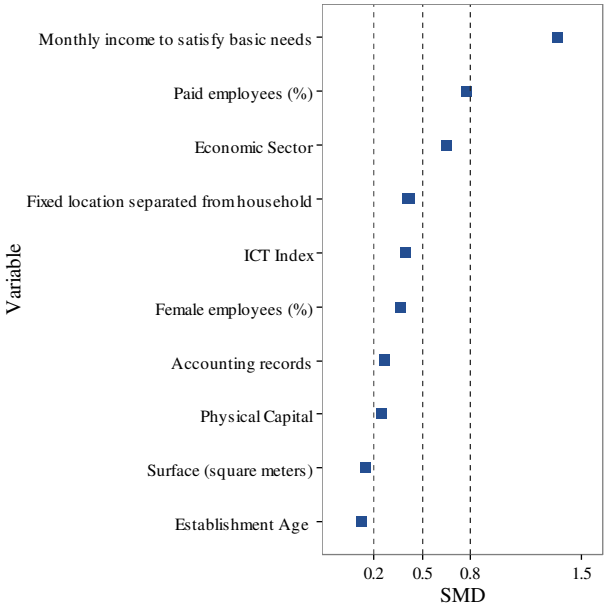

Figure 1.4. Average standardized mean difference (SMD) of the characteristics of the enterprises. The SMD was estimated for entire population using *tableone* package in R (Yoshida et al., 2015). ICT = Information and communication technology. Authors' calculation based on data from National Economic Census – Phase II, 2014.

1.2.7 Testing the typology of entrepreneurs through Gradient Boosting Models

We estimated the relative influence of the characteristics of microenterprises over the cluster distribution as explained in section 1.3.2. Figure 1.5 shows the results of our multivariate analysis using gradient boosting models.[37] As seen in the figure, we confirm the results obtained using the average of the standardized mean difference reported in section 1.5.2. Thus, we identify that the most relevant characteristics that differentiate the types of microenterprises are the capacity to generate monthly income to satisfy their basic needs, the economic activity and the percentage of paid employees. In fact, the three variables accounted for 88% of the total influence in the model. It does, however, change the order of the relevance of the variables. In the descriptive univariate analysis, we found that the standardized mean difference between the percentages of paid employees was greater than the difference of the economic activity whereas

[37] We estimate the model using *gbm* package in R (Ridgeway, 2007). The regularization process used to avoid the risk of overfitting the data includes a subsampling parameter of .5 and shrinkage parameter of .005 for 20,000 iterations. We also trimmed the data and used 80% as stopping rule for the algorithm with three-way iterations and a minimum size of 10 nodes in each iteration. The boosting algorithm converged after 17629 iterations.

in the multivariate analysis the economic activity is more relevant for explaining the cluster distribution than the percentage of paid employees. The remaining predictors show that the percentage of female employees and the surface in square kilometers are also influential predictors but its relative contribution is not greater than 6%.

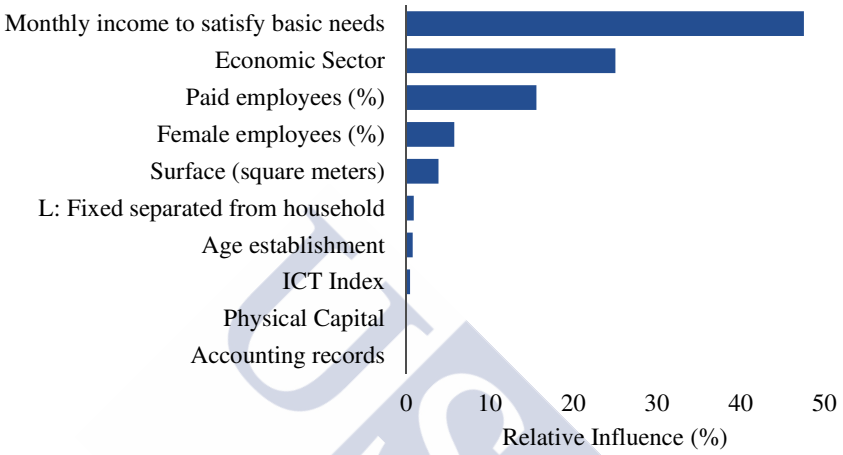

Figure 1.5. Relative contributions (%) of predictors over types of microenterprises. The graph shows the relative influence in percentages of the explanatory variables over cluster distribution using gradient boosting model with multinomial deviance loss function. The values are weighted for estimated Population at a National Level using expansion factor. Authors' calculations based on National Economic Census – Phase II (2014).

Finally, we included the partial dependence plots to show the marginal effect of the most influential variables after controlling for all the other variables in the model. As shown in Figure 1.6, we present the set of partial dependence plots of four characteristics: monthly income to satisfy basic needs, the economic sector and the percentage of paid employees.[38] We observe the survivalist and growth-oriented enterprises at both ends and their characteristics confirm those described in section 1.5.2. Survivalist enterprises generate monthly income lower than the minimum wage, are concentrated in commercial activities and depend on unpaid and female employment, whereas growth-oriented enterprises generate monthly income to meet their basic needs, are concentrated in manufacturing and service sectors, and are more likely to paid their employees and to create male employment. Overall, our results confirm the high degree of

[38] The percentage of female employees is not among the most relevant predictors of the typology of microenterprises. However, we included the partial dependence plot to show the heterogeneity identified in the descriptive analysis.

heterogeneity among microenterprises within the two logics of entrepreneurs, and their characteristics are in line with the typology of entrepreneurs described by Berner et al. (2012).

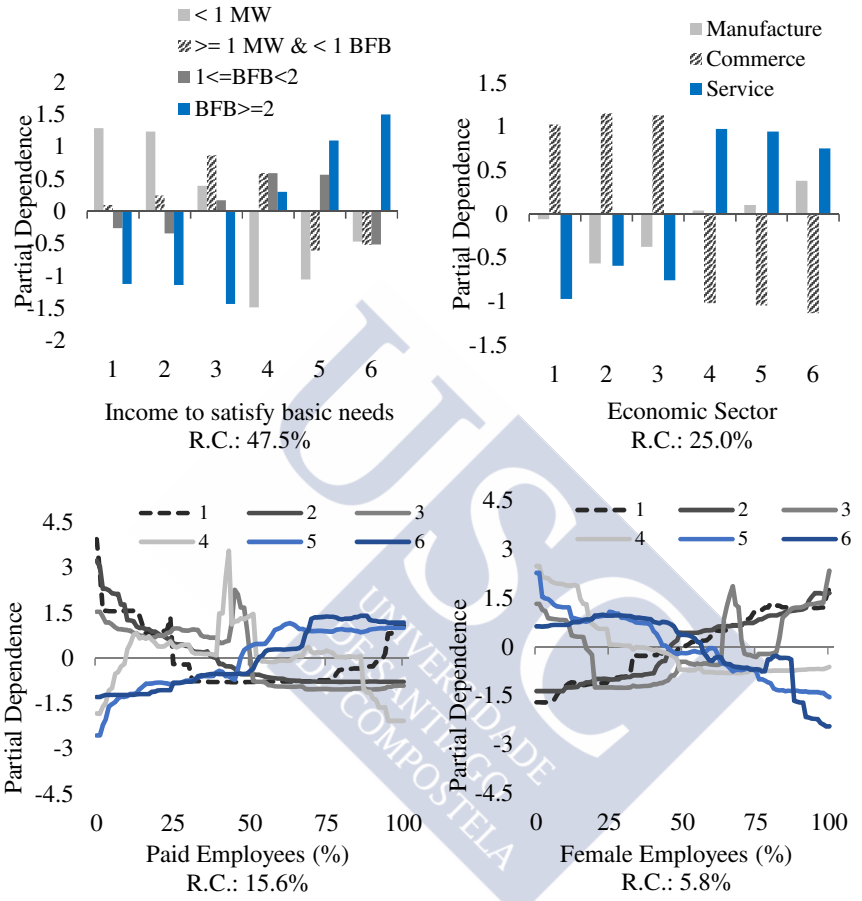

Figure 1.6. Partial dependence plots for the most influential variables over types of microenterprises. The graphs show the marginal effect of the variable on the cluster distribution after accounting for the average value of all other variables in the model using gradient boosting model with multinomial deviance loss function. All the variables are centered to have zero mean over the data distribution. The relative contribution (R.C.:) of the variables for each sample is shown on the x-axis. MW= Minimum Wage (US $264), BFB= National Basic Food Basket (US $578.04). Authors' calculation based on data from National Economic Census – Phase II, 2014.

1.6 CONCLUSIONS

In this chapter, we make several contributions to the literature of entrepreneurship in developing countries. We provide and empirical framework that is relatively easy to replicate in other countries using Economic Census or Enterprise Surveys. The application of a taxonomy analysis in two stages allows the incorporation of the characteristics included in this chapter as well as other characteristics such as individual characteristics of the entrepreneur that may be available in other data to explore heterogeneity among enterprises. To the best of our knowledge this is the first empirical application that explores heterogeneity among enterprises using model-based clustering. The methodology allows testing heterogeneity in a series of nested model to identify the optimal number of clusters that best fit data distribution.

We have shown that microenterprises in Ecuador are highly heterogeneous. Despite the initial descriptive analysis that show that the average profile of microenterprises in the country displays the characteristics of survival(ist) enterprises, our analysis show that there were six types of enterprise and roughly 10% of them are growth-oriented enterprises. We identified three subgroups within the logic of the survivalist entrepreneur and two subgroups of enterprises within the growth-oriented entrepreneurial logic whilst only one group shared some characteristics of both survivalist and growth-oriented enterprises.

In addition, the characteristics explored in the taxonomy analysis are line with the typology described by Berner et al. (2012). We find that the capacity to generate monthly income to satisfy their basic needs, the sector of economic activity and percentage of paid employees are the main distinctive features among the types of microenterprises in the country. Even more important, our results show that although most survivalist enterprises are run by female entrepreneurs, not all female entrepreneurs run survival enterprises. The heterogeneity in female entrepreneurship research has been overlooked under the argument that enterprises led by female entrepreneurs "underperformed" the ones led by the male ones. This result raises many questions to explain the apparent high degree of heterogeneity among the enterprises run by female entrepreneurs.

Based on the evidence of this chapter that shows heterogeneity among microenterprises we conclude that standardized policies would not be enough for entrepreneurship promotion or poverty alleviation programs among microentrepreneurs in Ecuador. Thus, we required specialized and differentiated programs and policies that better respond to the needs of each

type of microenterprise. We can feasibly expect, then, that homogenized policies such as microcredit, microinsurance or training programs that target the 'average' profile may not be enough to achieved development or entrepreneurship promotion goals and their effect may be masked by the heterogeneity of enterprises.

Finally, we focus the taxonomy of microenterprises considering that they are only production units using as output variable the generated value added. However, we know that survivalist entrepreneurs use their enterprises as a mean to smoothing consumption. Further research should explore the effect of the "benefits in-kind" such as donations, payments in-kind and consumption that are usually considered as a 'waste' in the production process but have been described as the main goal among survivalist entrepreneurs. Including benefits in-kind in the taxonomy analysis would allow exploring the role of these enterprises as consumption units and open the possibility to find evidence of the hybrid role (production and consumption) of microenterprises in the country.

APPENDICES TO CHAPTER I

Table A1.1: Variables definition for the establishment characteristics used in the gradient boosting models

Variable	Definition
Accounting records	Variable refers to 1 if the enterprises use accounting records for the management of the enterprise, and 0 otherwise (none, personal notes, basic records of sales and purchases)
Location	Location is equal to 1 if the establishment is separated from the household, and 0 otherwise (same at the household)
Economic Sector	Refers to the economic sector of the main activity and includes: (i) Manufacturing; (ii) Commerce/trade/retail; and (iii) Service.
Paid employees (%)	Includes the percentage of employees who work in or for the establishment and receive a payment.
Female employees (%)	Includes the percentage of females who works in or for the establishment over the total number of employees.
Age – establishment	Number of years running the business.
Surface (square km)	Surface of the establishment in square kilometers.
Income vs. Minimum Wage & Basic Food Basket	The variable compares the total amount of monthly income generated by the establishment with the Minimum Wage (US $264) and the National Basic Food Basket (US $578.04) at December of 2011. It takes a value of 1 if the amount of monthly income generated is below one minimum wage salary, 2 if the income generated cover at least a minimum wage but it does not cover one basic food basket; 3 if the income generates at least one basic food basket but does not cover two basic food baskets to generate enough income for supporting another family; and 4 if the establishment generates more than two basic food baskets.
Physical Capital Stock	Dummy variable that takes a value of 1 if the establishment have physical capital stock, 0 otherwise.
ICT Index	Index of Information and telecommunication technology usage in the establishment and includes five items: (i) Number of computers used in 2011, (ii) Internet connection used by the enterprise, (iii) Number of employees using internet at work in 2011, (iv) Use of DSL internet connection, and (v) Enterprises with access to emails. The index is constructed using factor analysis and the first factor accounts for 65.39% of common variance and is normalized to have values from 0 to 100. The index shows good measures of reliability of 0.9148 (standardize Cronbach's alpha) and sampling adequacy of 0.8082 (Kaiser-Meyer-Olkin).

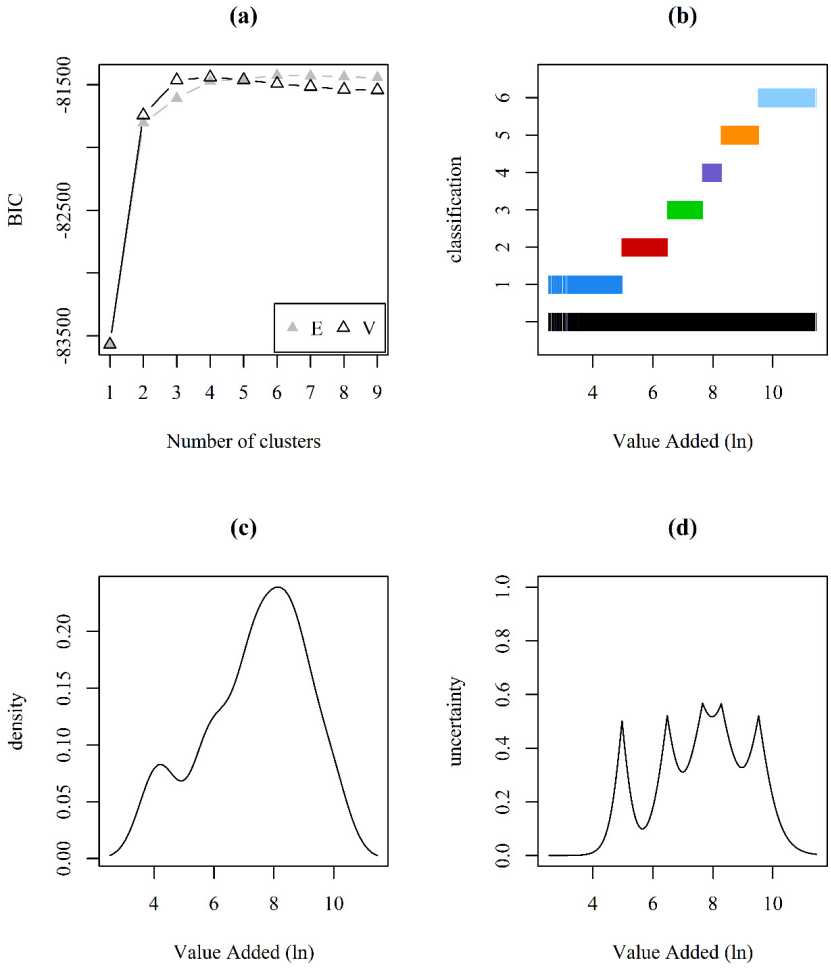

Figure A1.1. Results for the model-based clustering analysis. The plots show the result of the model-based cluster analysis using mclust package in R (Chris, Adrian E. Raftery, T. Brendan Murphy, & Luca Scrucca, 2012; Fraley & Raftery, 2006. Plot a) shows the Bayesian Information Criterion (BIC) for the model-based clusterization of Value Added (ln) of microenterprises in Ecuador. B) Model-based classification c) Density plot d) Uncertainty in the model-based classification produced by the best model (6 clusters) indicated by the BIC. In the classification plot, all the data is displayed at the bottom, with the separated classes shown on different levels above.

Table A1.2 Cluster distribution using Box-Cox power transformation

Cluster	Frequency			Value added	
	No.	Col %	95% CI	M (SD)	95% CI
1	50214	13.81	[13.0-14.6]	67.7 (34.3)	[65.40-69.65]
2	60227	16.57	[15.9-17.3]	365.7 (147.3)	[355.37-368.45]
3	80137	22.05	[21.3-22.8]	1,304.9 (420.9)	[1,281.85-1,316.20]
4	52236	14.37	[13.8-15.0]	2,935.9 (533.0)	[2,910.43-2,956.64]
5	85784	23.60	[22.9-24.3]	7,455.9 (2,729.0)	[7,296.10-7,474.35]
6	34881	9.60	[9.1-10.1]	26,765.2 (13,419.1)	[25,793.34-27,083.53]
Total	363,479	100		5,107.8 (8,748.3)	[4,968.53-5,247.00]

Note. Table shows the number of clusters using *mclust* package (Chris et al., 2012; Fraley & Raftery, 2006) and Box-Cox power transformation using *forecast* package in R for estimated population at a national level. [(a)] Model-based clustering using value added; [(b)] Model-based clustering using value added and own consumption. Authors' calculations based on National Economic Census – Phase II, 2014

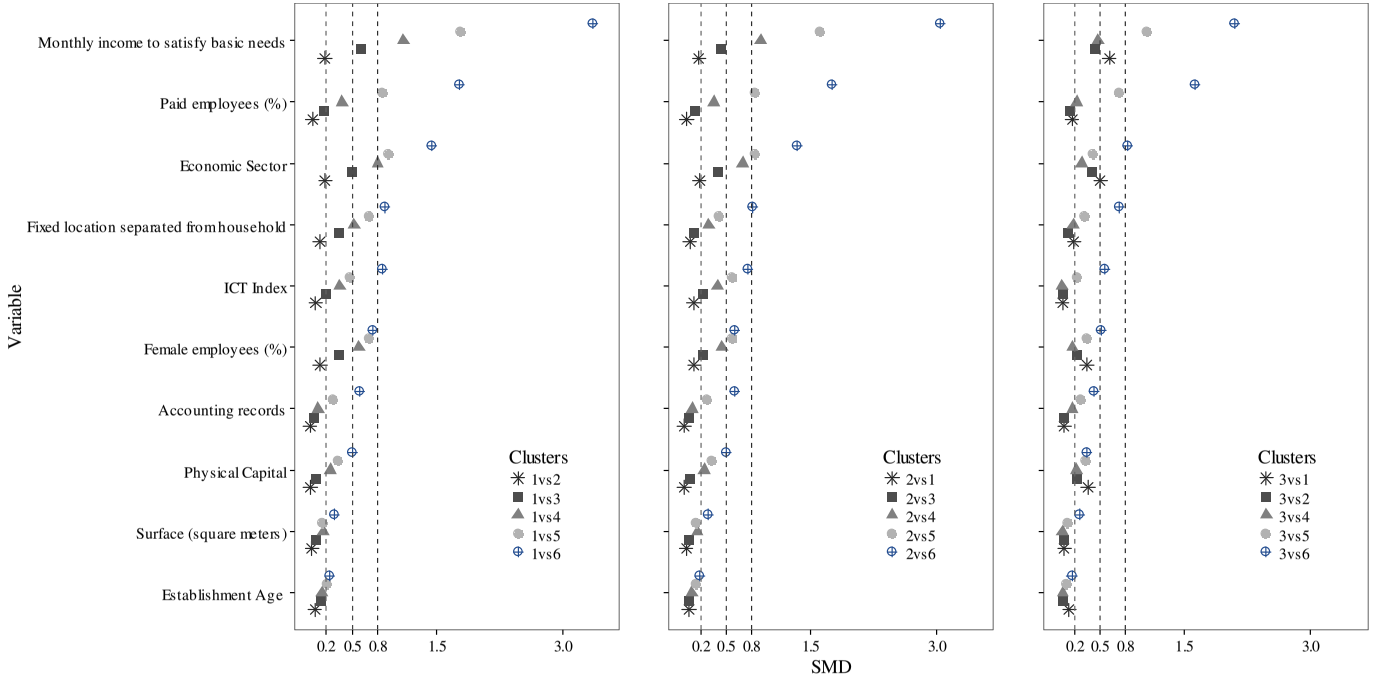

Figure A1.2. Pairwise standardized mean difference (SMD) for clusters 1, 2 and 3. The graphs shows SMD for the estimated population using *tableone* package in R. Points are offset horizontally so values are visible for each cluster. ICT = Information and communication technology. Authors' calculation based on data from National Economic Census – Phase II, 2014.

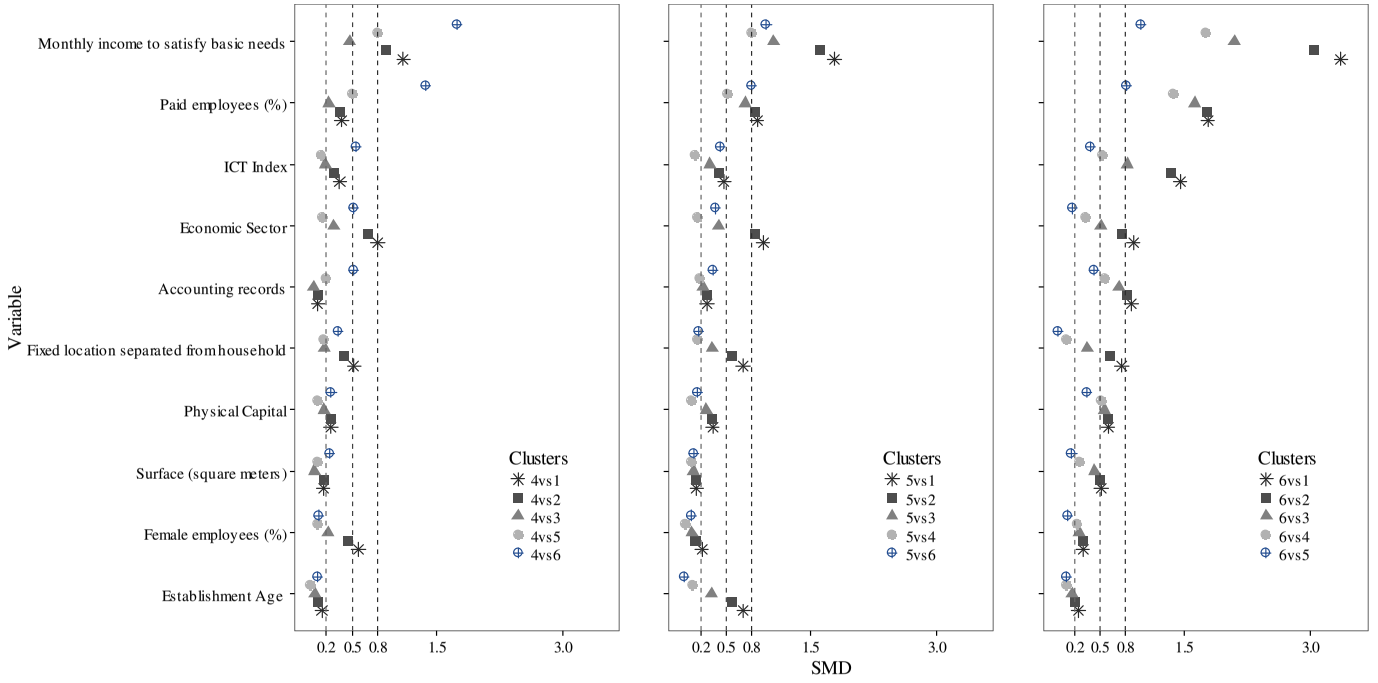

Figure A1.3. Pairwise standardized mean difference (SMD) for clusters 4, 5 and 6. The graphs shows SMD for the estimated population using *tableone* package in R. Points are offset horizontally so values are visible for each cluster. ICT = Information and communication technology. Authors' calculation based on data from National Economic Census – Phase II, 2014.

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CHAPTER II:

Mission drift or Specialization: Determinants of Financial and Social Efficiency of Microfinance Institutions in Ecuador

2.1 INTRODUCTION

The current face of the Microfinance Industry has its origins in the seventies with parallel experiments in Asia and in some countries of Latin America. In 1974, the Grameen Bank began with Muhammed Yunus providing small credits to poor women in Bangladesh based on the concept that the "lack of access to credit was one of the fundamental barriers to overcome poverty". At roughly the same time (1972) in Recife (Brazil) the *Projeto Uno* was the first program of microfinance in Latin America, followed by other programs in the Dominican Republic with *Banco Ademi* and *Fedecrédito* in El Salvador. The "revolution" of microcredit has spread all over the world mainly because it questioned preconceived notions of what poor households could do and showed the potential of innovative contracts and institutions to bring about financial inclusion.[39]

Microfinance institutions (MFIs) are called 'double bottom-line' institutions, emphasizing the possibility that sustainability and outreach can be achieved at the same time. But there is an ongoing debate about whether MFIs can meet both objectives, or whether those are mutually exclusive. The so-called 'self-sustainability approach' suggests that if microfinance institutions target more clients through growth and expansion they can reach more poor or excluded clients. The criticism about this approach, however, focus on the possibility that securing financial sustainability may lead to provide larger loans to better-off clients, increasing the average loan portfolio and excluding 'really poor' clients. Thus, the 'poverty approach' assumes that it is best to help few but very poor clients, since there is a trade-off between financial sustainability and poverty outreach that can drive institutions to *mission drift*.[40]

In this context, MFIs may be forced to decide between growth by imitation of successful institutions already established and focusing on having an impact on poverty by allocating their

[39] M. Berger *et al.* (2006), Armendáriz & Murdoch (2010).
[40] Hermes & Lensink (2011).

resources to higher risk operations with lower recovery rates. Mission drift occurs when MFIs are forced to increase the size of their loans to increase financial margins, which means that in the long run they move upmarket and start serving less poor clients that do not belong to the traditional microfinance targets.[41] However, assessing the presence of mission drift is a difficult task since there is a tiny line between mission drift and increasing average loan size due to "cross-subsidization" or "progressive lending"[42].

We depart from Copestake (2007) that defines mission drift as a process of *"ex-post changes in stated preferences to fit unplanned performance outcomes"*. His definition requires information not just about the performance of institutions, but also about their targets and goals. If institutions have a preference for financial performance they are interested in providing financial services not for the poorest of the poor but for unbanked better-off clients, we should expect to have a positive effect in the breadth of their outreach. If on the other hand, MFIs have an explicit poverty mission, it is necessary to look not only at the breadth but also at the depth of their outreach, broadening the range of their services to the target population, serving them for longer periods and ensuring that these services cause no harm.[43]

In this chapter, we aim to analyze which are the factors and determinants that influence both financial and social performance of MFIs in Ecuador using as a unit of analysis institutions members of *Red Financiera Rural* (RFR) [44], a national network of such institutions, to explore the possibility of detecting mission drift. The methodology applied in this chapter is a second-stage Data Envelopment Analysis (DEA) to measure efficiency in terms of sustainability and outreach using a balanced panel of 34 MFIs for the period 2009-2012. Our analysis differs from previous studies (Cornée, 2007; Cull, Demirgüç-Kunt, & Morduch, 2007; Flückinger & Vassiliev, 2007; Gutiérrez-Nieto, Serrano-Cinca, & Mar Molinero, 2007) in (i) its focus on the role played by the lending methodology used by the MFIs, (ii) the exploration of the relationship between efficiency scores and traditional financial performance ratios, and (iii) the consideration of the context of maximum legal interest rates and changes in regulation that have taken place in recent years in Ecuador.

[41] Traditional markets in microfinance are women, people living in rural areas and other groups traditionally excluded from financial services (see among others Yaron (1994), Hulme & Mosley, (1996a) and Mersland & Strøm (2010)).
[42] Progressive lending occurs when old clients that have shown good repayment records have access to higher credit ceilings in the subsequent credit cycles whereas that cross-subsidization refers to reaching unbanked wealthier clients (that are less expensive loans) to reach more poor clients with smaller loan size (more expensive). In both cases, the average loan portfolio of the MFI increases. For a further discussion see Armendáriz & Szafarz (2011).
[43] Copestake (2007).
[44] In 2016 the institution changes its name to *Red de Instituciones Financieras de Desarrollo* (RFD).

This chapter is organized as follows: next section describes a brief literature review and explores the studies conducted so far using non-parametric approaches. We present in section 2.3 the context in which we are analyzing efficiency of MFI. Section 2.4 explains in detail the methodology used. Section 2.5 details the characteristics and specification of our empirical study. The results obtained are described in Section 2.6. Finally, Section 2.7 summarizes the main conclusions as well as the possible applications for further research.

2.2 LITERATURE REVIEW

Evidence showing the presence of trade-offs among social and financial performance suggest that they may influence the overall performance of MFIs and thus challenge the idea of a win-win situation between social and financial performance. There is evidence that while targeting less poor clients improve operating efficiency, targeting very poor borrowers increases the cost per borrower and deteriorates operating efficiency (Gonzalez, 2010; Annim, 2012; Bédécarrats, *et al.* 2012), whilst Hermes *et al.* (2011) found that lending to women may have a negative effect in overall efficiency.

The literature examining MFIs' performance through efficiency analysis has increased rapidly in recent years. Cornée (2007), Cull *et al.* (2007), Flückinger & Vassiliev (2007), and Gutiérrez-Nieto *et al.* (2007) addressed the relationship between social and financial performance in MFIs. The non-parametric approach is more common for measuring performance in MFIs due to its flexibility regarding data requirements and sample size, and it was used in, e.g., Daraio & Simar (2007), Gutiérrez-Nieto *et al.*, (2007) and Gutiérrez-Nieto *et al.* (2009).

Efficiency measurement of financial institutions takes as its point of departure one of two different views about the workings of such institutions: the so-called "intermediation" and "production" views (Berger & Humphrey, 1997). The intermediation view conceptualizes the activity of financial institutions as mainly collecting deposits and making loans, with the aim to generate profits (Athanassopoulos, 1997). In contrast, the production view portrays financial institutions as users of physical resources (inputs) such as labor and capital, with the aim to produce services (outputs) such as savings and credits (Berger & Humphrey, 1997). In the specific case of MFIs, the production view is considered as the most suitable, in particular because non-governmental organization (NGOs) are not allowed to collect deposits from the

public (Cornée, 2007; Gutiérrez-Nieto *et al.*, 2009; Haq *et al.*, 2010; Kablan, 2012; Amersdorffer *et al.* 2013; Ben Abdelkader *et al.* 2014).

Input measures of capital and labor frequently used in the literature are total assets, operating expenses, and the number of employees (Cornée, 2007; Flückinger & Vassiliev, 2007; Gutiérrez-Nieto *et al.*, 2007, 2009; Hassan & Sanchez, 2009; Ahmad, 2011; Annim, 2012; Amersdorffer et al., 2013; Ben Abdelkader *et al.*, 2014). Other measures of capital like financial expenses (Annim, 2012; Kablan, 2012; Piot-Lepetit & Nzongang, 2014), total expenses (Annim, 2012), equity (Biener & Eling, 2011; Kablan, 2012; Piot-Lepetit & Nzongang, 2014), or cost-per-borrowers and cost-per-savers ratios (Haq *et al.*, 2010) are less common, as is the case for measures of labor like labor personnel expenses (Piot-Lepetit & Nzongang, 2014) and the number of loan credit officers (Gutiérrez-Nieto *et al.*, 2007).

Financial and social efficiency are differentiated in the literature through the specification of the outputs considered. Financial outputs are usually measured by financial revenues and the size of the gross loan portfolio (Gutiérrez-Nieto *et al.,* 2009; Ahmad, 2011; Annim, 2012; Kablan, 2012; Kipesha, 2012), while measures of social outputs are commonly related to the concept of outreach and include the number of women borrowers ("depth of outreach") and the number of total borrowers ("breadth of outreach") (Cornée, 2007; Gutiérrez-Nieto *et al.*, 2009; Hassan & Sanchez, 2009; Annim, 2012; Kablan, 2012; Kipesha, 2012). More sophisticated social scores include an indicator of benefit to the poorest[45] (Gutiérrez-Nieto *et al.*, 2009; Kablan, 2012; Ben Abdelkader *et al.*, 2014; Lebovics *et al.*, 2014) or social performance management tools (Amersdorffer *et al.*, 2013), but they are limited in scope since only a few institutions can provide the level detailed information needed to compute them.

There are three main aspects to consider in the specification of a frontier approach for the estimation of efficiency: the orientation of the frontier estimation, the assumption about returns to scale, and the effect of environmental variables on efficiency measures. Regarding orientation, in the input-oriented (output-oriented) estimation the aim is to reduce (increase) the amount of inputs (outputs) as much as possible until the frontier is reached while keeping the outputs (inputs) unchanged. The decision between one or the other orientation must be made according to whether the decision-maker has control over the inputs or over the outputs (Daraio & Simar, 2007). In the case of MFIs, the usual assumption is that their managers have more

[45] This indicator includes the average loan portfolio relative to Gross National Income, therefore being more accurate in cross-country analysis.

control over the inputs. Therefore, many studies assume an input-oriented framework (Gutiérrez-Nieto *et al.*, 2007; Sufian, 2007; Bassem, 2008; Biener & Eling, 2011; Gutiérrez-Goiria & Goitisolo, 2011; Annim, 2012; Kablan, 2012; Kipesha, 2012; Amersdorffer *et al.*, 2013; Ben Abdelkader *et al.*, 2014), but some others run the estimations for both orientations in order to be able to compare the results (Qayyum & Ahmad, 2006; Flückinger & Vassiliev, 2007; Hassan & Sanchez, 2009; Haq *et al.*, 2010; Pal, 2010; Ahmad, 2011).

With respect to returns to scale, some authors have assumed constant returns to scale (Gutiérrez-Nieto *et al.*, 2007, 2009; Lebovics *et al.*, 2014). As this assumption is appropriate only when firms operate at an optimal scale, many authors have compared the results assuming constant and variable returns to scale (Qayyum & Ahmad, 2006; Cornée, 2007; Sufian, 2007; Bassem, 2008; Hassan & Sanchez, 2009; Haq et al., 2010; Ahmad, 2011; Annim, 2012; Kablan, 2012; Kipesha, 2012; Amersdorffer et al., 2013). Yet, only a few studies have tested the returns to scale hypotheses for the entire sample (Biener & Eling, 2011; Ben Abdelkader *et al.*, 2014).

Only a few studies have analyzed the effect of environmental variables in second-stage DEA, using Ordinary Least Squares (OLS) regression (Qayyum & Ahmad, 2006), Tobit regression (Kablan, 2012; Lebovics *et al.*, 2014) or a truncated bootstrap approach (Biener & Eling, 2011; Annim, 2012).

Results vary according to DEA specifications and the region analyzed. E.g. Gutiérrez-Nieto *et al.* (2009) studied 89 MFIs with data for the year 2006 and found a small but positive correlation between social and financial efficiency that differed depending on geographic location: Asian MFIs were associated with high social efficiency, African MFIs revealed low financial efficiency, Latin American MFIs were the most efficient financially, and Eastern European MFIs presented lower social efficiency but higher financial efficiency. They also provided evidence that NGOs were more socially efficient than other institutions. In contrast, Annim (2012) using balanced panel data for 164 MFIs around the world for the period 2004-2008 (implementing both parametric and non-parametric estimations) reported a trade-off between financial sustainability and social performance: in their sample, targeting women had negative effects on financial efficiency scores and increases in financial efficiency were at the expense of social efficiency. Some determinants of efficiency like a better business environment had a positive effect on social efficiency, while others like the degree of financial development affected only financial efficiency. By types of MFIs, banks presented higher financial efficiency scores and NGOs the highest average total efficiency scores (but they were

not among the best performers individually). Cooperatives and Credit Unions (CUCs) showed relatively high efficiency scores across the different measures of social and financial efficiency, and non-bank financial institution (NBFI) emerged to be the most efficient in terms of size of operations.

Kablan (2012) analyzed efficiency in 104 MFIs in West Africa between the years 2000 and 2010, observing that MFIs which stressed outreach tended to be less financially efficient, and that regulation with prudential ratios and accounting standards had a negative impact on social efficiency but a positive one on financial efficiency, results that suggest the existence of a sustainability-outreach trade-off.[46]

Some studies combined social and financial outputs in the same specification. These include on the one hand cross-country analyses such as Hassan & Sanchez (2009), who explored efficiency for 214 MFIs with data for the year 2005 in three regions: Latin America countries, Middle East and North Africa (MENA) countries, and South Asia countries. They found that formal institutions (Banks and CUCs) performed better than non-formal ones. Also, Haq *et al.* (2010) studied efficiency for 39 MFIs in different countries using data for the year 2004, and provided evidence about the dependence of efficiency scores on the approach used. Thus, under the production approach NGOs were more efficient, whereas Banks were more efficient under thje intermediation approach. Furthermore, Ben Abdelkader *et al.* (2014) evaluated MFI efficiency in the MENA region for the period 2006-2009 and found that average efficiency decreased over the period, with NGOs showing higher scores than NBFIs. On the other hand, single country analysis include: Cornée (2007), who investigated efficiency in 18 MFIs in Peru and found that there was no evidence of a trade-off between financial and social efficiency, or Ahmad (2011), who studied the efficiency of MFIs in Pakistan for two years (2003 and 2007) and found efficiency scores decreasing with time. More recently, Amersdorffer *et al.* (2013) explored efficiency for 15 Bulgarian agricultural credit cooperatives and found that institutions with higher financial performance also reached higher rankings in the specification using social outputs.[47]

[46] Another related result was that CUCs showed lower levels of social efficiency mainly because they lend prioritarily to their own members.

[47] Other studies do not distinguish between financial and social efficiency outputs. Thus, Qayyum & Ahmad (2006) for 85 MFIs in South Asia, Gutiérrez-Nieto *et al.* (2007) for 30 MFIs in Latin America in 2003, Sufian (2007) for 315 MFIs in Latin America, and Kipesha (2012) for 35 MFIs in East Africa.

2.3 THE FINANCIAL SYSTEM IN ECUADOR

The financial System in Ecuador had been traditionally divided into regulated and unregulated institutions. The 'regulated' sector covered all the institutions that were under the Banking Supervisory Agency – *Superintendencia de Bancos y Seguros* (SBS) including private and public institutions, and included banks, finance companies, mutual organizations, non-bank financial institutions (NBFIs, composed of insurance and non-insurance companies), and Credit Unions and Cooperatives (CUCs) that were 'large enough' to be supervised (assets greater than USD $10 million) on the private side. The sector included five major public institutions: the National Development Bank (*Banco Nacional de Fomento*-BNF); the National Financial Corporation (*Corporación Financiera Nacional*-CFN); the Ecuadorian Housing Bank (*Banco Ecuatoriano de la Vivienda*-BEV); the Development Bank of Ecuador (Banco de Desarrollo de Ecuador–BEDE); and the National Intendency of Social Security System (*Intendencia Nacional de Seguridad Social*-INSS). In contrast, the 'non-regulated' sector included those small CUCs created under the *Ley de Cooperativas* that did not meet the size requirements of the SBS, non-government organizations (NGOs), and member-based organizations that where part of the informal sector such as savings banks (*cajas solidarias)*, rotating savings and credit association (ROSCAS), Village Banks (*Bancas Comunales*) and other credit and savings associations.

In recent years, financial reforms and regulatory measures have transformed the financial system. The first reform came in august 2007 when the Congress *(Asamblea Nacional)* passed the *Ley de Regulación del Costo Máximo efectivo,* prohibiting commissions and setting maximum limits on the interest rates within different categories[48]. In 2008, the Constitution defined that the financial system is composed of public, private and popular and solidarity-based sectors, as is shown in Figure 2.1, eliminating the dual legal framework for CUCs as well as recognizing for the first-time member-based organizations. However, the 'new' popular and solidarity-based sector was not legally described until the Congress approved the *Ley de Economía Popular y Solidaria* in 2011. This law declared the sector as the sum of three subsectors: CUCs, support organizations and member-based structures, which were put under the supervision of *Superintendencia de Economía Popular y Solidaria* (SEPS).[49]

[48] See Figure A2.1 in the appendix of the chapter.
[49] The Law also allowed upscaling for CUCs and NGOs, and established a moratorium period for the creation and expansion of institutions within the sector.

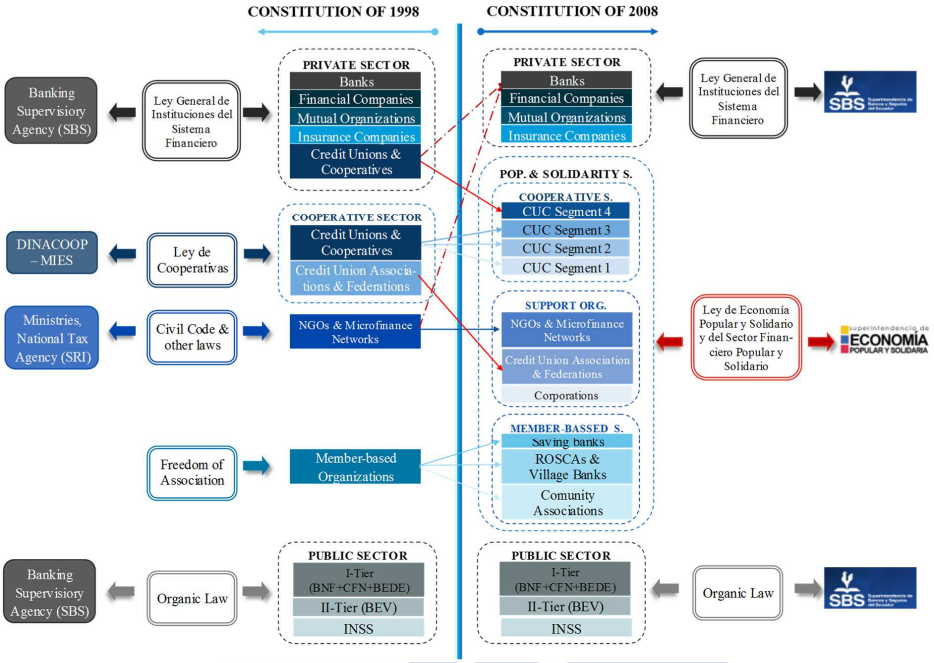

Figure 2.1 Financial Sector in Ecuador and Regulatory Policy. Own elaboration based on the Constitutions of the Republic of Ecuador (1998,2008), *Ley General de Instituciones del Sistema Financiero, Ley de Economía Popular y Solidaria y del Sector Financiero Popular y Solidario, Ley Orgánica de la Corporación Financiera Nacional, Ley Orgánica Reformatoria de la Ley Orgánica del Banco Nacional de Fomento*.

Microfinance markets in Latin America show differences with other markets such as those of Asia and Sub-Saharan Africa. In Latin America MFIs are more commercially-oriented, with higher levels of financial sustainability and less dependence on donations (Armendáriz & Szafarz, 2011; CAF, 2011). There are also differences regarding outreach: Latin American MFIs target better-off clients and build larger average loan portfolios than those in Asia.[50] MFIs in Ecuador share the characteristics described above for the Latin American market.

Red Financiera Rural (RFR) legally started in 2000 as a national network of different institutions gathered in the *Grupo Sistema Financiero Alternativo* that were concerned about three major aspects: law and regulation of microfinance institutions, specialized microcredit methodologies and training; and access to financial services for medium, small and micro

[50] Their clientele lives in urban areas in a higher proportion, and is much more balanced in terms of gender (60% of women, against 80% in Asia). Besides, the percentage of individual lending contracts is around nine times that of South Asian MFIs (CAF, 2011).

enterprises especially in rural and peri-urban areas (C. RFR, 2003). It includes different organizations specialized in microfinance such as Banks, CUCs, financial and non-financial NGOs, second-tier financial institutions, and local networks.[51] Although not all MFIs in the country are members of RFR, the network includes many of the larger ones that represent around 58% of the total microcredit borrowers and 55% of the gross loan microcredit portfolio (EQUIFAX, 2015). As Table 2.1 illustrates, the average loan microcredit portfolio has increased for all type of institutions in RFR between 2009 and 2012.

Table 2.1 Average Loan Portfolio (Microcredit) of MFIs members of RFR

	2009	2010	2011	2012	Average
Banks	2,210	2,558	2,606	2,653	2,507
CUCs	1,980	2,443	3,197	3,575	2,799
NGOs	956	1,108	1,218	1,420	1,175
RFR	*1,909*	*2,213*	*2,471*	*2,648*	*2,310*
Ecuador	2,189	2,123	2,316	3,149	2,444

Note. Authors' elaboration based on EQUIFAX (2015)

The mission statements of RFR have changed from poverty reduction objectives to social and financial inclusion for vulnerable population. In 2003, its mission was to *"promote the creation of tools, mechanisms and processes to overcome poverty as well as social and gender inequality through sustained growth and enhanced productivity of small and medium producers in rural and peri-urban areas"* emphasizing the importance of strengthening MFI members (C. RFR, 2003). In recent years, their focus is on becoming a *"benchmark organization"* that represents common interests of the different stakeholders to develop microfinance, to influence public policies, to strengthen MFI members and to promote social and financial transparency in order *"to contribute improving living conditions of vulnerable people in Ecuador" (C. RFR, 2013).*[52]

These changes in RFR's goals preferences could be explained by the fact that most of its members have financial inclusion as its main goal. Self-reported development goals, target

[51] In addition, to be recommended by two current members, prospective members of RFR must meet the following criteria: to have at least 45% of their portfolio in microcredit, to apply a specialized microcredit methodology based on average outstanding loan portfolio, profile of clients, and outreach. (C. RFR, 2014).

[52] The definition of vulnerable population depends on each MFI and can include low income, poor and very poor population, as well as people with lower education levels, women, micro and small business and other groups without access to financial and non-financial services (C. RFR, 2014).

markets and poverty targets described in the Social Information Profile compiled by the Microfinance Information eXchange (MIX) of 29 MFIs members are shown in Table 2.2.

Table 2.2 First Development Goal by type of MFI

Type IMF	Inclusion		Poverty		Women		Other		Total
	N	%	N	%	N	%	N	%	N
BANK	3	75.00	1	25.00	0	0.00	0	0.00	4
CUC	12	80.00	1	6.67	1	6.67	1[a]	6.67	15
NGO	3	30.00	4	40.00	1	10.00	2[b]	20.00	10
Total	18	62.07	6	20.69	2	6.90	3	10.34	29

Note. [a] Housing (1), [b] Growth Business (1), Adults>65 years(1). Authors' elaboration based on Mix Market (2009) ; *Red Financiera Rural* (2012).

According to the same source, over 60% of CUCs and NGOs target people living in rural areas, while 75% of Banks consider people living in urban and peri-urban areas as their first target. Gender-oriented targets are prominent especially for NGOs although targeting women remains relatively low compared to other targets.[53] Table 2.3 shows that around 62% of the institutions include 'less poor clients' in their poverty targets. Only 2 institutions mention to have "poor and very poor clients" as their target clientele. Differences between poverty targets remains that NGOs and some CUCs are more interested in reaching the poorest of the poor.

Table 2.3 Poverty Targets

Type IMF	1 Target		2 Target				3 Target		No target		Total
	Low income		Low income & poor		Poor & Very poor		Low income, poor & very poor				
	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N
BANK	2	50	2	50.00	0	0.00	0	0.00	0	0.00	4
CUC	6	40	2	13.33	0	0.00	4	26.67	3	20.00	15
NGO	1	10	5	50.00	2	20.0	2	20.00	0	0.00	10
ALL	9	31.03	9	31.03	2	6.90	6	20.69	3	10.34	29

Note. Authors' elaboration based on Mix Market (2009) ; *Red Financiera Rural* (2012).

2.4 METHODOLOGY

There are two types of approaches to estimate efficiency measures based on a frontier approach: parametric and non-parametric. Parametric approaches require the assumption of a specific functional form for the frontier (usually a production or cost function) (Førsund *et al.*,

[53] See Table A2.1 in the appendix.

1980). On the other hand, non-parametric approaches such as DEA have the advantage of avoiding the need for assessing *a priori* measures of the functional relationship between inputs and outputs (Cooper *et al.*, 2011), estimating the production or cost frontier only on the basis of the observed data. The underlying idea is to measure the comparative or relative efficiency with which individual units carry on transformation processes based on the distances between observed performance points and a frontier of "best practices" (Daraio & Simar, 2007, Cooper *et al.*, 2011; Annim, 2012). Nonetheless, DEA also have some limitations. Due to the absence of noise in the model DEA estimators are very susceptible to extreme observations and measurement error (Førsund et al., 1980; Daraio & Simar, 2007).

New techniques have been developed to improve the non-parametric frontier analysis approach (Daraio & Simar, 2007). In order to correct for its deterministic nature and the difficulties in making statistic inference, new approaches consider using asymptotic results or applying bootstrap methodology, implementing methods to detect outliers (partial frontier) or introducing approaches based on local maximum likelihood techniques. Moreover, one-stage and second-stage DEA approaches were developed to include external-environmental factors. Second-stage methods estimate the efficiency scores calculated in the first-stage with DEA, in an appropriate limited dependent variable parametric regression model (like truncated or censored regressions) on the environmental factors. Because of the correlation in DEA efficiency estimates, (Simar & Wilson, 2007) proposed a two-bootstrap-based algorithm to obtain more accurate inferences that will be used in our estimations, as is explained below.

2.4.1 DEA – Bootstrapping approach

According to the Pareto-Koopmans standard definition of efficiency (Cooper *et al.*, 2011), any Decision Making Unit (DMU) attains full efficiency (100%) if and only if none of its inputs or outputs can be improved without worsening some other of its inputs and outputs.

Suppose that some Data Generating Process (DGP) can be denoted by $\mathrm{P} = \mathrm{P}\big(\Psi, f(x,y)\big)$, generates a random sample $\chi = \{(x_i, y_i) | i = 1, .., n\}$. The sample defines, by some method $\mathcal{M}$ (DEA), the estimators $\widehat{\Psi}$, $\widehat{X(y)}$ and $\partial\widehat{X(y)}$. The bootstrap considers a data set $\chi^* = \{(x_i^*, y_i^*) | i = 1, .., n\}$ generated by $\hat{\mathrm{P}}$, and defines de corresponding quantities for $\widehat{\Psi}^*$, $\widehat{X^*(y)}$ and $\partial\widehat{X^*(y)}$. The definition of $\widehat{\Psi}^*$ for DEA approach with variable returns to scales is define as:

$$\hat{\Psi}^* = \left\{(x,y) \in \mathbb{R}_+^{p+q} \mid y \leq \sum_{i=1}^{n} \gamma_i y_i^* ; x \geq \sum_{i=1}^{n} \gamma_i x_i^* ; \sum_{i=1}^{n} \gamma_i = 1;\ \gamma_i \geq 0,\ \forall\, i = 1,..,n\right\} \tag{2.1}$$

Then $\hat{\theta}_k$ is computed by solving the following linear program:

$$\hat{\theta}_k^*(x,y) = min\left\{\theta > 0 | y_k \leq \sum_{i=1}^{n} \gamma_i y_i^* ; \theta x_k \geq \sum_{i=1}^{n} \gamma_i x_i^* ; \sum_{i=1}^{n} \gamma_i = 1;\ \gamma_i \geq 0;\ \forall\, i = 1,..,n\right\} \tag{2.2}$$

Since $\hat{\Psi}^* \subseteq \hat{\Psi}$, which mimics the original fact $\hat{\Psi} \subseteq \Psi$. Conditional on χ the sampling distributions of $\hat{\Psi}^*$, $\widehat{X^*(y)}$ and $\widehat{\partial X^*(y)}$ are (in principle) know since $\hat{\mathrm{P}}$ is known, however difficult to compute. Monte Carlo methods can be used to approximate sample distribution, using $\hat{\mathrm{P}}$ to generate B samples $\chi_b^*, b = 1, ..., \mathrm{B}$, and applying $\mathcal{M}$ to each of these pseudo samples yields pseudo estimates $\{\hat{\theta}_{k,b}^*\}_{b=1}^{\mathrm{B}}$, the empirical density function of $\{\hat{\theta}_{k,b}^*\}_{b=1}^{\mathrm{B}}$ is the Monte Carlo approximation of the distribution $\hat{\theta}_k^*$ conditional on $\hat{\mathrm{P}}$. If the bootstrap method is consistent, then $\hat{\mathrm{P}}$ is a reasonable estimator of P, and for the efficiency measure θ_k for a given fixed unit (x_k, y_k) we have:

$$\left(\hat{\theta}_k^* - \hat{\theta}_k\right)|\hat{\mathrm{P}} \sim \left(\hat{\theta}_k - \theta_k\right)|\mathrm{P} \tag{2.3}$$

Where θ_k, $\hat{\theta}_k$ and $\hat{\theta}_k^*$ are define by (2.4), (2.5) and (2.6).

$$\begin{aligned} \partial X(y) &= \{x | x \in X(y), \theta x \notin X(y) \quad \forall\, 0 < \theta < 1\} \\ \partial Y(x) &= \{y | y \in Y(x), \beta y \notin Y(x) \quad \forall \quad \beta > 1\} \end{aligned} \tag{2.4}$$

$$\hat{\theta}_k(x,y) = min\left\{\theta > 0 | y_k \leq \sum_{i=1}^{n} \gamma_i y_i ; \theta x_k \geq \sum_{i=1}^{n} \gamma_i x_i ; \sum_{i=1}^{n} \gamma_i = 1;\ \gamma_i \geq 0;\ \forall\, i = 1,..,n\right\} \tag{2.5}$$

and,

$$\hat{\theta}_k^*(x,y) = min\left\{\theta > 0 | y_k \leq \sum_{i=1}^{n} \gamma_i y_i^* ; \theta x_k \geq \sum_{i=1}^{n} \gamma_i x_i^* ; \sum_{i=1}^{n} \gamma_i = 1;\ \gamma_i \geq 0;\ \forall\ i = 1,..,n\right\}. \quad (2.6)$$

Simar & Wilson, (1998; 2000; 2007) showed that non-parametric efficiency scores are biased by construction and the property that is mean is equal to the target value of the parameter being estimated is not met, then $\hat{\theta}_k^*$ is a biased estimator of θ_k , so the bias can be define as:

$$bias\left(\hat{\theta}_k(x,y)\right) = E_{\mathrm{P}}\left(\hat{\theta}_k(x,y)\right) - \theta_k(x,y) \quad (2.7)$$

By its bootstrap estimates:

$$bias\left(\hat{\theta}_k^*(x,y)\right) = E_{\mathrm{P}}\left(\hat{\theta}_k^*(x,y)\right) - \hat{\theta}_k(x,y) \quad (2.8)$$

The expectation is given by the mean of Monte Carlo simulations of $\{\hat{\theta}_{k,b}^*\}_{b=1}^{\mathrm{B}}$, so its bootstrap estimate:

$$\widehat{bias}\left(\widehat{\theta_k}\right) = B^{-1}\sum_{b=1}^{B}\hat{\theta}_{k,b}^* - \hat{\theta}_k = \bar{\theta}_k^* - \hat{\theta}_k, \qquad \forall\ i = 1,\dots,n \quad (2.9)$$

A bias-corrected estimator of θ_k is obtained by defining:

$$\tilde{\theta}_k = \hat{\theta}_k - \widehat{bias}\left(\widehat{\theta_k}\right) = 2\hat{\theta}_k - \bar{\theta}_k^* \quad (2.10)$$

And the standard error of $\tilde{\theta}_k$ may be estimated by:

$$\widehat{se} = \left\{\frac{1}{\mathrm{B}-1}\sum_{b=1}^{\mathrm{B}}\left(\hat{\theta}_{k,b}^* - \bar{\theta}_k^*\right)^2\right\}^{1/2} \quad (2.11)$$

Since correcting for the bias introduces additional noise increasing the variance of the estimator, the DEA efficiencies are corrected unless $\frac{|\widehat{BIAS}(\hat{\theta}_i)|}{\widehat{std}(\hat{\theta}_i)} > \frac{1}{4}$. However, due to the inherited bias of the DEA estimators, the bias-correction has almost been performed (Daraio & Simar, 2007).

2.4.2 Returns to Scale

In order to avoid the risk of inconsistency estimating technical efficiency considering constant returns to scale (CRS) or a loss of statistical efficiency if we assume variables return

to scale (VRS) we have tested the hypothesis regarding returns to scale as suggested by (Simar & Wilson, 2002). They proposed a bootstrap procedure to test the more restrictive model of constant returns to scale against the VRS, if there is no evidence to the contrary there is no point in estimating scale efficiency. Using the bootstrap procedure, they specified the production set in equation (1), so the boundary of Ψ referred as the *technology* or *production frontier*, and is given by the intersection of Ψ and the closure of its complement, denoted by Ψ^B, Formally, this suggest Test 1: H_0: Ψ^B is globally CRS against H_1: Ψ^B.

Under VRS the attainable set is estimated by the free-disposal convex hull of the cloud of points. The VRS estimators are consistent whatever being the hypothesis on RTS, the CRS are only consistent if the CRS hypothesis is true. So, if the CRS hypothesis is true, the two sets of estimators would be very similar using as test statistics the mean of ratios of the efficiency scores:

$$\hat{\mathcal{S}}_{in}^{CRS} = n^{-1} \sum_{i=1}^{n} \frac{\hat{\theta}_{VRS,n}(x_i, y_i)}{\hat{\theta}_{CRS,n}(x_i, y_i)} \tag{2.12}$$

By construction $\hat{\theta}_{CRS,n}(x_i, y_i) \leq \hat{\theta}_{VRS,n}(x_i, y_i)$ and we will reject the null hypothesis if the test statistics $\mathcal{S}$ is too small. The *p*-value of the null hypothesis is then obtaining by computing:

$$p = Pr(\hat{\mathcal{S}}_{in}^{CRS} \leq \mathcal{S}_{OBS} | \mathrm{H}_0) \tag{2.13}$$

Given that $\hat{\mathcal{S}}_{in}^{CRS}$ is unknown, we can approximate this value to $\mathcal{S}_{OBS}$ using bootstrap algorithm described above, together with the original values to estimate $\hat{\mathcal{S}}_{in}^{CRS}$, $\mathcal{S}_{OBS}$ or . $\hat{p}$, defined as:

$$\hat{p} = Pr(\hat{\mathcal{S}}_{in}^{CRS^*} \leq \hat{\mathcal{S}}_{OBS} | \mathrm{H}_0) \tag{2.14}$$

2.5 Data and Settings

The data source is *Red Financiera Rural* (RFR). Our database includes the 34 institutions that reported financial information for each and all of the years in the period 2009-2012.[54] These include five 60ssig (*Solidario, Procredit, Finca, D'Miro and Coopnacional*)[55]; eighteen CUC

[54] This is a limited number of institutions in comparison with e.g. the information gathered by Equifax, a National Bureau. In fact, we could not even include all MFI members of RFR in our analysis because some institutions stopped reporting information or dropped out the network during our period of analysis. The 34 institutions (out of 43 current members) represent only 45% of the total microcredit loan portfolio of Ecuador.

[55] *D'Miro* (ex-NGO) and *Coopnacional* (ex-CUC) became banks in 2011.

(*Jardín Azuayo, Mujeres Unidas, Luz del Valle, La Benéfica, Santa Anita, Mushuc Runa, San Antonio, Codesarrollo, San José, Cooprogreso, Maquita Cushunchic, Chone, Artesanos, 4 de Octubre, Ambato, Kullki Wasi, UCADE-Padre Vicente Ponce Rubio, San Gabriel*); and eleven NGOs (*UCADE-Fasca Sto. Domingo, UCADE-Diósesis Latacunga, Fundación Alternativa, Insotec, Fundamic, Casa Campesina de Cayambe, Fodemi, Espoir, Faces, Cepesiu, UCADE-Diósesis Ambato*).

We performed a second-stage DEA following a production approach where MFIs are treated as firms that use physical inputs, employees and spend money in order to grant loans and collect fees.[56] In the first-stage, after testing for returns to scale we calculated efficiency scores using an input-oriented approach (minimizing inputs to a given output and technology) with mean normalized data[57]. In the second-stage, we obtain bias-corrected technical efficiency scores using the bootstrap method suggested by Simar & Wilson (2007) and then we run a truncated regression on the external explanatory variables of MFIs' efficiency.

The inputs used in this analysis are total expenses (T)[58] and the number of total employees I. As financial outputs, we include the gross loan portfolio (L) and financial revenue I, whereas as social efficiency outputs we define *breadth of outreach* as the number of all borrowers (B) and *depth of outreach* as the number of women (W) and microcredit borrowers (M).[59] We have created six different model specifications: TE-L, TE-R, TE-LR as measures of technical financial efficiency and TE-M, TE-W and TE-B as measures of social efficiency. The definitions of the different inputs and outputs can be seen in table 4.[60]

[56] Gutiérrez-Nieto *et al.* (2009), Annim (2012). Current regulations do not allow NGOs to collect deposits from the general public. This and other MFI characteristics do not allow us to justify conventional costs and profit functions for social and financial outcomes

[57] Sarkis (2007) recommends data transformation when there is imbalance in data magnitudes.

[58] We explored using financial expenses, and also operating expenses plus impairment losses instead of total expenses, as in Annim (2012). Estimations using operating expenses yielded similar results to the ones here presented, because operating expenses represent the bulk of all costs for the MFIs included in the sample. The results of these estimations are reported in Table A2.3 in the appendix.

[59] Depth of outreach is usually measured by the average loan portfolio; see e.g. Hulme & Mosley (1996b), Schreiner (2002), Cull et al. (2007), Armendáriz & Murdoch (2010). However, standard DEA models do not consider ratios as output, since the denominator can become an input in the estimation process and may result in incorrect efficiency scores; see Emrouznejad, Anouze, & Thanassoulis (2010). We chose microcredit borrowers to measure depth of outreach because they are the main target clients of RFR (C. RFR, 2014), and they face the lack of access to financial services as one of the main barriers in order to improve their business (SALTO-USAID, 2005). We included also the number of women, because it is one of the main objectives of microfinance; see Morduch (1999), Dowla & Barua (2006) or Armendáriz & Murdoch (2010).

[60] Due to the lack of information we included only outreach outputs as measures of social performance, excluding other important targets for MFIs such as geographical outreach (rural clients), or adapted services and social responsibility (as in e.g. Bédécarrats et al., 2012).

Table 2.4. Definitions of Inputs and Outputs for DEA models

Variable symbol	Variable name	Definition	Unit
Input T	Total expenses	Financial Expenses + Impairment Losses + Operating Expenses	($)
Input E	Personnel	Total number of staff members	Number
Output L	Gross loan portfolio	Outstanding principal balance of all outstanding client loans (including current, delinquent, and renegotiated)	($)
Output R	Financial Revenue	Interest, fees & commissions incurred on the loan portfolio & other financial assets + other operating revenue	($)
Output M	Number of microcredit borrowers	Number of active microcredit borrowers	Number
Output W	Number of active women borrowers	Number of active borrowers who are women	Number
Output B	Number of active borrowers	Number of active borrowers	Number

Note. Authors' elaboration based on Red Financiera Rural (2009-2012).

The external explanatory variables used for the truncated regression in a second stage are summarized in table 2.5 and include institutional characteristics such institutional type and credit methodology[61] and a dummy variable for each year of the period 2009-2012. MFIs report their loan portfolio by the credit methodology applied using three categories[62]: individual lending (single-client lending where repayment relies solely on the individual), group lending (a group of individuals provide collateral or loan guarantee through a group repayment pledge), and village banking (clients form groups of approximately 10-30 individuals that are autonomously responsible for leadership, bylaws, bookkeeping, fund management and loan supervision):

Table 2.5. Definitions of explanatory variables for 2nd stage

Type of variable	Variable name	Definition
Institutional Characteristics	Institutional Type	1 = Bank; 2 = Credit Union/Co-operative (CUC); and 3 = Non-government organization (ONG)
	Credit methodology	% of GLP granted: 1=Group lending + Village banking; and 0= Individual lending
Time	Period	Takes values from 1 to 4 for each year of the period 2009-2012

Note. Authors' elaboration based on Red Financiera Rural (2009-2012).

[61] It is important to notice that despite the new regulatory framework, CUCs began to report information to the SEPS only after December 2012. Therefore, regulation (whether the MFIs were under the supervision of SBS) can be considered as a proxy of size and we excluded it from our analysis.
[62] See MIX (2004) and Table A2.4.

Figure 2.2 illustrates descriptive statistics by type of institution.[63] It can be easily observed that Banks are large MFIs, both in gross loan portfolio and in number of borrowers, and that NGOs are smaller. In contrast, CUCs show wide ranges in all input and output measures, including both relatively small institution and very large ones.

[63] Normalized descriptive statistics can be found in Table A2.5 in the appendix.

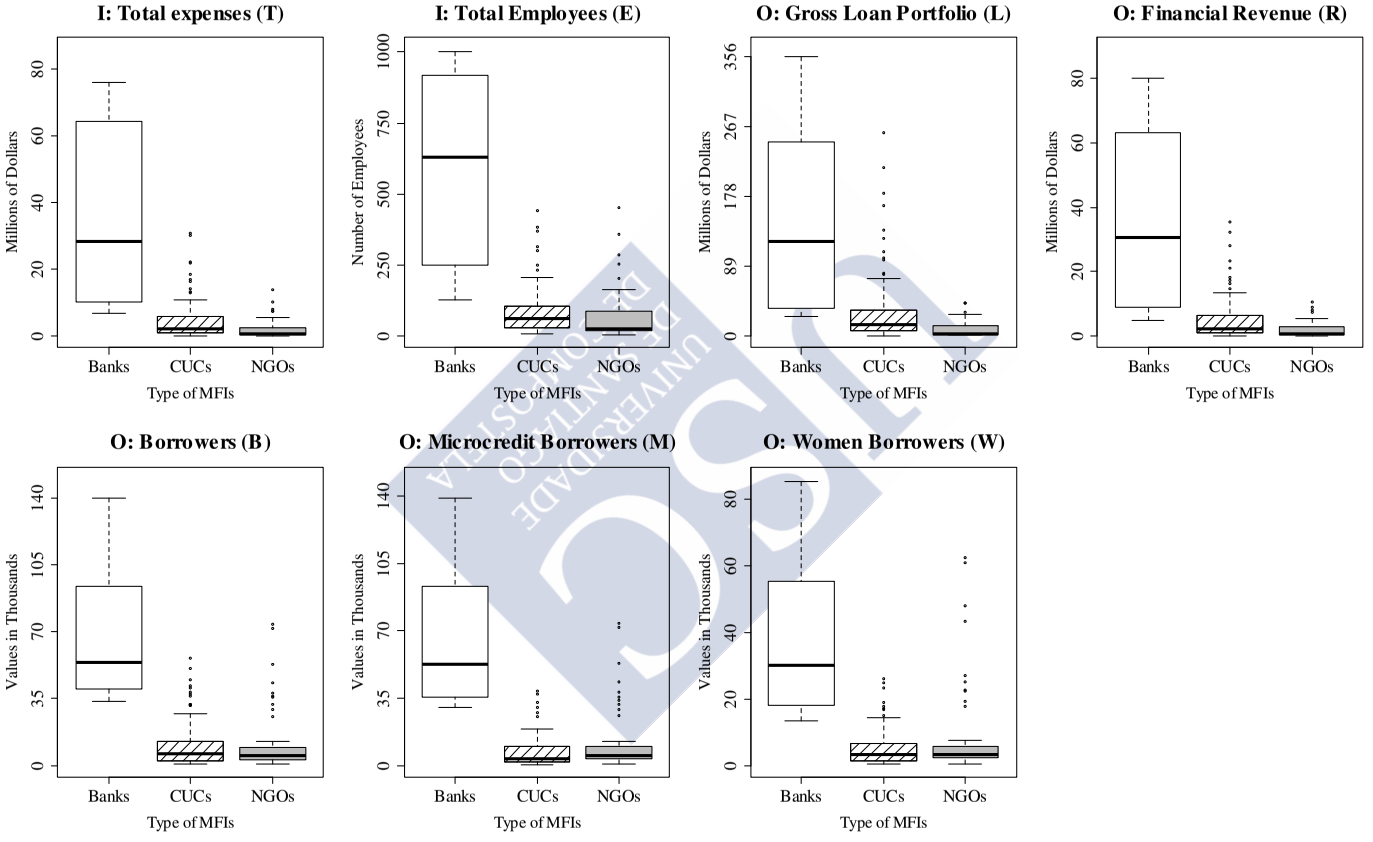

Figure 2.2 Boxplots of inputs and outputs for DEA estimations. Authors' elaboration based on Red Financiera Rural (2009-2012).

We are interested in exploring up to what extent our efficiency scores are correlated with traditional performance indicators (both related to financial and social targets).[64] Descriptive statistics for the indicators considered are shown in table 2.6.

Table 2.6. Descriptive Statistics for Performance Ratios

Variables	Total
Overall Financial Performance	*Mean (Sd.)*
ROE	0.112 (0.10)
ROA	0.026 (0.02)
OSS	1.229 (1.13)
Outreach	
Women borrowers	0.575 (0.54)
Risk	
PAR >30 days	0.034 (0.03)
Finance Structure	
Cost-of-funds ratio	0.065 (0.06)
Yield on gross loan portfolio	0.188 (0.18)
Efficiency and productivity	
GLP/staff members	246,895 (224,541)
Borrowers/staff members	151.981 (131.92)
Personnel allocation ratio	0.366 (0.35)
Personnel allocation ratio (women)	0.163 (0.16)
Operational Efficiency Ratio	0.136 (0.12)
N	136

Note. Authors' elaboration based on Red Financiera Rural (2009-2012).

The use of the different credit methodologies is described in table 2.7. MFIs in RFR grant loans using mostly and increasingly individual lending methods.[65] Only NGOs rely substantially (almost 50% on average) on group lending techniques for their credit operations.

Table 2.7. Group-based lending methodology – MFI members of RFR

	2009	2010	2011	2012	Average
Banks	0.280	0.304	0.181	0.148	0.212
CUCs	0.150	0.131	0.108	0.127	0.129
NGOs	0.472	0.445	0.492	0.460	0.467
Total	0.275	0.257	0.243	0.238	0.253

Note. Authors' elaboration based on Red Financiera Rural (2009-2012).

[64] The definitions of the indicators can be found in Table A2.6 in the appendix and are divided into five groups: i) Overall Financial Performance, ii) Outreach, iii) Risk and Liquidity, iv) Financing Structure and v) Efficiency and Productivity. Detailed information by type of institution can be found in Table A2.7 in the appendix.

[65] Notwithstanding, there are a few institutions (1Bank and 2 CUC) that base more than 50% of their portfolio on group lending methods.

2.6 RESULTS

The choice of assumptions regarding returns to scale in the estimation of technical efficiency may lead to inconsistent estimators if constant returns to scale (CRS) are wrongly assumed or to a loss of statistical efficiency when the wrong assumption imposes variable returns to scale (VRS). In order to avoid these potential problems, we have tested the CRS hypothesis following the bootstrap procedure suggested by Simar & Wilson (2002). Thus, we build a test statistic by computing the mean of ratios of the VRS and CRS efficiency scores with our data, and then obtain p-values using the bootstrap algorithm described in Section 4.[66] We find that we cannot reject the null hypothesis of CRS when we use gross loan portfolio (L) and all outreach outputs (M, W, B), but we can reject it (and, hence, assume VRS) when we include financial revenues as output.[67]

Table 2.8. Testing Returns to Scale (p-values)

	2009	2010	2011	2012
TE-L	0.414	0.406	0.242	0.420
TE-R	0.030	0.026	0.008	0.005
TE-LR	0.026	0.049	0.013	0.016
TE-W	0.805	0.842	0.527	0.631
TE-M	0.596	0.789	0.520	0.581
TE-B	0.700	0.713	0.392	0.401

Note. Authors' elaboration based on Red Financiera Rural (2009-2012).

Figure 2.3 pictures the values of bias-corrected efficiency scores. The general trend was of decline in the first two years and recovery in the last half of the period. But while financial efficiency scores returned and even overcome their 2009 levels in 2012, outreach efficiency scores fell behind.[68] By type of institutions, CUCs show consistently higher financial efficiency scores, while NGOs are the more efficient institutions regarding our outreach measures. Banks occupy a middle position in both dimensions.

[66] This procedure uses the consistency properties of the estimators to build the test flor the CRS hypothesis. VRS estimators are always consistent, while CRS estimators are only consistent if the CRS hypothesis is true. Thus, if the CRS hypothesis were true, the two sets of estimators would be very similar.

[67] All the reported results were obtained using the FEAR package in R. In this particular case, we run 2,000 replicas. See Table A2.8 in the appendix for a full report of the results.

[68] The only exception to the trend is the evolution of financial efficiency scores for Banks, that decrease continuously for all model specifications.

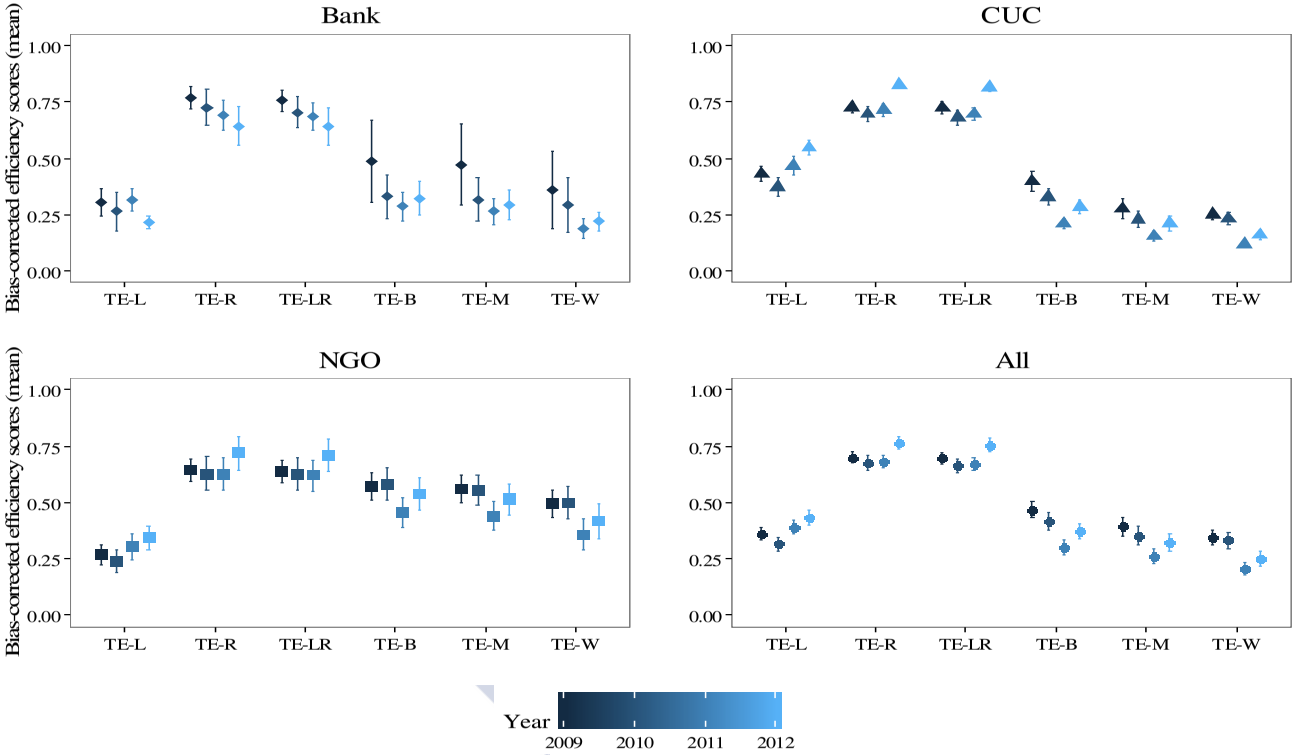

Figure 2.3. Patterns of MFI's efficiency. The graph shows the mean values of the bias-corrected efficiency scores. Error bars represent 95% confidence intervals. CUC= Cooperative and Credit Unions. NGOs= non-governmental organization. *Note.* Authors' elaboration based on Red Financiera Rural (2009-2012).

In Figure 2.4 we show the size of the differences between each type of microfinance institutions for both social and financial efficiency scores. We use pairwise comparisons of the standardized mean differences (SMD) described in detail in Chapter I, to show the differences in efficiency scores among types of microfinance institutions.[69] As seen in the figure, there are small differences among financial efficiency with the exception being on TE-L efficiency scores where large differences are observed between CUCs and the other two types of MFIs. At the same time, we observed that there are differences between types of microfinance institutions in social efficiency scores. More specifically, the greatest differences occur between the efficiency scores that have as output the female borrowers and nd among pairwise comparisons that include NGOs in the analysis.

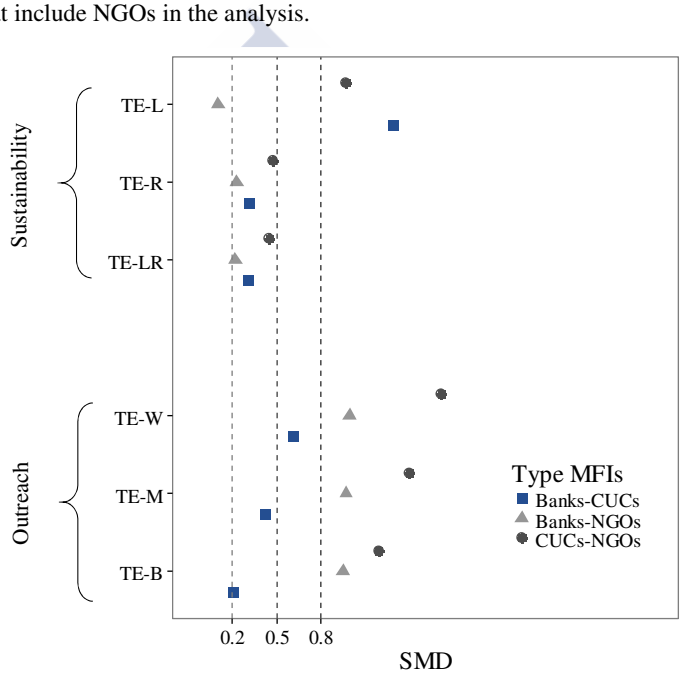

Figure 2.4. Standardized mean difference of social and financial efficiency scores by type of microfinance institutions. The SMD was estimated using *tableone* package in R (Yoshida et al., 2015). Authors' elaboration based on Red Financiera Rural (2009-2012).

We explore the relationship of bias-corrected efficiency scores (financial and social) with a series of standard indicators of (financial and social) performance. The correlations for the pooled sample are shown in Table 2.9. These results only describe associations between

[69] We use the same cutoffs defined by Cohen (1992) corresponding to small, medium and large differences (d=.20, .50, .80, respectively). For a detail discussion about the effect size please see Chapter I.

efficiency scores and traditional ratios. Although causal inferences cannot be made from them, we can nevertheless detect some possible complementarities and trade-offs by looking at the signs of the correlations.

In short, all indicators considered show positive correlation with some efficiency score, with the exception of the portfolio-at-risk measure, which shows no significant correlation with any score, and the cost-of-funds ratio, which is an inverse measure of productivity, and thus shows negative correlation with financial efficiency scores. More interestingly, some of the indicators that show positive correlation with social efficiency scores are, at the same time, negatively correlated with financial efficiency scores. This is the case for the percentage of female borrowers, as well as for the yield on the gross loan portfolio (GLP), that indicates the ability to generate cash financial revenues from interest, fees and commissions, regarding the efficiency in generating GLP as output. On the other side, apparent labor productivity measured as the size of GLP per staff member, an indicator positively associated with financial efficiency, shows negative correlation with social efficiency scores (except in the case where the output measured is the number of active borrowers).

Table 2.9. Correlation between efficiency scores and financial ratios (DEA-Bootstrap)

	TE-L	TE-R	TE-LR	TE-M	TE-W	TE-B
Overall Financial Performance						
ROE	0.022	0.300***	0.302***	0.050	0.019	–0.009
ROA	–0.026	0.164	0.178*	0.543***	0.478***	0.501***
OSS	0.353***	0.190*	0.188*	0.356***	0.202*	0.385***
Outreach						
Women borrowers (pct.)	–0.522***	–0.375***	–0.362***	0.476***	0.655***	0.385***
Risk						
PAR >30 days	0.131	0.020	0.021	–0.175*	–0.155	–0.143
Finance Structure						
Cost-of-funds ratio	–0.306***	–0.242**	–0.241**	0.129	0.145	0.017
Yield on gross loan portfolio	–0.613***	–0.124	–0.098	0.385***	0.389***	0.255**
Efficiency and productivity						
GLP/staff members	0.860***	0.482***	0.456***	–0.229**	–0.276**	–0.050
Borrowers/staff members	0.046	0.138	0.152	0.790***	0.748***	0.822***
Personnel allocation ratio	–0.219*	–0.097	–0.082	0.608***	0.577***	0.544***
Personnel allocation ratio (women)	–0.099	–0.329***	–0.340***	0.047	0.082	0.045
Operational Efficiency Ratio	–0.717***	–0.377***	-0.354***	0.213*	0.260**	0.103
N	136	136	136	136	136	136

Note. Authors' elaboration based on Red Financiera Rural (2009-2012).
Sig.: $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$

Finally, we estimated a truncated regression on environmental external variables using maximum likelihood with 1,000 bootstrap replicas. The results are summarized in Table 2.10.[70] The sharper ones are related to the lending methodology, suggesting the existence of a trade-off between financial and social efficiency for the institutions with higher percentages of their loan portfolio granted through group-based lending methodologies.[71] These MFIs got higher scores in depth of outreach and lower scores in terms of profitability, in a way consistent with

[70] Since DEA scores are biased by construction, we performed a principal component analysis for improving discrimination as suggested by Cinca & Molinero (2004) or Adler & Yazhemsky (2010), and then performed an OLS in a second stage. The results were similar to the ones reported in Table 2.10 from the double bootstrap truncated regression. See Table A2.9 in the appendix. We also implemented the methodology suggested by Banker & Natarajan (2008) to include DEA in the first stage followed by OLS in the second stage and estimated the relationship $ln\,\hat{\theta}_k^* = Z_i\beta + \varepsilon_i$. The results, presented in Table A2.10, were once again similar, with equal signs but greater coefficients for all variables, which may reflect the bias of DEA estimates identified by Simar & Wilson (2011).

[71] Excluding associative and second tier lending.

the results obtained by Cull et al. (2007). It is interesting to note that, in our sample, group lending is highly and significantly associated with the percentage of women borrowers, hinting at a negative relationship between MFI focused on female borrowers and efficiency in terms of sustainability, like the one found in Hermes *et al.* (2011).

A second outstanding result is the evidence about a negative effect for outreach efficiency in the year 2011 (taking 2009 as reference). One possible explanation for this can be ascribed to the impact of the approval of the *Ley de Economía Popular y Solidaria* that introduced entry barriers for CUC prohibiting its expansion and opening of new branches. This negative effect seems to have spilled into the following year, 2012, although with lower and less statistically significant coefficient values.

Table 2.10. Determinants of social and financial technical efficiency of bias-corrected DEA estimates – Total Expenses (Truncated Regression)

	(1) TE-L	(2) TE-R	(3) TE-LR	(4) TE-M	(5) TE-W	(6) TE-B
Type of MFI (Ref.: Banks)						
CUCs	0.203***	0.050	0.042	-0.144*	-0.074	-0.046
	(4.788)	(0.902)	(0.850)	(-2.439)	(-1.522)	(-0.789)
NGOs	0.075	-0.006	-0.003	0.153*	0.130**	0.158*
	(1.406)	(-0.088)	(-0.049)	(2.469)	(2.599)	(2.452)
Methodology (Ref.: Others)						
Group lending (pct.)	-0.167***	-0.166***	-0.156***	0.250***	0.309***	0.189***
	(-3.387)	(-3.551)	(-3.462)	(4.751)	(6.524)	(3.339)
Period (Ref.: Year=2009)						
2010	-0.057	-0.036	-0.044	-0.050	-0.011	-0.055
	(-1.301)	(-0.730)	(-0.955)	(-0.864)	(-0.283)	(-1.009)
2011	0.035	-0.028	-0.036	-0.180**	-0.185***	-0.198***
	(0.861)	(-0.599)	(-0.837)	(-3.150)	(-4.713)	(-3.796)
2012	0.080*	0.087	0.074	-0.086	-0.108*	-0.102+
	(2.001)	(1.620)	(1.487)	(-1.481)	(-2.556)	(-1.901)
Constant	0.257***	0.750***	0.740***	0.329***	0.240***	0.384***
	(5.565)	(12.589)	(13.790)	(4.828)	(4.519)	(5.815)
Sigma						
Constant	0.159***	0.181***	0.173***	0.188***	0.149***	0.186***
	(11.101)	(9.563)	(9.891)	(10.525)	(14.150)	(12.263)
Wald	74.335	28.277	26.876	109.511	164.690	73.399
N. of cases	136	136	136	136	136	136

Note. Z-values in parentheses are based on 1,000 bootstrap estimations of the truncated regression. Authors' elaboration based on Red Financiera Rural (2009-2012).
Sig.: *p < .05, ** p < .01, *** p < .001

We have also included the type of institution in our regression as a potential determinant of the efficiency scores, taking Banks as the reference category. Although Banks are the MFIs with the highest profit levels and the ones with the larger number of borrowers, we could find no evidence of a relatively negative impact on efficiency of an institution giving microcredit not being a bank. [72]. 'In fact, being an NGO rather than a Bank appears to have a positive effect on social efficiency no matter how we measure the outreach outputs. As this effect is present even if we consider all borrowers, this can be interpreted as lack of evidence that cross-subsidization is taken place in the microcredit practices of the NGOs. Finally, being a CUC in our sample rather than a Bank has a positive effect on financial efficiency scores when we use gross loan portfolio as output.[73]

2.7 CONCLUSIONS

To analyze the possibility of detecting mission-drift among MFI in Ecuador, we have explored both mission statements of the institutions and performance. Overall, we provide evidence suggesting that MFI members of RFR have shift their mission statements from poverty to self-sustainability goals. While the information by type of institution refers to a single period, the evolution of the mission and objectives of the RFR may be a reflection of the situation of the mission statements and poverty goals for most member institutions.

Our results show that in a context of maximum interest rates and regulatory changes, Cooperatives and Credit Unions have moved up-market to segments that are more profitable, NGOs are more efficient in terms of outreach but sustainability is not ensure and Banks even though are the major providers of financial services are not the most efficient ones. One plausible explanation for the changes in performance for CUCs have experience most of the regulatory framework that have limited the expansion of CUC prioritizing financial outcomes over social ones. Hence, regulation may be causing unplanned changes in mission statements and preferences (*mission-pull)* among CUCs that now have strong incentives to focus on sustainability at the expense, of social outcomes. In fact, the efficiency scores for social outcomes decline sharply and CUCs are not able to recover the levels of efficiency prior to the

[72] With the only exception of a negative effect for CUCs when social efficiency is measured using the number of microcredit borrowers as output. These results stand even in the presence of VRS for financial efficiency (financial revenues). In this case, we included size as an independent variable using Asset (ln) and the effect after controlling for this variable is that CUCs and NGO performed better than Banks. See Table A2.11 in the appendix.

[73] The estimations for CUCs have to be taken with precaution because the number of institutions analyzed in our study only represents around 35% of the entire total microcredit loan portfolio and 37% of total microcredit borrowers of all CUCs in the country, undermining our ability to make inferences.

introduction of regulatory changes while sustainability scores are amongst the highest in the sample.

Our empirical results show that group-based lending methodology has a positive effect on social efficiency but negative on financial efficiency. This suggest that trade-offs between social and financial outcomes are stronger that the synergies of providing financial services for vulnerable populations. Hence, there is not apparent win-win relationship in Ecuador and targeting traditional excluded groups comes with a price. The results may be extended to trade-offs between social and financial efficiency when lending to female entrepreneurs because group-lending methodology has been traditionally used to provide financial services mainly to female borrowers.

Further research should explore the reasons for this negative association and test whether the heterogeneity among female entrepreneurs described in Chapter I may increase the cost of providing specialized financial services to better target the characteristics of female entrepreneurship.

APPENDICES TO CHAPTER II

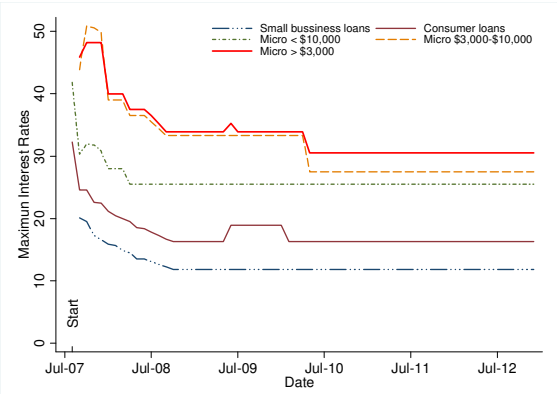

Figure A2.1. Maximum interest rates (2007-2012). Authors' elaboration based on Ecuadorian Central Bank (2007-2012).

Table A2.2. Female Microcredit Borrowers – MFI Ecuador

	2009	**2010**	**2011**	**2012**	**Average**
Total	898,772	1,309,005	1,457,214	1,290,736	1,238,932
Women Borrowers	522,297	842,945	929,027	723,117	754,347
% of Women Borrowers	**58.11%**	**64.40%**	**63.75%**	**56.02%**	**60.6%**

Note. Authors' elaboration based on Equifax (2015) special report for CACMU.

Table A2.3 Determinants of social and financial technical efficiency of bias-corrected DEA estimates –Financial Expenses (Truncated)

	(1) FE-L Coef./ z-value	(2) FE-R Coef./ z-value	(3) FE-LR Coef./ z-value	(4) FE-M Coef./ z-value	(5) FE-W Coef./ z-value	(6) FE-B Coef./ z-value
Type of MFI (Ref.: Banks)						
CUCs	0.159***	-0.047	0.025	-0.131*	-0.062	-0.038
	(3.718)	(-0.761)	(0.412)	(-2.318)	(-1.286)	(-0.683)
NGOs	0.016	-0.056	-0.056	0.109+	0.105*	0.116+
	(0.303)	(-0.828)	(-0.862)	(1.905)	(2.116)	(1.960)
Methodology (Ref.: Others)						
Group lending (pct.)	-0.106+	-0.153**	-0.125*	0.217***	0.277***	0.160**
	(-1.856)	(-3.099)	(-2.481)	(4.630)	(6.246)	(3.167)
Period (Ref.: Year=2009)						
2010	-0.066	0.077	-0.010	-0.055	-0.006	-0.063
	(-1.381)	(1.588)	(-0.216)	(-1.040)	(-0.162)	(-1.282)
2011	0.048	0.011	0.002	-0.197***	-0.206***	-0.220***
	(1.094)	(0.242)	(0.050)	(-3.762)	(-5.195)	(-4.553)
2012	0.033	0.018	0.032	-0.063	-0.096*	-0.087+
	(0.789)	(0.400)	(0.686)	(-1.208)	(-2.394)	(-1.787)
Constant	0.338***	0.509***	0.541***	0.327***	0.234***	0.384***
	(6.917)	(7.516)	(8.568)	(5.190)	(4.522)	(6.216)
Sigma						
Constant	0.173***	0.183***	0.182***	0.175***	0.143***	0.175***
	(11.413)	(16.087)	(16.231)	(10.133)	(13.508)	(12.067)
Wald	37.938	15.535	17.062	93.321	115.839	62.506
N. of cases	136.000	136.000	136.000	136.000	136.000	136.000

Note. We test for RTS and we could not reject the null hypothesis for all the specifications therefore CRS are assumed. [a] z-values are based on 1000 bootstrap estimation of the Truncated regression. Authors' elaboration based on Red Financiera Rural (2009-2012).

Sig.: * $p < .05$,** $p < .01$,*** $p < .001$

Table A2.4. Descriptive Statistics of credit methodology variables

Variables	*mean*	*median*	*st. dev*	*min*	*max*
Individual Lending	0.733	0.968	0.375	0.000	1.000
Group Lending	0.113	0.000	0.227	0.000	0.990
Village banking	0.140	0.000	0.300	0.000	1.000
Association lending	0.005	0.000	0.020	0.000	0.140
Second-tier lending	0.010	0.000	0.055	0.000	0.430
N	136				

Note. Authors' elaboration based on Red Financiera Rural (2009-2012).

Table A2.5. Descriptive Statistics of normalized inputs and outputs

Variables	*mean*	*median*	*St. dev.*	*Min*	*max*
Total expenses	1.00	0.31	1.94	0.01	11.26
Personnel	1.00	0.45	1.60	0.03	7.60
Gross loan portfolio	1.00	0.32	1.70	0.02	8.40
Financial Revenue	1.00	0.30	1.90	0.02	10.00
Number of microcredit borrowers	1.00	0.35	1.60	0.04	8.60
Number of active women borrowers	1.00	0.32	1.50	0.04	7.50
Number of active borrowers	1.00	0.35	1.40	0.04	7.60
N	136				

Note. Authors' elaboration based on Red Financiera Rural (2009-2012).

Table A2.6. Indicator Definitions

Type of variable	*Variable name*	*Definition*
Overall financial performance	Returns on equity (ROE)	(Net Operating Income – Taxes) / Average Total Equity
	Returns on assets (ROA)	(Net Operating Income – Taxes) / Average Total Assets
	Operational self-sufficiency (OSS)	Financial Revenue / (Financial Expense + Impairment Loss + Operating Expense)
Outreach	Percentage of female borrowers	Number of active women borrowers/Number of Active Borrowers
Risk	Portfolio at risk > 30 days ratio (PAR>30 days)	The value of all loans outstanding of microcredit that have one or more installments of principal past due more than 30 days (Includes unpaid principal balance and loans that have been restructured or rescheduled)
Financing structure	Cost of Paying Liabilities	Weighted average rate paid on paying liabilities
	Yield on gross loan portfolio	Interest and Fees on Loan Portfolio/ Average Gross Loan Portfolio
Efficiency & Productivity	Loans per staff members	Gross Loan Portfolio/ Number of Personnel
	Borrowers per staff members	Number of Active Borrowers / Number of Personnel
	Personnel allocation ratio	Number of Loan Officers / Number of Personnel
	Personnel allocation ratio (women)	Number of Loan Officers (women) / Number of Personnel
	Operating expense ratio	Operating Expense / Average Gross Loan Portfolio

Note. Authors' elaboration based on Red Financiera Rural (2009-2012).

Table A2.7. Descriptive Statistics for Financial Performance Ratios

Variables (mean(sd))	**Banks**	**CUCs**	**NGOs**
Overall Financial Performance			
ROE	0.082 (0.08)	0.098 (0.09)	0.146 (0.13)
ROA	0.012 (0.01)	0.015 (0.01)	0.049 (0.05)
OSS	1.091 (1.10)	1.117 (1.1)	1.456 (1.26)
Outreach			
Women borrowers (pct.)	0.554 (0.59)	0.517 (0.49)	0.676 (0.68)
Risk			
PAR >30 days	0.027 (0.02)	0.04 (0.03)	0.027 (0.02)
Finance Structure			
Cost-of-funds ratio	0.052 (0.06)	0.057 (0.06)	0.08 (0.08)
Yield on gross loan portfolio	0.206 (0.20)	0.168 (0.17)	0.212 (0.23)
Efficiency and productivity			
GLP/staff members (thousands)	233.33 (243.51)	301.15(287.78)	164.33(121.49)
Borrowers/staff members	147.05(144.69)	120.45(101.19)	204.42(173.27)
Personnel allocation ratio	0.327 (0.35)	0.305 (0.28)	0.479 (0.49)
Personnel allocation ratio (women)	0.156 (0.17)	0.151 (0.14)	0.184 (0.17)
Operational Efficiency Ratio	0.179 (0.14)	0.108 (0.1)	0.165 (0.16)
N	16	74	47

Note. Authors' elaboration based on Red Financiera Rural (2009-2012).

Table A2.8. Test Returns to Scale

	Year	S	Critical Value	Test Ho	p-value
TE-L	2009	0.812	0.702	True	0.414
	2010	0.749	0.606	True	0.406
	2011	0.784	0.702	True	0.242
	2012	0.833	0.722	True	0.420
TE-R	2009	0.839	0.848	False	0.030
	2010	0.736	0.754	False	0.026
	2011	0.730	0.781	False	0.008
	2012	0.768	0.825	False	0.005
TE-LR	2009	0.840	0.853	False	0.026
	2010	0.737	0.738	False	0.049
	2011	0.740	0.769	False	0.013
	2012	0.790	0.819	False	0.016
TE-M	2009	0.823	0.571	True	0.805
	2010	0.849	0.577	True	0.842
	2011	0.701	0.505	True	0.527
	2012	0.796	0.582	True	0.631
TE-W	2009	0.751	0.556	True	0.596
	2010	0.820	0.550	True	0.789
	2011	0.628	0.420	True	0.520
	2012	0.739	0.523	True	0.581
TE-B	2009	0.848	0.689	True	0.700
	2010	0.859	0.673	True	0.713
	2011	0.717	0.577	True	0.392
	2012	0.800	0.690	True	0.401

Note. Authors' elaboration based on Red Financiera Rural (2009-2012).

Table A2.9. Determinants of social and financial technical efficiency of DEA-PCA estimates – Total Expenses (OLS): Group lending without 2nd tier and collective methodology

	(1) TE-L Coef./ p-value	(2) TE-R Coef./ p-value	(3) TE-LR Coef./ p-value	(4) TE-M Coef./ p-value	(5) TE-W Coef./ p-value	(6) TE-B Coef./ p-value
Type of MFI (Ref.: Banks)						
CUCs	0.177**	-0.091	-0.056	-0.103*	-0.049	-0.041
	(3.137)	(-1.419)	(-0.914)	(-2.116)	(-1.166)	(-0.757)
NGOs	0.087	-0.124+	-0.130*	0.203***	0.177***	0.220***
	(1.434)	(-1.801)	(-1.981)	(3.875)	(3.940)	(3.736)
Methodology (Ref.: Others)						
Group Lending	-0.189***	-0.265***	-0.248***	0.276***	0.359***	0.243***
	(-3.534)	(-4.366)	(-4.305)	(5.971)	(9.047)	(4.690)
Period (Ref.: Year=2009)						
2010	-0.040	0.006	-0.009	-0.039	0.011	-0.009
	(-0.819)	(0.108)	(-0.171)	(-0.919)	(0.296)	(-0.185)
2011	0.014	-0.011	0.006	-0.114**	-0.075*	-0.084+
	(0.289)	(-0.194)	(0.111)	(-2.680)	(-2.043)	(-1.754)
2012	0.038	0.058	0.045	-0.074+	-0.074*	-0.077
	(0.766)	(1.034)	(0.849)	(-1.738)	(-2.007)	(-1.618)
Constant	0.190**	0.726***	0.637***	0.279***	0.171***	0.247***
	(3.062)	(10.354)	(9.546)	(5.216)	(3.720)	(4.126)
Adj. R-sq	0.188	0.166	0.190	0.580	0.641	0.450
F statistics	6.201	5.480	6.278	32.098	41.162	19.446
N. of cases	136.000	136.000	136.000	136.000	136.000	136.000

Note. We tested for RTS and we could not reject the null hypothesis for all the specifications therefor CRS are assumed. Authors' elaboration based on Red Financiera Rural (2009-2012).
Sig.: * p < .05, ** p < 0.01, *** p < 0.001

Table A2.10. Determinants of social and financial technical efficiency of DEA estimates – Total Expenses (OLS)

	(1) TE-L Coef./ p-value	(2) TE-R Coef./ p-value	(3) TE-LR Coef./ p-value	(4) TE-M Coef./ p-value	(5) TE-W Coef./ p-value	(6) TE-B Coef./ p-value
Period (Ref.: Year=2009)						
CUCs	0.482***	0.004	0.003	-0.376**	-0.169	-0.080
	(4.304)	(0.050)	(0.036)	(-2.816)	(-1.280)	(-0.688)
NGOs	0.117	-0.096	-0.103	0.408**	0.422**	0.401**
	(0.974)	(-1.123)	(-1.198)	(2.843)	(2.970)	(3.210)
Methodology (Ref.: Others)						
Group Lending	-0.355**	-0.218**	-0.222**	0.548***	0.793***	0.377***
	(-3.349)	(-2.891)	(-2.941)	(4.341)	(6.348)	(3.426)
Period (Ref.: Year=2009)						
2010	-0.167+	-0.062	-0.075	-0.106	-0.053	-0.113
	(-1.705)	(-0.889)	(-1.075)	(-0.905)	(-0.459)	(-1.116)
2011	0.059	-0.052	-0.061	-0.358**	-0.512***	-0.400***
	(0.599)	(-0.741)	(-0.880)	(-3.066)	(-4.429)	(-3.931)
2012	0.136	0.042	0.033	-0.159	-0.292*	-0.195+
	(1.383)	(0.606)	(0.480)	(-1.358)	(-2.527)	(-1.921)
Constant	-1.160***	-0.201*	-0.184*	-1.070***	-1.338***	-0.952***
	(-9.464)	(-2.306)	(-2.106)	(-7.318)	(-9.251)	(-7.475)
Adj. R-sq	0.325	0.107	0.115	0.508	0.536	0.387
F statistics	11.816	3.693	3.934	24.221	26.940	15.234
N. of cases	136.000	136.000	136.000	136.000	136.000	136.000

Note. We tested for RTS and we could not reject the null hypothesis for all the specifications therefor CRS are assumed. Authors' elaboration based on Red Financiera Rural (2009-2012).
Sig.: *p < .05, ** p < 0.01, *** p < 0.001

Table A2.11. Determinants of social and financial technical efficiency of bias-corrected DEA estimates – Total Expenses (Truncated): Including Size

	(1) TE-L Coef./ z-value	(2) TE-R Coef./ z-value	(3) TE-LR Coef./ z-value	(4) TE-M Coef./ z-value	(5) TE-W Coef./ z-value	(6) TE-B Coef./ z-value
Type of MFI (Ref.: Banks)						
CUCs	0.307***	0.236***	0.209***	-0.101	0.004	0.039
	(6.273)	(3.614)	(3.441)	(-1.283)	(0.072)	(0.537)
NGOs	0.215***	0.232***	0.209**	0.207*	0.226***	0.267***
	(3.822)	(3.365)	(3.243)	(2.488)	(3.822)	(3.375)
Methodology (Ref.: Others)						
Individual lending (pct.)	-0.088	-0.035	-0.040	0.276***	0.355***	0.244***
	(-1.431)	(-0.644)	(-0.760)	(4.624)	(7.440)	(3.927)
Period (Ref.: Year=2009)						
2010	-0.071+	-0.059	-0.065+	-0.056	-0.021	-0.065
	(-1.762)	(-1.479)	(-1.697)	(-0.964)	(-0.596)	(-1.272)
2011	0.014	-0.062	-0.067+	-0.187**	-0.196***	-0.212***
	(0.359)	(-1.612)	(-1.822)	(-3.213)	(-5.134)	(-4.105)
2012	0.046	0.026	0.020	-0.098	-0.128**	-0.126*
	(1.147)	(0.524)	(0.437)	(-1.587)	(-2.980)	(-2.242)
Assets (ln)	0.051***	0.086***	0.077***	0.020	0.036**	0.040*
	(3.526)	(4.499)	(4.346)	(0.978)	(2.988)	(2.316)
Constant	-0.700*	-0.870*	-0.710*	-0.038	-0.426+	-0.362
	(-2.567)	(-2.463)	(-2.159)	(-0.101)	(-1.877)	(-1.128)
Sigma						
Constant	0.147***	0.156***	0.152***	0.186***	0.143***	0.181***
	(9.140)	(11.667)	(11.943)	(11.081)	(13.987)	(13.064)
Wald	112.003	65.824	64.622	114.747	193.205	86.517
N. of cases	136	136	136	136	136	136

Note. We test for RTS and we could not reject the null hypothesis for all the specifications therefore CRS are assumed. [a] z-values are based on 1000 bootstrap estimation of the Truncated regression. Authors' elaboration based on Red Financiera Rural (2009-2012).

Sig.: * $p < .05$,** $p < .01$,*** $p < .001$

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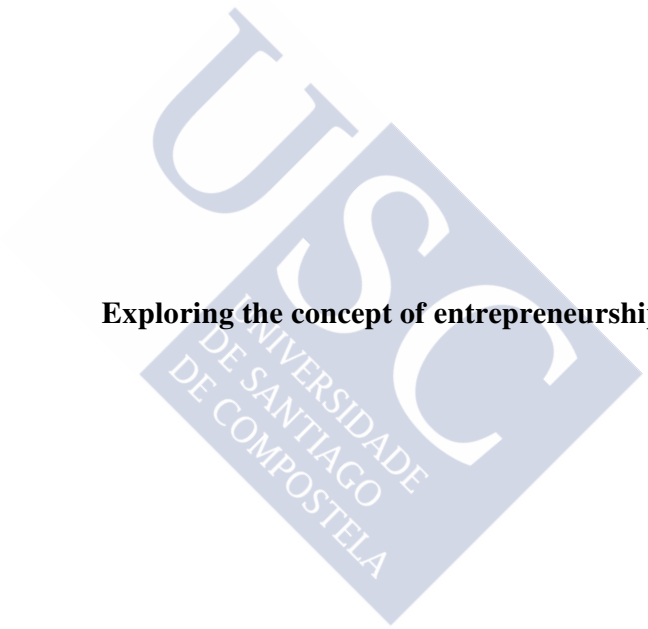

PART II:

Exploring the concept of entrepreneurship in Ecuador

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CHAPTER III:

The role of perceptions over decision-making in the work-family interface of microentrepreneurs in Ecuador

3.1 INTRODUCTION

Drawing upon the family embeddedness perspective to entrepreneurship that assume that the business and the family are two interrelated social institutions (Loscocco, 1997; Aldrich & Cliff, 2003; Dyer, 2003; Steier et al., 2009), this chapter makes two contributions to the literature on gender and entrepreneurship. First, we use gender as a category and provide empirical evidence on gender differences between men's and women's perceptions about decision-making in the work-family interface (WFI). We argue that decision-making is context specific and hypothesize that female that own a microenterprise in Ecuador participate actively on entrepreneurial decision-making as well as male entrepreneurs but gendered division of labor may persist when it comes to decision-making related with traditional roles and reproductive responsibilities. We use microenterprises as unit of analysis and explore the degree of similarity/dissimilarity of eleven questions about intra-household and entrepreneurial decision-making. This initial analysis is the basis for the second contribution of this chapter. In the case of gender differences over decision-making, we analyze in a subsequent analysis, the factors and characteristics at individual, household, institutional and enterprise levels that differentially influence decision-making between male and female entrepreneurs.

The general literature of entrepreneurship assumes that the enterprise and the family are two separate spheres with no direct relationship to each other. Starting with the definition of 'the entrepreneur' as a homogeneous male-gendered concept who has no room for the family and reproductive responsibilities (Ahl, 2002; Lewis, 2006; Ahl, 2006; Calas et al., 2009; Ahl & Marlow, 2012), the analysis of the role of the family in entrepreneurship research has been almost nonexistent (Loscocco, 1997; Dyer, 2003; Ahl, 2006). However, the increasing participation of women into entrepreneurship and their relevance as drivers of development (Minniti, 2010; Minniti & Naudé, 2010; Acs et al., 2011) has challenged the traditional concept of the entrepreneur and brought the analysis of the work-family interface into the research

agenda on gender and entrepreneurship (Shelton, 2006; Eddleston & Powell, 2012; Hughes et al., 2012; Jennings & Brush, 2013; Vossenberg, 2013).

In the absence of any relationship between the enterprise and the family, research that explore gender differences on entrepreneurship highlights that female entrepreneurs underperform compared with their male counterparts. The gender gap in entrepreneurship shows that women are less likely to participate into self-employment and entrepreneurship (Parker, 2009; Minniti, 2010; Minniti & Naudé, 2010), exhibit limited performance with smaller business ventures (Rosa et al., 1996; Cliff, 1998; Du Rietz & Henrekson, 2000; Klapper & Parker, 2011) and have higher exit rates than male entrepreneurs (Watson, 2003; Fairlie & Robb, 2009). The 'female underperformance hypothesis' (Du Rietz & Henrekson, 2000) picture the gender gap on entrepreneurship because of female deficiency (Ahl & Marlow, 2012; Jennings & Brush, 2013) where variations in performance are attributed directly to female-specific differences on individual capabilities and preferences (Klapper & Parker, 2011), female lack of entrepreneurial orientation and self-efficacy (Wilson et al., 2007; Dato-on & Mueller, 2008; Coleman & Kariv, 2014) or female-specific personality traits (Wagner, 2007; Koellinger et al., 2013; Noguera et al., 2013). Thus, reducing direct discrimination in the markets would allow reducing differences between female and male entrepreneurs. In this context, policies that focus on increasing access of women to education, training and entrepreneurship promotion programs as well as improving women's access to financial services and growth capital.

Conversely, considering the enterprise as an entity that may be influenced by gendered institutions such as the family (Mirchandani, 1999; Aldrich & Cliff, 2003), the gender gap in performance and differences among female and male entrepreneurs characteristics among the enterprises (Cunningham & Maloney, 1998; Grimm et al., 2012; Calderon et al., 2016) may be explained by a gender division of labor, gender norms and gender perceptions[74] (Gomez, 2008; Díaz-García & Jiménez-Moreno, 2010; Fuentes-Fuentes et al., 2015), resource allocation choices (Powell & Eddleston, 2013) and the relationship of balance or conflict between entrepreneurial activities and household chores (Aldrich & Cliff, 2003; Jennings & McDougald, 2007; Jennings et al., 2010; Maertz & Boyar, 2011; Jennings et al., 2013). According to this

[74] In many societies women bear the major responsibility for child-rearing (reproductive role) while men are in charge or the mostly to fulfill their productive activities (productive role). Hence, the gender division of labor is influence by gender norms and perceptions that refer to all the social norms that enhance or constrain the activities that men or women are socially allow to do usually reinforcing traditional roles for men and women. For a further discussion see among others (Blumberg, 1991; Blumberg, 2001; Chant, 2011)

perspective, policies that aim at reducing the differences among female and male entrepreneurs or at increasing the female participation into entrepreneurship should address reducing both direct and indirect discrimination and market constraint as well as increasing women's capabilities and opportunities.

The prevailing assumption that the enterprise and the family are somehow separate institutions is also evident in the literature about empowerment and entrepreneurship. Within the bargaining approach that consider decision-making as proxy of bargaining power and agency (Agarwal, 1997; Kabeer, 1999; Mayoux, 2002; Holvoet, 2005), several researchers have mainly focused on intra-household decision-making concerning only female entrepreneurs based on the general assumption that women may be empowered through entrepreneurship[75]. In fact, a significant body of research explores whether certain policies of entrepreneurship promotion (such as access to microcredit and training programs) can increase women's bargaining power[76], thus positioning the decision-making analysis in the business sphere as secondary or irrelevant. In the best of cases, decisions within the enterprise are included in composite indicators (De Mel et al., 2009) but it is rarely explored whether they are correlated constructs or whether there are differences between intra-household and entrepreneurial decision-making patterns. Furthermore, since the family is usually considered as women's domain, there is no empirical evidence about gender differences among female and male entrepreneurs on the decision-making in the work-family interface.

Exploring gender differences over decision-making in the work-family interface of entrepreneurs is particularly relevant in the Ecuadorian context for several reasons. First, female

[75] Contrary to the unitary model developed by (Becker, 1965), the bargaining framework assumes that household members have different preferences and the distribution of income, assets and resource allocation varies among household members based on their bargaining power (Sen, 1987; Alderman et al., 1995). The bargaining power is determined by credible exit options and the fallback position of household members determined by different factors at individual (e.g. assets, income, human capital and perceived notion of legitimacy), household (e.g. marital status, number of children) and extra-household levels (e.g. inheritance laws, labor market structure, gender division of labor). Thus, the promotion of female entrepreneurship allows generating incomes for themselves and their families increasing women's fallback position and their bargaining power within the household. Criticism about promoting entrepreneurship to empower women argue that since women usually have the weaker fallback position within the household they are unable to make decisions on their own and it is likely that they will replicate intra-household decision-making within the enterprise. Therefore, differences on resource allocation within the household may also influence entrepreneurial decision-making and traditional gender roles and perceptions may be reinforced rather than challenged by entrepreneurship and self-employment (Mirchandani, 1999; Ahl, 2006).

[76] (Doss, 2013) explains the difficulties of assessing women's empowerment and argues that evidence mostly reflects correlation rather than causal inferences. Besides, decision-making can be considering as a process instead of an output (Kabeer, 1999) and conclusions may vary depending on how researchers treat decision-making responses (Peterman et al., 2015). However, most of the analyses that explore the effect and impact of specific policies use a decision-making index as a proxy for women's empowerment. See, among others, (Holvoet, 2005; Garikipati, 2008; De Mel et al., 2009; Ashraf et al., 2010; Crépon et al., 2011; Karlan & Zinman, 2011; Duflo et al., 2013; A. V. Banerjee, 2013; A. Banerjee et al., 2015; Crépon et al., 2015)

self-employed outnumber their male counterparts, and the gender composition of self-employment is more biased in favor of females than in other countries and regions in the world (Marlow & McAdam, 2013a). In fact, women-owned microenterprises represent around 54% of the total and are the main source of female employment in the country (INEC, 2010). Secondly, in contrast to other countries in Latin America with the same marital regimes of partial common property rights and inheritance laws, previous research has shown that there are no gender differences on the distribution of wealth and women own 52% of the gross household physical wealth (Deere et al., 2013). Moreover, Ecuadorian households have amongst the highest rates of joint homeownership and landownership in the region (Deere & Twyman, 2012; Diana Deere et al., 2012) and females own most of business in the country (Doss et al., 2011). Finally, regarding intra-household decision-making, evidence shows that Ecuadorian households are mainly characterized by a relatively higher degree of joint decision-making and women are more likely than men to make autonomous decisions within the household when they are not in a relationship or when the 'norm' of joint decision-making is not met (Deere & Twyman, 2012; Diana Deere et al., 2012).

The following sections of this chapter are structured as follows. In the next section, we provide a brief literature review of the family embeddedness perspective on entrepreneurship and explain the possible strategies and determinants that male and female entrepreneurs use in the work-family interface. Section 3.3 outlines the empirical model used to estimate factors and determinants of decision-making using gradient boosted models. Section 3.4 contains the data structure, and descriptive results about entrepreneurial profiles, gender differences on decision-making and gender roles perceptions in the work-family interface. Section 3.5 reports the results of the estimations based on the degree of similarity/dissimilarity between male and female entrepreneurs over decision-making described in previous sections. Finally, we conclude in section 3.6 with a summary of key findings of the chapter, as well as the limitations and suggestions of future research.

3.2 The Family Embeddedness Perspective and Entrepreneurship

The family embeddedness perspective suggests that business and family are inextricable intertwined institutions rather than separate spheres (Loscocco, 1997; Aldrich & Cliff, 2003; Dyer, 2003; Steier et al., 2009). Instead of analyzing how one sphere influences the other, separately, (Jennings & McDougald, 2007) argue that the family embeddedness perspective

allows linking work-family interface (WFI) factors and strategies to the formation, management, performance and closure of entrepreneurs' business ventures. Under this perspective, the WFI factors, strategies, determinants and outcomes are constrained or enhanced by socially constructed arrangements and practices (Marlow, 2002; Gupta et al., 2009; Carter et al., 2009; Eddleston & Powell, 2012; Marlow & McAdam, 2013b).

Differences in the WFI respond to the way in which entrepreneurs manage their multiple roles within the family and the enterprise. On the one hand, there is the conflict perspective (Greenhaus & Beutell, 1985) that assumes that since time and resources are limited, pursuing multiple tasks and achieving balance between the family and the work are mutually exclusive. (Greenhaus & Beutell, 1985) identified three sources of conflict in the WFI: i) time-based conflict where individuals must allocate their limited time into the family or the work, ii) strain-based conflict where stress experienced in one sphere have negative spill-over effects over the other and iii) behavior-based conflict related with fulfilling expectations in behavioral styles in the enterprise and the family. These sources of conflict have negative effects over the work-family performance, increasing stress and decreasing the quality of life of entrepreneurs. On the other hand, there is the enrichment perspective (Greenhaus & Powell, 2006) where individuals may experience affective and instrumental support from one sphere enhancing and nurturing positively the other. Therefore, the family and the business are complementary rather than competing spheres, reinforcing to each other.

Although the bulk of the empirical literature about these issues adopts the conflict perspective[77], some authors emphasize that there are gender differences on how male and female entrepreneurs experience conflict or enrichment in the work-family interface. For instance, (Jennings & McDougald, 2007; Kirkwood & Tootell, 2008) argue that female entrepreneurs are more likely to experience greater conflict in the WFI than their male counterparts. However, (Eddleston & Powell, 2012) found that female entrepreneurs are more likely to create work-family synergies that nurture their work-family experiences while male entrepreneurs have more instrumental support at home from other relatives in the household. Furthermore, (Powell & Eddleston, 2013) claim that since female entrepreneurs are usually excluded from resources such as human, social and financial capital they are more likely to benefit from the family-to-business enrichment than male entrepreneurs. Therefore, gender

[77] See among others, (Parasuraman & Simmers, 2001; Boyar et al., 2003; Shelton, 2006; Jennings et al., 2010; Maertz & Boyar, 2011; Jennings et al., 2013)

differences in the experiencing of the WFI may be based on the gender division of labor where family arrangements, norms and values influence differently the factors, strategies and outcomes in the WFI.

At the enterprise level, work-related factors show two differentiated gendered profiles of entrepreneurs. Compared to male entrepreneurs, female entrepreneurs are more likely to start business ventures to achieve balance between the work and their household chores (Loscocco, 1997; Ahl, 2002; Jennings & Brush, 2013).[78] Hence, they start home-based business (Mirchandani, 1999; Kelley et al., 2011; Jennings & Brush, 2013; Marlow, 2014) in traditional sectors with little entry barriers and low value added usually in trade and service activities (Marlow & Patton, 2005; Brush et al., 2009; Brush et al., 2010). Besides, female entrepreneurs spend less hours in their business ventures (Jennings et al., 2010; Maertz & Boyar, 2011; McKenzie & Woodruff, 2013; Marshall & Flaig, 2014) and have less experience and training than male entrepreneurs (Ahl, 2002; Shaw et al., 2009; Brush et al., 2010). On the other hand, female entrepreneurs are more likely to exit their business ventures for personal and voluntary reasons while male entrepreneurs are more likely to exit entrepreneurship looking for other opportunities in the wage labor market (Justo et al., 2015).

At the household level, family-related factors also reflect gender differences among entrepreneurs. Marriage and parenthood may trigger the decision to start a business venture or becoming self-employed and influence resource allocation choices in the work-family interface. In fact, (Loscocco, 1997; Elizabeth & Baines, 1998; Ahl, 2006; Brush & Brush, 2006; Jennings & McDougald, 2007) argued that male entrepreneurs are more likely to delegate reproductive and child-rearing to other adults in the family (spouses or significant others) to focus exclusively on their business while female entrepreneurs integrate their roles as caregivers and the time required to run their households with the management of their business (Shelton, 2006; Cruz et al., 2012; Justo et al., 2015). If male entrepreneurs experience a relief from their household chores and responsibilities focusing exclusively in their business, they may fulfill their gender roles within the household as being breadwinners while female entrepreneurs may consider their income as secondary or complementary in the household, suppressing or postponing growth-oriented entrepreneurial opportunities. Moreover, male entrepreneurs are more likely than female entrepreneurs to involve their spouses to 'help' in the enterprise, while

[78] Due to the need for more flexible schedules, to inadequate family income and to discrimination of paid labor market (Minniti, 2010; Minniti & Naudé, 2010; Kobeissi, 2010; Koellinger et al., 2013).

females are more likely to use their children labor instead of their spouses to avoid conflict in the enterprise (Blumberg, 2001). However, if the enterprise does not generate enough income to male entrepreneurs, fatherhood have a negative effect for male self-employment increasing their likelihood of searching for higher paid jobs in the wage labor market (Saridakis et al., 2014).

In summary, the family embeddedness perspective allows exploring how gender systems and gender stereotypes constrain or enhance entrepreneurship. Therefore, it is important to analyze the strategies that both female and male entrepreneurs engage in to manage conflict or balance in the WFI. (Jennings et al., 2010) identify the direct strategies that female and male entrepreneurs enact to manage WFI conflict, and find no gender differences in the strategies that enhance and facilitate or constrain growth performance at an aggregated level. However, they find gender differences in the retail, wholesale and service firms. Specifically, they find that female entrepreneurs are more likely to enact strategies that repress and constrain their entrepreneurial experience on those sectors. (Greenhaus & Beutell, 1985; Greenhaus & Powell, 2003) argue instead that the conflict between the work and the family is only evident after individuals have made the decision to get involved in one sphere or the other. We extended this latter proposal and present in the following section individualized analyses for eleven decision-making in the WFI. We attempt to identify the gendered entrepreneurial profiles through decision-making analysis to explore apparent conflict or enrichment in the work-family interface.

3.3 EMPIRICAL MODEL

In this section, we explain the empirical model used to explore gender differences of the determinants that influence decision-making in the work-family interface. We focus on individual decision-making instead of an overall analysis since there is evidence that autonomous and joint decision-making have different correlates that change depending on the decision analyzed (Kishor & Subaiya, 2008). Moreover, criticism about an overall approach on intra-household decision-making emphasize that a single index can conceal possible determinants that influence each type of decision-making that are lost in the process of

aggregation and argue that an individual analysis may be more appropriate (Holvoet, 2005; Deere & Twyman, 2012).[79]

Drawing from the theoretical framework developed by (Mabsout & Van Staveren, 2010) that identify decision-making as an output we explore possible correlations of socioeconomic characteristic and family-related factors at individual, household and institutional levels that may influence intra-household and entrepreneurial decision-making.[80] Observed covariates at individual level include age, married status and education. At the household level, the characteristics included are whether there are children in the household, a dummy variable that explain if there are other adult members at the household (>18-years-old), a multidimensional Household Wealth Index and a proxy of health status of the family members of the household. At the institutional level, we included an index of socioeconomic characteristics by sector[81], a gender roles perception index and whether or not the person assigns monetary value to her/his household labor. Given the assumption that the family and the enterprises are interrelated spheres, we also consider the enterprise as another gendered level where economic activity choices, number of employees and enterprise characteristics may also influence male and female decision-making in the work-family interface. Therefore, at the entrepreneurial level we incorporate the economic sector of the enterprise, the type of enterprise (self-employed, employs exclusively family members, and employs others that are not family members), age of the enterprise, an indicator of innovation and an indicator of accounting skills[82].

We use gradient boosting models (GBMs) with multinomial distribution to explore gender differences of the determinants at the individual, household, institutional and enterprise levels

[79] Recent research has found evidence that using Structural Equation Modelling (SEM) for creating decision-making index may overcome most of the criticism of traditional approaches since they allow accounting for measurement error. However, most of the research using SEM focuses only on women's decision-making power and we aim to compare gender differences over intra-household and entrepreneurial decision-making. We hypothesized a multi-group multiple-indicator multiple causes model (MIMIC) for categorical variables but tests show evidence of measurement non-invariance between men and women entrepreneurs over intra-household decision-making. Specifically, measurement non-invariance was related with decision-making about childbearing and child-rearing. We found measurement non-invariance only when considering the enterprise sphere (the results are shown in supplementary material to this chapter). Therefore, we opted for individual analysis because, in the presence of measurement non-invariance, comparisons of latent factor means (overall index) or regression coefficients between groups (the main goal of this chapter) may lead to biased regression parameters (Meredith & Teresi, 2006; Millsap & Olivera-Aguilar, 2012; Van de Schoot et al., 2012; Van De Schoot et al., 2015).

[80] Detailed definitions of the variables are presented in Table A3.1 in the appendix.

[81] The index is a measure developed by (SENPLADES, 2013) that captures the differences in socioeconomic conditions of parishes in Ecuador and represents 50.5% of the total variance from the 19 social indicators in areas of education, health, housing characteristics and basic services.

[82] The index was constructed using polychoric principal component analysis (PCA) that includes: (i) if the entrepreneurs keeps money separated from personal expenses; (ii) keep accounting records; and (iii) if they know which is/are the most profitable product(s) or service(s).

described above.[83] The methodology about GBMs has been discussed in detail in Chapter 1. Notwithstanding, we emphasize that the advantages of using gradient boosting models here come from their ability to handle various type of responses, their invariance to one-to-one transformation of the independent variables and their capability to include many covariates, even if they are correlated to one another (McCaffrey et al., 2004). Empirical studies have shown that combining models using GBMs produce more accurate classifications than regression models especially when we are interested on the relative influence of input variables over variations on dependent variables rather than on the estimation parameters (Friedman et al., 2000). In the remainder of this section we present the description of the gradient boosting classification with multinomial distribution and the variables used to explore gender differences of intra-household and entrepreneurial decision making.

3.3.1 Gradient Boosting classification with Multinomial distribution

Following the exposition in data (Natekin & Knoll, 2013) we define a given a dataset $(X_p, Y_q)_{i=1}^{N}$, where $X_p = (X_{1p}, ..., X_{dj})$ are all exploratory input variables at each bargaining level ($p =$ individual, household, institutional, enterprise) and Y_q is the response variable corresponding to each individual decision-making ($q =$ dwelling, expenditures, leisure, childbearing, education, health, contraceptive use, business management, business profits, purchases and credit for the business). The response variable is classified over all observed covariates at each bargaining level X_p for female and male entrepreneurs, separately.

The unknown functional dependence $X_p \overset{f}{\rightarrow} Y_q$ may be estimated by $\hat{f}(X_p)$, such that some loss function $\Psi(Y_q, f(X_p))$ is minimized:

$$\hat{f}(X_p) = arg \min_{f(X_p)} \Psi(Y_q, f(X_p)) = arg \min_{f(X_p)} E_{X_p}[E_{Y_q}(\Psi[Y_q, f(X_p)])|X_p]. \quad (12)$$

Let $Y_k \in \{1,2,3\}$ be the unordered categorical variable reflecting the decision-making mechanism that gives a value of 1 if someone else makes the decisions, 2 if the decisions are

[83] We also explore individual analysis using Ordered Logistic Regression, but when we test the odds proportional assumption we cannot reject the null hypothesis that there is no difference in the coefficients between models and the parallel regression assumption does not hold. This may indicate that the transition from someone else making the decision to a joint-decision and to making the decision alone is different from each other and a generalized approach is more accurate (Cameron & Trivedi, 2009).

shared, and 3 when the decisions are taken alone. Thus, $\Psi(Y_q, f(X_p))$ corresponds to a multinomial deviance loss function.

With a *k*-class classification, each individual decision-making Y_q, takes value from a set $G = \{G_1, G_2, G_3\}$. Given the conditional probability of $p_k(X_p) = Pr(Y_q = G_k|X_p)$, where $k = 1,2,3$, then the Bayes classifier is:

$$G(X_p) = G_k \text{ where } k = \underset{l}{arg\,max}\, p_l(X_p), \tag{13}$$

where $p_l(X_p)$ is the class probability, for $l = 1,2,3$, and the logistic model generalized to K classes is:

$$p_k(X_j) = \frac{e^{f_k(X_p)}}{\sum_{l=1}^{3} e^{f_l(X_p)}}, \tag{14}$$

where $p_k \geq 0,\ \sum_{k=1}^{3} p_k = 1$. The multinomial deviance loss function can be defined as:

$$\Psi(Y_q, f(X_p)) = -\sum_{k=1}^{3} I(Y_q = G_k) f_k(X_p) + log\left(\sum_{l=1}^{3} e^{f_l(X_p)}\right). \tag{15}$$

The function is estimated using a gradient boosting algorithm where optimization is held out of the function space. Let ρ_t be the optimal step-size, $h(X_p, \theta_t)$ is the custom "base-learner" function and $\hat{f}$ be the function estimate in additive functional form$\hat{f}_t = \sum_{i=0}^{M} \hat{f}_i(X_p)$, and then the optimization rule can be defined as:

$$\hat{f}_t \leftarrow \hat{f}_{t-1} + \rho_t h(X_p, \theta_t), \tag{16}$$

$$(\rho_t, \theta_t) = \underset{\rho,\theta}{arg\,min} \sum_{i=1}^{N} \Psi(Y_{p,i}, \hat{f}_{t-1}) + \rho_t h(X_p, \theta_t) \tag{17}$$

The form of the algorithm would depend on $h(X_p, \theta_t)$ and the multinomial deviance loss function $\Psi(Y_q, f(X_p))$. Finally, the relative influence (I_{lk}) of an explanatory variable X_l in separating each decision-making response (*k*=3) from other responses is obtained by the average of the influence (the number of times the variable has been selected in the splitting process) over all the decision-making responses such as:

$$I_l^2 = \frac{1}{3}\sum_{k=1}^{3} I_{lk}^2. \quad (18)$$

3.4 DATA AND SETTINGS

This study uses data from a cross-sectional survey conducted to microentrepreneurs from the northern region of Ecuador from February to June of 2013 and comes from a longer and detailed questionnaire administrated to investigate several characteristics of microentrepreneurs that have an ongoing business for more than one year and employed from 1 to 9 employees describe in the preface of this thesis.[84] After listwise deletion[85] the final sample included 747 microentrepreneurs, of which 60.2% were women. The main characteristics of our sample are shown in Table 3.1. Differences by sex reflect two differentiated profiles of male and female entrepreneurs. At an individual level, women in the sample are younger, less likely to be married and have lower levels of education compared with male entrepreneurs. Almost a quarter of women in the sample have incomplete primary education or no education and only 12% have tertiary education. At a household level, women are more likely to have children, live in less wealthy households and are more likely to consider their household income participation as complementary or secondary. Differences at institutional level show that women recognize the importance of their housework contribution since they are more likely to assign monetary value to housework activities regardless of the time spent on those activities[86] and also considered that both men and women are equally capable of performing traditional gender roles[87]. Finally, at an enterprise level, women have run the enterprise for a shorter period than men, are more likely to work in commercial activities such as grocery stores, trade and retail and are most

[84] The information used in this paper come from a research project following a quasi-experimental design that aimed to analyze the effects of access to credit over set non-pecuniary outcomes. The sample selection was restricted to geographical areas where the cooperative and credit union operates in the northern region in Ecuador.

[85] Total sample size was 783, but 30 enterprises had closed their business at the time the survey was conducted. We tested for attrition using the probability of firm exit and included the Inverse Mills Ratio (IMR) as another predictor of the decision-making for each type of decision-making. In either case, the relevance of the IMR was higher than 5% in the boosted models. Hence, we excluded the 30 observations from the analysis. Results are presented in the Table A3.2 in the appendix of this chapter.

[86] The relationship between the time they spend doing housework and whether they assign monetary value to their contribution is not statistically significant for the women sample $\chi^2(3)=5.752$, $p>0.05$, while for the men sample, the relationship is statistically significant $\chi^2(3)=5.752$, $p<0.05$.

[87] Most of the sample respondents perceive that both (women and men) are equally capable of performing certain social and economic activities such as holding public offices, running business, raising and bearing children and being the household breadwinner, with the only exception being jobs such as carpentry, masonry and mechanics that are perceived to be traditional for men. However, the perception of men as being breadwinners and women as wives-mothers is predominant for those entrepreneurs who consider that the activities are not gender neutral. In fact, women are the ones that assign to themselves the major responsibility of taking care of the children while men look themselves as primary breadwinners, reproducing partially the breadwinner paradigm. We present data about gender roles perception in Table A3.3 in the appendix.

often self-employed while men are more likely to use family labor and employ non-family workers.

Table 3.1 Descriptive statistics of explanatory variables

	Male	Female	p-value[(a)]
Individual Level			
Age (median (sd))	44.00 (14.88)	42.00 (13.06)	.068
Married/Consensual union = Yes (%)	218 (73.40)	272 (60.44)	<.001***
Level of education (%)			.041*
Less than primary education	52 (17.5)	114 (25.3)	
Primary education	99 (33.3)	135 (30.0)	
Secondary education	96 (32.3)	146 (32.4)	
Tertiary education	50 (16.8)	55 (12.2)	
Household Level			
Children = Yes (%)	186 (62.6)	337 (74.9)	<.001***
Other household members >18-years-old (median (sd))	1.00 (1.20)	1.00 (1.20)	.105
Household Wealth Index (median (sd))	0.37 (0.20)	0.33 (0.17)	<.001***
Household Income Contribution (%)			<.001***
Someone else	33 (11.1)	145 (32.2)	
Shared	90 (30.3)	131 (29.1)	
Alone	174 (58.6)	174 (38.7)	
HH Health proxy (%)			.320
No medical attention/ Control and Prevention	115 (38.7)	150 (33.3)	
Health Checkup & Illness	84 (28.3)	140 (31.1)	
Illness	98 (33.0)	160 (35.6)	
Institutional Level			
Sector (Index 2010) (median (sd))	0.72 (0.12)	0.64 (0.11)	.199
Gender Roles Perception Index (median (sd))	0.85 (0.18)	0.93 (0.24)	.848
Assign monetary value to Housework activities (%)			<.001***
No	102 (34.3)	64 (14.2)	
Yes	195 (65.7)	386 (85.8)	
Enterprise Level			
Age - enterprise (median (sd))	8.00 (13.76)	6.00 (10.27)	.013*
Economic Sector (%)			.005**
Agriculture & Other (5)	82 (27.6)	102 (22.7)	
Commerce/trade/retail	96 (32.3)	203 (45.1)	
Manufacturing	28 (9.4)	41 (9.1)	
Service	91 (30.6)	104 (23.1)	
Type of enterprise (%)			<.001***
Self-employed	147 (49.5)	288 (64.0)	
Employer (family members)	105 (35.4)	117 (26.0)	
Employer (no family members)	45 (15.2)	45 (10.0)	
Innovation Index (median (sd))	0.37 (0.27)	0.39 (0.27)	.498
Accounting Skill Component (mean (sd))	0.68 (0.34)	0.68 (0.34)	.690
N	**297 (39.8)**	**450 (60.2)**	

Note. [(a)] Probability corresponds to Chi-square test for categorical variables and Mann-Whitney U test for continuous variables (non-normal).
Author's own calculation based on field-work (CACMU, 2013).
Sig.: *** p < .001, ** p <.01, * p < .05.

3.4.1 Descriptive statistics for decision-making patterns

In this first part of the descriptive analysis we explore gender differences over decision-making patterns and gender roles perception in our sample. We included eleven questions about decision-making in the WFI: seven questions about intra-household decision-making and four questions about entrepreneurial decision-making. The decision-making mechanism gives an ordered value of 1 if someone else makes the decisions, 2 if the decisions are shared,[88] and 3 when the decisions are made alone. Table 3.2 presents the descriptive statistics of intra-household decision-making patterns and reflects statistical significant differences between male and female entrepreneurs in all the decisions analyzed. Female entrepreneurs are more likely to report making autonomous decisions[89] while men are more likely to report sharing their decisions with someone else. With respect to decision-making about dwelling, household expenditures and leisure time, female entrepreneurs are more likely than their male counterparts to report that someone else makes the decision, whilst on decisions about childbearing (contraceptive use and childbearing) and child-rearing (children's education and family's health status) male entrepreneurs are more likely than female entrepreneurs to delegate those decisions to someone else.

[88] In the case where the respondent answered that decision-making was shared with someone else, we included a control question and asked about the percentage of participation in that decision. Results show an average participation of 50% in each question without any statistically significant differences by sex.

[89] Deere & Twyman (2012) using information of 1776 households found similar results, suggesting that women in Ecuador are more likely than men to make autonomous decisions.

Table 3.2 Household decision-making patterns by sex

	Male	Female	p-value[(a)]
Dwelling (%)			.022*
Someone else	27 (9.1)	57 (12.7)	
Shared	162 (54.5)	202 (44.9)	
Alone	108 (36.4)	191 (42.4)	
HH Expenditures (%)			.002**
Someone else	27 (9.1)	53 (11.8)	
Shared	178 (59.9)	211 (46.9)	
Alone	92 (31.0)	186 (41.3)	
Leisure Time (%)			.001**
Someone else	23 (7.7)	47 (10.4)	
Shared	178 (59.9)	206 (45.8)	
Alone	96 (32.3)	197 (43.8)	
Childbearing (%)			<.001***
Someone else	61 (20.5)	63 (14.0)	
Shared	181 (60.9)	220 (48.9)	
Alone	55 (18.5)	167 (37.1)	
Contraceptive Use (%)			<.001***
Someone else	77 (25.9)	87 (19.3)	
Shared	166 (55.9)	180 (40.0)	
Alone	54 (18.2)	183 (40.7)	
Children's Education (%)			<.001***
Someone else	62 (20.9)	44 (9.8)	
Shared	171 (57.6)	208 (46.2)	
Alone	64 (21.5)	198 (44.0)	
Family's health check-ups (%)			<.001***
Someone else	39 (13.1)	39 (8.7)	
Shared	168 (56.6)	179 (39.8)	
Alone	90 (30.3)	232 (51.6)	
N	**297 (39.8)**	**450 (60.2)**	

Note. [(a)] Probability corresponds to Chi-square test for categorical variables and Mann-Whitney U test for continuous variables (non-normal). Author's own calculation based on field-work (CACMU, 2013).
Sig.: *** p < .001, ** p <.01, * p < .05.

We now turn to decision-making within the enterprise. Table 3.3 shows the descriptive statistics. Most decisions within the enterprise are made alone, but there are significant differences by sex when entrepreneurs decide about business profits and credit for the business. In addition, male entrepreneurs are more likely to share their decisions in the four questions analyzed. This is consistent with the existence of a gender division of labor, pointing to the hypothesis that female entrepreneurs are more likely to balance household chores with the management of the business while male entrepreneurs are more likely to experience a relief of household and reproductive responsibilities.

Table 3.3 Enterprise decision-making patterns by sex

	Male	Female	p-value[(a)]
Business Management (%)			.260
Someone else	12 (4.0)	20 (4.4)	
Shared	88 (29.6)	109 (24.2)	
Alone	197 (66.3)	321 (71.3)	
Business Profits (%)			.023*
Someone else	12 (4.0)	18 (4.0)	
Shared	112 (37.7)	127 (28.2)	
Alone	173 (58.2)	305 (67.8)	
Purchases (%)			.532
Someone else	14 (4.7)	26 (5.8)	
Shared	81 (27.3)	108 (24.0)	
Alone	202 (68.0)	316 (70.2)	
Credit for Business (%)			.046*
Someone else	16 (5.4)	36 (8.0)	
Shared	118 (39.7)	142 (31.6)	
Alone	163 (54.9)	272 (60.4)	
N	**297 (39.8)**	**450 (60.2)**	

Note. [(a)] Probability corresponds to Chi-square test for categorical variables and Mann-Whitney U test for continuous variables (non-normal). Author's own calculation based on field-work (CACMU, 2013).
Sig.: *** p < .001, ** p <.01, * p < .05.

3.4.2 Degree of similarities/dissimilarities of decision-making

Most of the analysis comparing differences among male and female entrepreneurs focus on tests of statistical significance based on *p-values* as presented in section 3. However, since *p-values* do not capture the magnitude of the differences among groups as explained in detail in Chapter I.[90] Therefore, we also use the effect size (d) defined by Cohen (1977) to explore the degree of similarities/dissimilarities between male and female entrepreneurs over intra-household and entrepreneurial decision-making.[91] Figure 3.1 shows the effect size based on Cohen's statistic. We have identified three different sets of decision-making patterns depending on the degree on similarity/dissimilarity between male and female entrepreneurs. The first group is associated with decision-making that is most similar between male and female entrepreneurs corresponding to little or no size effect (SMD $\leq$ .20) and includes all

[90] Tests of statistical significance consider both effect size and sample size (Coe, 2002; Sullivan & Feinn, 2012).
[91] The effect size is defined as the difference between the groups means divided by the standard deviation for the data (Cohen, 1977). We use the cutoffs proposed by (Cohen, 1992) for the effect size, corresponding to small, medium and large differences ($d = .20, .50, .80$, respectively), to determine the degree of similarity/dissimilarity over decision-making among male and female entrepreneurs. Although, (Cohen, 1992; Coe, 2002) argue that these cutoffs should be taken with caution since small differences may be relevant for policy design, implementation and evaluation, we use them as guide to determine how decision-making differs between male and female entrepreneurs.

entrepreneurial decision-making. Initially, there are no apparent gender differences in decision-making over input purchases, business management and credit for the business between the two groups with the higher difference being about the decision-making over business profits.[92]The second set of decisions with small differences between both samples ($.20 < SMD \leq .50$) includes decisions about household resources: dwelling, household expenditures and leisure time. And the final set of decisions, refers to the most dissimilar decision-making with medium effect size ($.50 < SMD \leq .80$), and are related with decision-making about childbearing (childbearing and contraceptive use) and child-rearing (health and children's education). Both samples differ mostly on decisions about children's education and contraceptive use. It is worth notice, that there is no large effect size between the two groups in any of the eleven decisions analyzed.

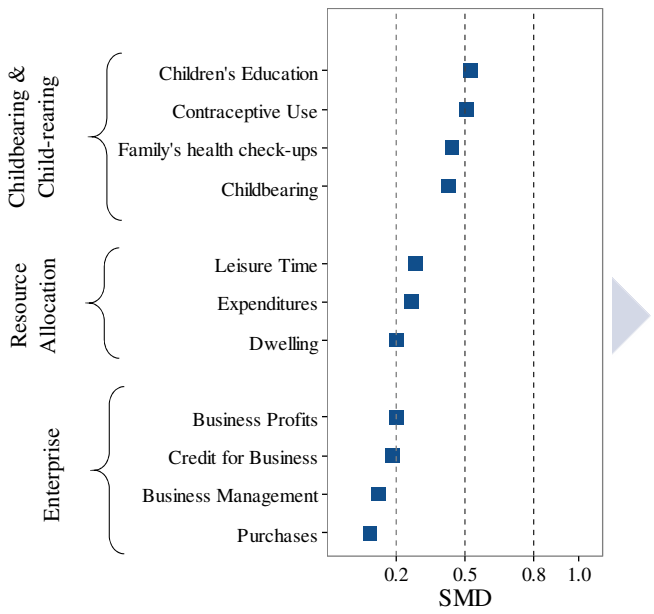

Figure 3.1. Degree of similarities/dissimilarities between male and female entrepreneurs over decision-making. The plot shows the average standardized mean (SMD) difference over intra-household and entrepreneurial decision-making. The effect size was estimated using *tableone* package in R (Yoshida et al., 2015).

[92] Effect size over decision-making about business profits ($d = .205$) is slightly higher than decision-making about dwelling ($d = .201$). Since both are in the limit from no effect size to small effect, we included decision-making about business profits into the group of entrepreneurial decision-making and decision-making about dwelling in the group of decision-making over resource allocation for theoretical comparisons.

3.5 RESULTS

In the previous section, we presented the descriptive results of decision-making patterns showing that female and male entrepreneurs make more similar decisions within the enterprise and are more dissimilar in decision-making over childbearing and child-rearing. In this section, we present the results of the predictors (explanatory variables) that influence individual decision-making (response variable) using the GBMs described in the previous section. We performed individual analyses for male and female samples including the same variables into the gradient boosting models of the eleven questions about decision-making, and using the same regularization process in all the estimations.[93]

In the rest of this section we present our results divided into the three groups of decisions identified in section 3.2: i) entrepreneurial, ii) resource allocation and iii) childbearing and child-rearing. We show the relative influence of the predictors included in the model for each group, distinguishing between the female and male samples.[94] However, as explained in Chapter I, the relative influence of the variable does not provide any information about how the explanatory variables affect the response variable. Therefore, we also included the partial dependence plots for the most relevant predictors influencing individual decision-making in each group, taking female and male samples separately.[95] We centered all the partial dependence plots to have zero mean over the data distribution allowing comparisons both within-group and across type of decision-making.

3.5.1 Determinants of entrepreneurial decision-making

Even within the group which includes the most similar decision-making between men and women we have been able to identify differences both in the factors that influence entrepreneurial decision-making and in the marginal effect of the predictors that influence those decisions. We start by presenting in Figure 3.2. the relative influence of all the predictors over entrepreneurial decision-making. As seen in the figure, two of the three most important

[93] The regularization process is an important feature in GBMs to prevent the risk of overfitting the data (Natekin & Knoll, 2013). The boosting algorithm includes a subsampling parameter of .5 and shrinkage parameter of .005 for 20,000 iterations. We also trimmed the data and used 80% as stopping rule for the algorithm with three-way iterations and a minimum size of 10 nodes for each iteration.

[94] Because GBM automatically standardize the relative influence to add up to 100%, we can easily compare between-group differences over the predictors that influence decision-making.

[95] Graphical representations are one of the strengths of the GBM models for the interpretation of the effect of the variable through partial dependence plots (Natekin & Knoll, 2013). Partial dependence plots allow showing the marginal effect of the variable on the individual decision-making after accounting for the average value of all the other variables in the model (Elith et al., 2008).

predictors for the four decisions analyzed are common in both samples: perceived household income contribution and being married. It does, however, change the order of relevance of the predictors between the two samples. The perceived household income contribution is more relevant in all entrepreneurial decision-making for male entrepreneurs whilst being married is more relevant for female entrepreneurs for three of the four decision-making questions. In the decision-making about the business profits being married is more relevant for male than for female entrepreneurs.

The remaining top-three predictors are specific for each sample: the gender roles perception index is shown to be particularly influential for male entrepreneurs' decision-making, while the type of enterprise (related to whether other employees work in the enterprise) is an influential predictor mostly for female entrepreneurs.[96]

[96] Other predictors are influential over specific decisions. For instance, for female entrepreneurs, the age is relevant for decision-making over credit for the business and business profits and the socioeconomic characteristics of the location of the household is only relevant for decision-making over the input purchases for the business. On the other hand, the innovation index is relevant for decision-making about business profits and input purchases but only for male entrepreneurs.

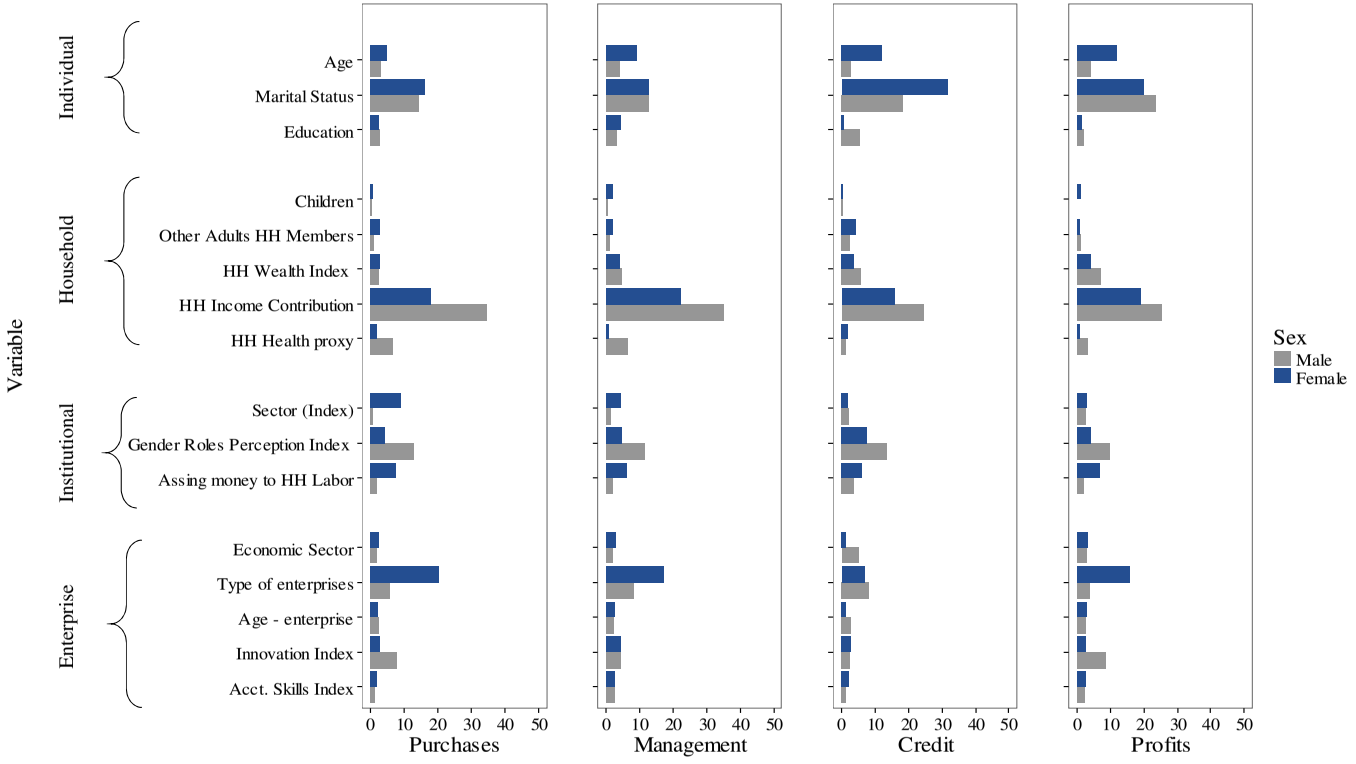

Figure 3.2 **Relative Influence of predictor variables of entrepreneurial decision-making patterns by sex**. The graphs show the relative influence in percentages of the explanatory variables over entrepreneurial decision-making using gradient boosting model. Common predictors of decision-making are household (HH) income contribution and being married. There are gender differences among the factors that influence entrepreneurial decision-making.

Once we have identified the most influential predictors we explore within-group variations using partial dependence plots. We include the variables that present higher relative influence among all the decision-making for each sample. In Figure 3.3 we present partial dependence plots for the male sample showing the marginal effect of the marital status, the perceived household income contribution, and the gender roles perception index over decision-making within the enterprise.

Our results show that being married has a positive effect on male entrepreneurs sharing their entrepreneurial decision-making. The set of partial dependence plots reflecting the effect of the household income contribution shows a general correlation between who is perceived as contributing income to the household and how decisions are taken within the enterprise.[97] In particular, the perception of being the breadwinner in their household is associated with making autonomous decisions. Finally, the third set of partial dependence plots shows the marginal effect of the gender roles perception index. By construction, higher values of the index correlate positively with the perception that both men and women are equally capable of performing the various activities described in section 3.2. The plots suggest that the higher the index the more decision-making is shared within the enterprise.

[97] Albeit the marginal effect of other person being perceived as the income contributor to the household on the male entrepreneur making his decisions alone is very small and changing in sign according to the type of decision.

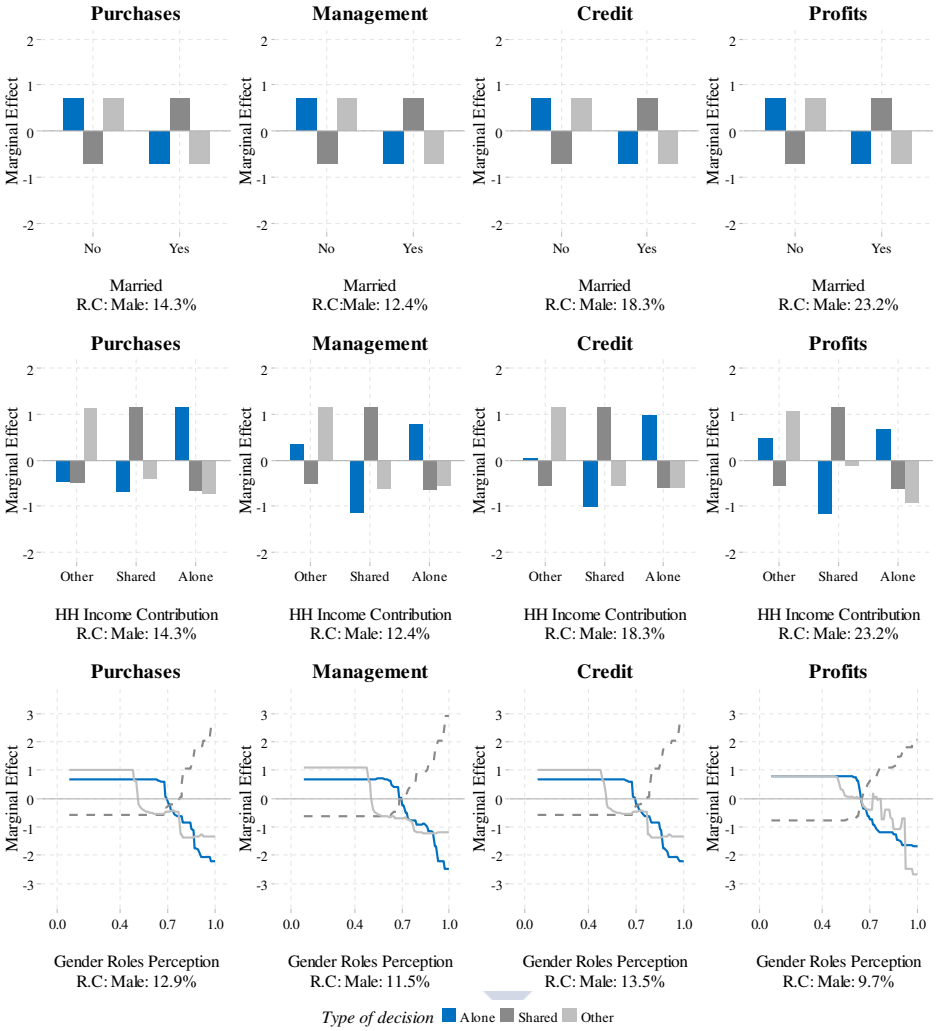

Figure 3.3. **Partial dependence plots for the most influential predictors over entrepreneurial decision-making for male entrepreneurs.** The graphs show the marginal effect of the variable on the individual decision-making after accounting for the average value of all other variables in the model using gradient boosting model with multinomial deviance loss function. All the variables are centered to have zero mean over the data distribution. The relative contribution (R.C.:) of the variables for each sample is shown on the x-axis.

Figure 3.4 shows the marginal effect of the marital status, the perceived household income contribution and the type of the enterprise over entrepreneurial decision-making for female entrepreneurs. Our results show differences with respect to the male sample regarding the two common predictors: being married and the perception of household income contribution. First, for female entrepreneurs the effect of being married is positive not just for sharing decision-making, but also for allowing others to make decisions for them about all entrepreneurial dimensions. Second, the correlation between who is perceived as contributing income to the household and how decisions are taken within the enterprise appears only for purchase decisions, but the marginal effect of perceiving themselves as the household breadwinners on making decisions autonomously is consistently positive and even greater than for male entrepreneurs.

Finally, regarding the specific predictor, the marginal effect of the type of enterprise the female entrepreneur owns on her making decisions alone is positive when the entrepreneur is self-employed, negative when she has relatives as employees, and negligible when her employees are non-relatives.

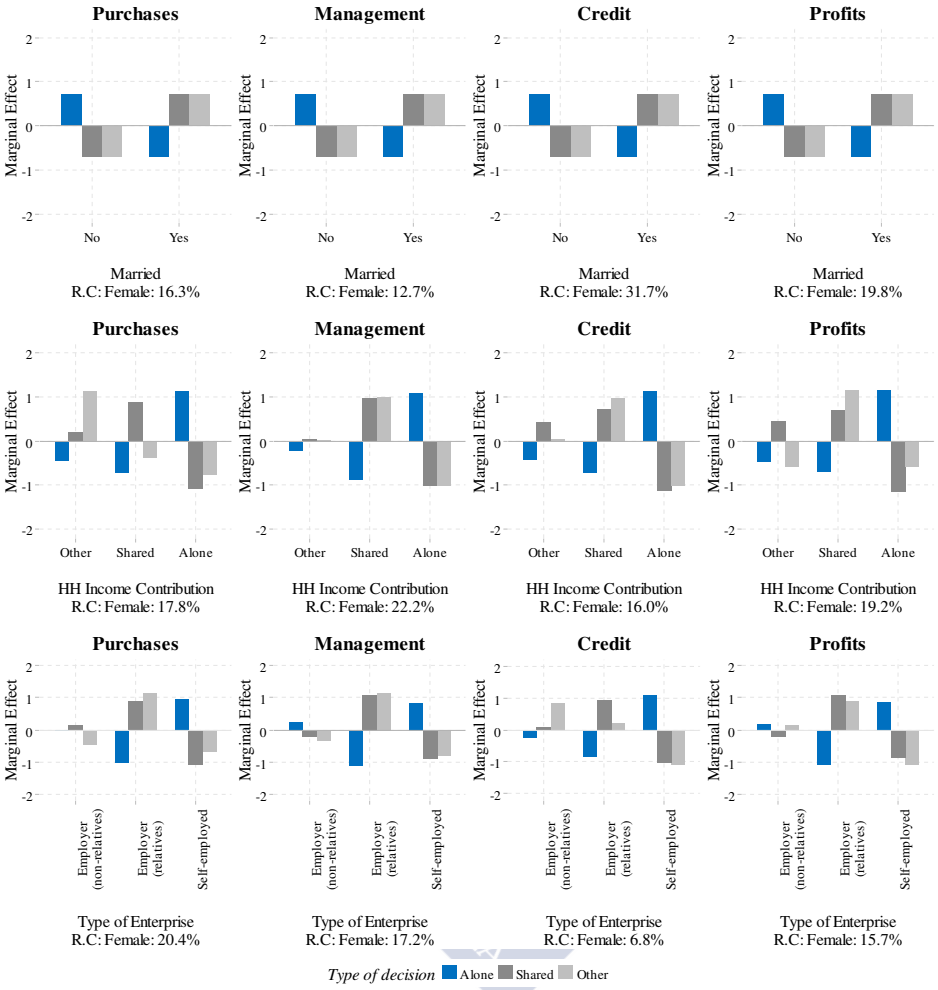

Figure 3.4. **Partial dependence plots for the most relevant predictors over entrepreneurial decision-making for female entrepreneurs**. The graphs show the marginal effect of the variable on the individual decision-making after accounting for the average value of all other variables in the model using gradient boosting model with multinomial deviance loss function. All the variables are centered to have zero mean over the data distribution. The relative contribution (R.C.:) of the variables for each sample is shown on the x-axis.

3.5.2 Determinants of decision-making about intra-household resource allocation

The determinants that influence decision-making about intra-household resource allocation are shown in Figure 3.5. As it was the case with entrepreneurial decisions, marital status and the perceived household income contribution are among the most influential predictors of resource allocation decision-making both for the male and the female samples. These two variables are the most relevant predictors for female decision-making, jointly accounting for roughly 70% of the influence for each of the three decisions analyzed. However, in the case of male entrepreneurs the wealth of the household stems out as an important predictor, being ranked the third most influential for each of the decisions analyzed.

The age of the entrepreneur and the gender roles perception index are also common but less influential factors in all the decisions analyzed but in either case their relative influence is higher than 10%. The only exception is the influence of the gender roles perception index over male decision-making about dwelling in the household. In this case, the relative influence is around 15%. The remaining influences are specific to the male sample. Thus, the presence of other adults in the household influence male decision-making on the household resource allocation, particularly on decision-making about leisure time. Worthy of mention is that the level of education of the entrepreneur and the presence of children in the household do not have a major influence in decision-making about resources allocation. Besides, none of the characteristics at the enterprise level have any relevance over decision-making about resource allocation for either male or female entrepreneurs.

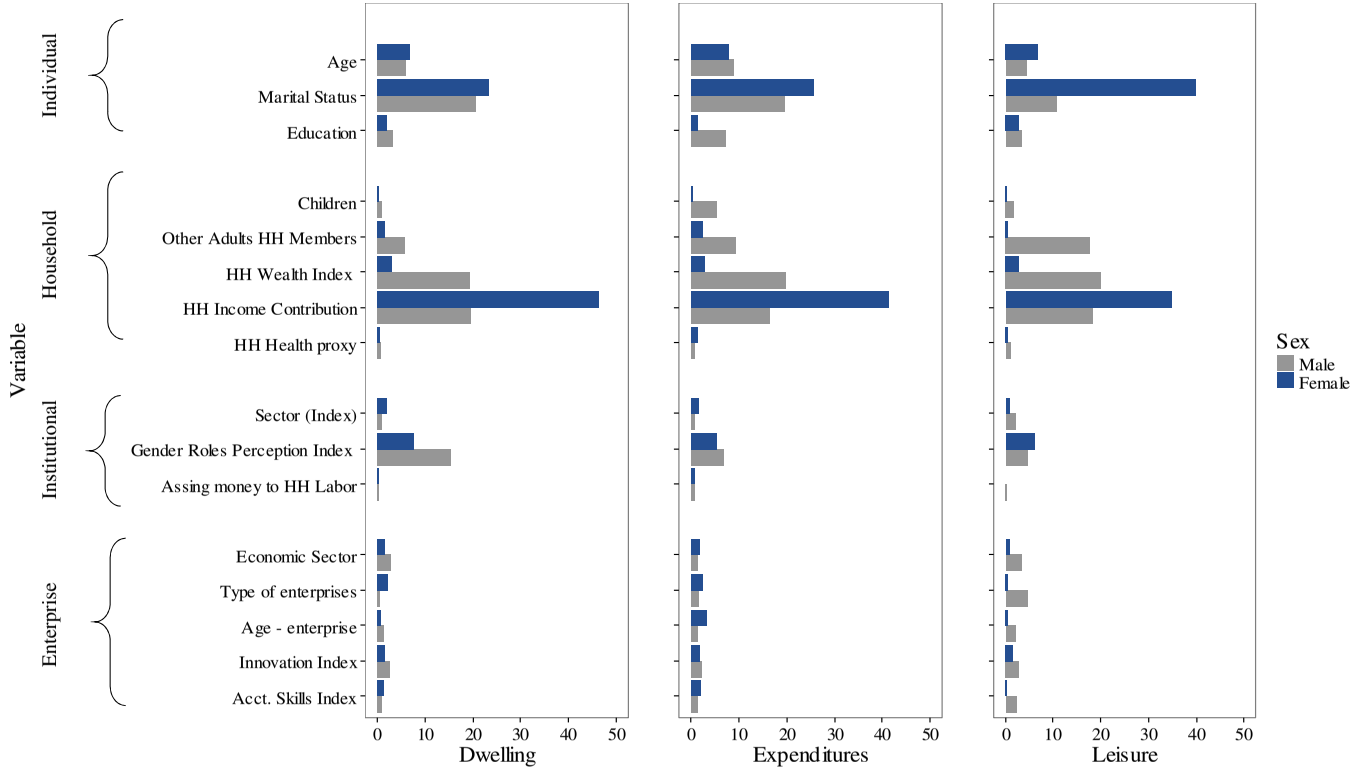

Figure 3.5 **Relative Influence (%) of predictor variables of decision-making patterns about resource allocation. The** graphs show the relative influence in percentages of the variables over entrepreneurial decision-making by sex using gradient boosting model. There are gender differences among the factors that influence entrepreneurial decision-making

Similarly to what has been done above for entrepreneurial decisions, now we present the partial dependence plots for the most relevant predictors of decision-making about intra-household resource allocation for each sample. In figure 3.6, we show the partial dependence plots for male entrepreneurs representing the marginal effect of the most influential predictors on the three decisions about intra-household resource allocation, i.e. marital status, perceived household income contribution and the household wealth index. As it happened with entrepreneurial decisions, being married is shown to have a positive effect on male entrepreneurs sharing their intra-household resource allocation decision-making, and there is correlation (even more general than for entrepreneurial decisions) between who is perceived as contributing income to the household and how decisions are taken about resource allocation within the household.

Finally, we present the partial dependence plots for the household wealth index. This index was constructed such that higher values represent wealthier households. The marginal effect of the household wealth index over decision-making about dwelling shows a positive value for shared decision-making from relatively low values of the household wealth index (.25). In comparison, the marginal effect for decision-making about household expenditures and leisure time shows three differentiated ranges: starting from low values the effect is positive for autonomous decisions, then as the wealth index increases the effect turns positive for shared decisions, and finally for higher values of the index the effect is positive for the making of decisions by someone else.

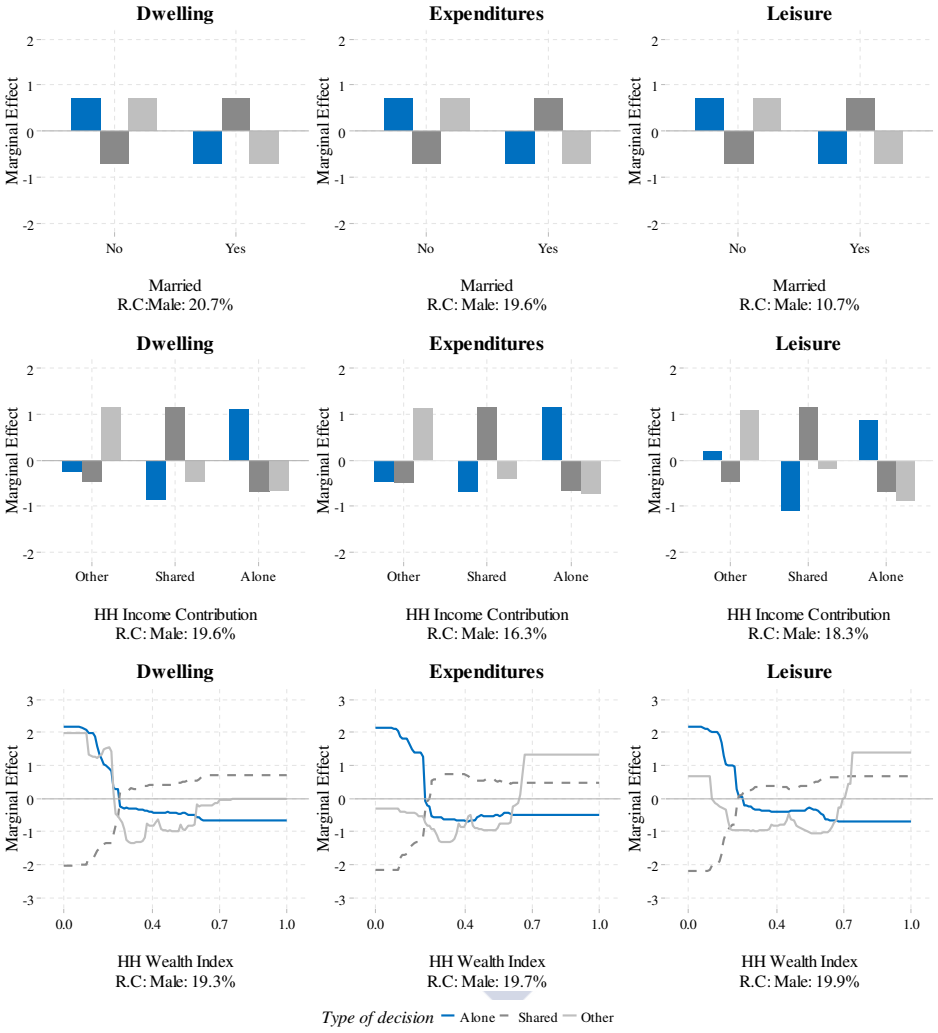

Figure 3.6. **Partial dependence plots for the most relevant predictors in the decision-making over resource allocation for female entrepreneurs**. The graphs show the marginal effect of the variable on the individual decision-making after accounting for the average value of all other variables in the model using gradient boosting model with multinomial deviance loss function. All the variables are centered to have zero mean over the data distribution. The relative contribution (R.C.:) of the variables for each sample is shown on the x-axis.

The marginal effect of the most influential predictors affecting decision-making about intra-household resource allocation for female entrepreneurs is shown in Figure 3.7. We included partial dependence plots for the two most important predictors: marital status and the perceived household income contribution. In the first case, we observe a difference with the male sample only regarding decisions about leisure time, where the marginal effect of being married is positive not just for the sharing of decision-making but also for the making of decisions by someone else. In the second case, the main difference with respect to the male sample is that the marginal effect of other person (different from the female entrepreneur) being perceived as the income contributor to the household on shared decision-making is positive (albeit very small) for all three decisions analyzed.

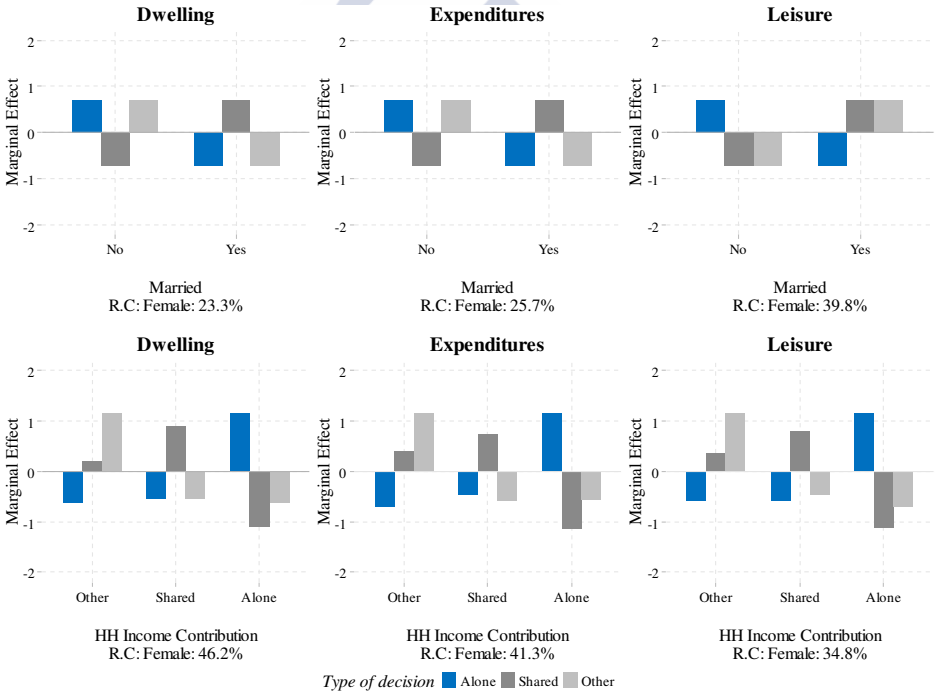

Figure 3.7. **Partial dependence plots for the most relevant predictors in the decision-making over resource allocation for female entrepreneurs.** The graphs show the marginal effect of the variable on the individual decision-making after accounting for the average value of all other variables in the model using gradient boosting model with multinomial deviance loss function. All the variables are centered to have zero mean over the data distribution. The relative contribution (R.C.:) of the variables for each sample is shown on the x-axis.

3.5.3 Determinants of decision-making about childbearing and child-rearing

The determinants of decision-making about childbearing (childbearing and contraceptive use) and childrearing (health and children's education) of both male and female entrepreneurs are shown in Figure 3.8. This group of decisions shows the more stark differences in the identification of the most influential predictors between the male and female samples. For female entrepreneurs, once again the perceived household income contribution and the marital status (in this order) are the most influential predictors, jointly accounting for more than 50% of the relative influence in all the decisions analyzed. In contrast, for male entrepreneurs the most influential predictor is the marital status, and the influence of the perceived household income contribution is much smaller, lower than the influence of other predictors like the wealth of the household, the gender roles perception index, or the age of the entrepreneur.[98]

[98] Except for decision about health, where the perceived household income contribution is the second most influential predictor both for the male and the female samples.

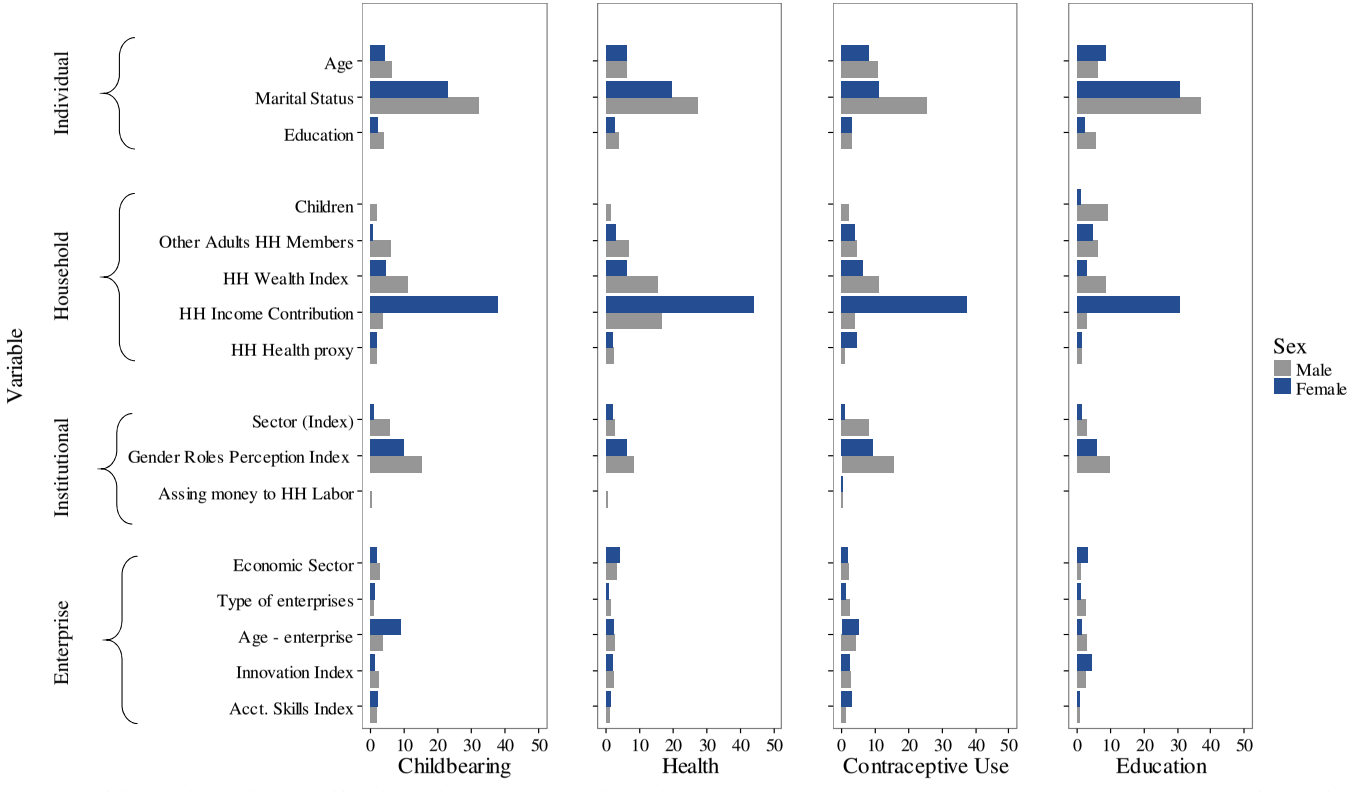

Figure 3.8 **Relative Influence (%) of predictor variables of decision-making patterns about childbearing and child-rearing**. The graphs show the relative influence in percentages of the variables over entrepreneurial decision-making by sex using gradient boosting model. There are gender differences among the factors that influence entrepreneurial decision-making.

The partial dependence plots for the most influential predictors of decisions about childbearing and child-rearing for the male sample are reported in Figure 3.9. We included the marginal effect of the marital status, the household wealth index and the gender roles perception index. It can be easily seen that the marginal effect of marital status is consistently the same that in all other decisions considered: the effect of being married is positive on sharing the making of decisions. The marginal effects of the household wealth index, on the contrary, present differentiated patterns for the different decisions considered. Thus, the effect is positive on the making of autonomous decisions for the lowest levels of the index, except in the case of childbearing decisions, where the positive effect corresponds to intermediate values. Regarding the effect on someone else making the decisions instead of the entrepreneur, it is positive for a narrow range of the lowest values of the index in the case of the child-bearing decisions, and for a wider one in the case of the child-rearing decisions. Correspondingly, the marginal effect on the sharing of decision-making is positive for the highest values of the index regarding child-bearing decisions, while it is positive for all values except the lowest of the index in the case of child-rearing decisions.

A similar differentiated pattern between child-bearing and child-rearing decisions can be observed in the marginal effects of the gender roles perception index. Once again, the effect is positive on the making of autonomous decisions for approximately the same set of values of the index (roughly below 0.7) for all the four decisions analyzed, but the sign of the effects on sharing decisions and letting others to make the decisions varies differently according to the type of decision (child-bearing or child-rearing) considered. For child-bearing decisions, the effect on sharing decisions is positive for values higher than 0.5 and the effect on letting others make the decision is positive for values lower than 0.5. On the other hand, for child-rearing decisions, the effect on sharing decisions is positive and increasing for a narrower range of high values of the index (roughly above 0.7), while the effect on letting others make the decision is also positive for relatively higher values of the index, but peaks around a value of 0.7 for the index.

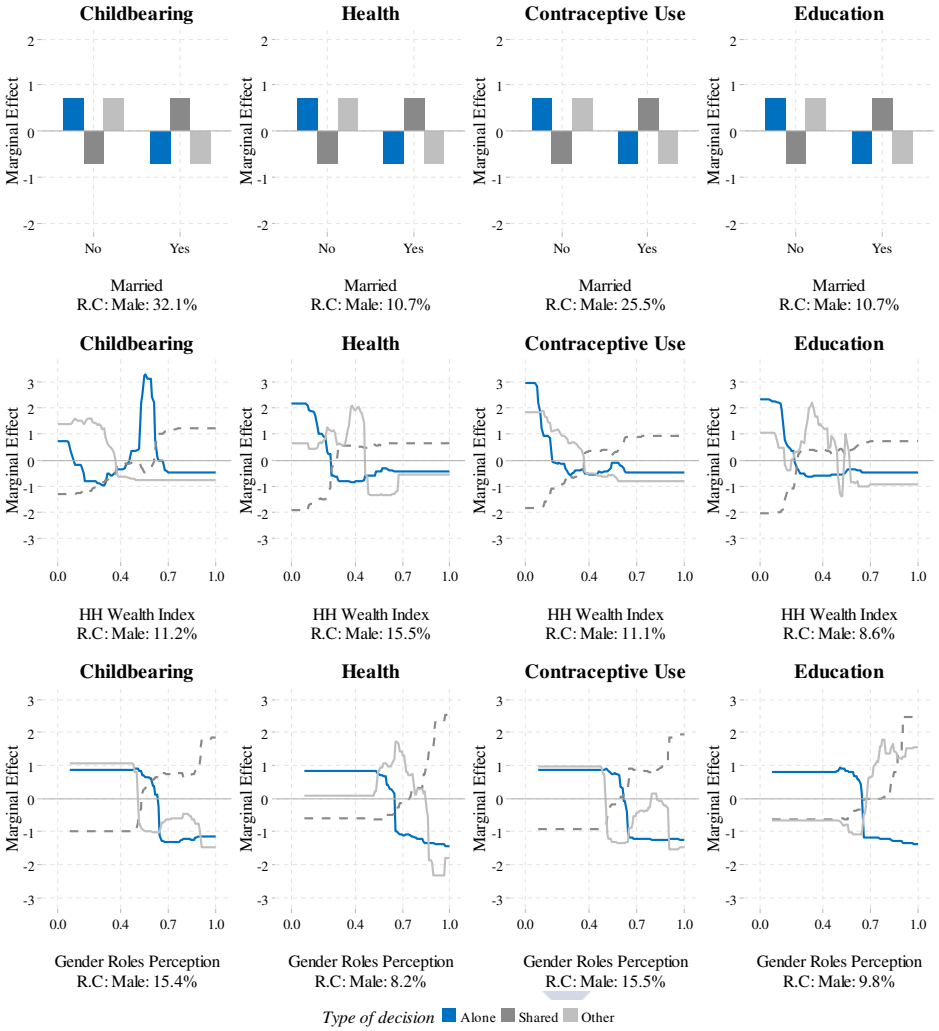

Figure 3.9. **Partial dependence plots for the most relevant predictors in the decision-making over childbearing and child-rearing for male entrepreneurs**. The graphs show the marginal effect of the variable on the individual decision-making after accounting for the average value of all other variables in the model using gradient boosting model with multinomial deviance loss function. All the variables are centered to have zero mean over the data distribution. The relative contribution (R.C.:) of the variables for each sample is shown on the x-axis.

Figure 3.10 shows the partial dependence plots of the two most influential predictors of decision-making about childbearing and child-rearing for female entrepreneurs: being married and the perceived household income contribution. The results are in line with those obtained above for other decisions, with being married having a positive marginal effect on shared decision-making and a general correlation between the perception of who contributes to household incomes and who makes the decisions within the household.

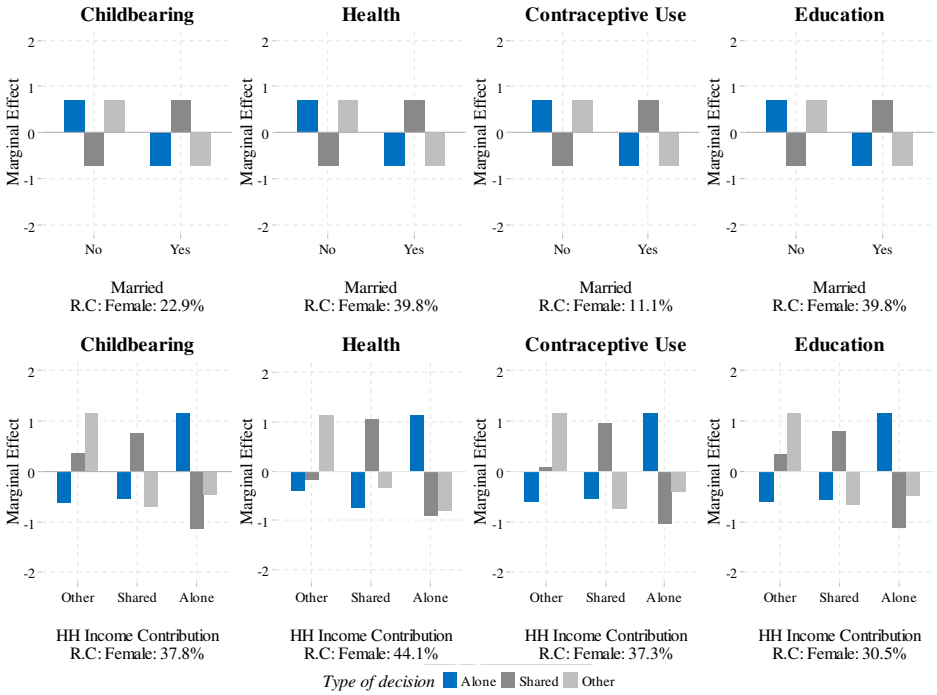

Figure 3.10. **Partial dependence plots for the most relevant predictors in the decision-making over childbearing and child-rearing for female entrepreneurs**. The graphs show the marginal effect of the variable on the individual decision-making after accounting for the average value of all other variables in the model using gradient boosting model with multinomial deviance loss function. All the variables are centered to have zero mean over the data distribution. The relative contribution (R.C.:) of the variables for each sample is shown on the x-axis.

3.6 CONCLUSIONS

This chapter makes several contributions to the literature on gender, empowerment and entrepreneurship. Our incorporation of the family embeddedness perspective into the decision-making analysis using gender as a category represents the first empirical application that explores gender differences over decision-making in the work-family interface of

entrepreneurs. In the literature about entrepreneurship, the analysis of the enterprise is usually isolated from decisions within the household whilst in the literature of empowerment most of empirical applications focus mainly on women's intra-household decision-making leaving both men's decision-making and the analysis of decision-making within the enterprise almost unexplored.

While the nature of the empirical analysis developed in this chapter is purely descriptive, its results are highly suggestive of the potential benefits for further empirical research focused on the WFI. We have shown how, under the apparent homogeneity of entrepreneurial decision-making, clear gendered differences can be identified. The introduction of the domain of intra-household decisions and their potential determinants has led us to locate a large source of gender heterogeneity in decision-making in a subset of this domain, the one encompassing decisions related to child-bearing and child-rearing. This clearly suggests that the existence of a sharp gender division of labor regarding conception and child-related tasks may have effects that spill over other domains and in particular over the entrepreneurial one.

The application of the standardize mean difference and a GBM methodology to our database has allowed us to identify child-bearing and child-rearing decisions as the ones where there are large differences in the decision-making process between female and male entrepreneurs. The nature of these differences describes a realm within the WFI where women have relatively high autonomy to make decisions for themselves without the help or interference of others, attenuated only by the conventional bindings of the marriage institution and/or situations of income dependency within the household. Interestingly, we have found that not only decision-making is different by gender within this dominion, but also that the factors influencing such decisions act differently on female than on male entrepreneurs. Characteristics like the wealth of the household or the perceptions about adequate roles by gender present relatively high influence over the decisions of male entrepreneurs, but almost none over the ones by their female counterparts. Besides, the influence of these factors is clearly different for decisions related to child-bearing (use of contraceptives, the decision to have children) than for decisions related to child-rearing (children's education, family health) in the case of male entrepreneurs, while for female ones the most influential factors present homogeneous marginal effects for all the four decisions.

Even for those decisions (like the ones directly linked to the enterprise) where decision-making appears to be very similar for female and male entrepreneurs, we have found substantial gender heterogeneity regarding the factors that influence such decision making. Thus, while the most influential factors on how entrepreneurial decisions are made are, in general, the marital status and who is perceived to contribute to household income both for male and female entrepreneurs, their marginal effects show differences in sign. For male entrepreneurs, being married and perceiving other persons to be the main contributor to household income both has a positive marginal effect on shared decision-making. For female entrepreneurs, instead, the positive marginal effect of such characteristics extends also to allowing others to make decisions for them. Moreover, we have also identified highly influential factors that are gender-specific. In particular, we have found that the type of enterprise is a relatively influential factor in entrepreneurial decisions for female entrepreneurs but not for male ones. For a female entrepreneur, being self-employed has a positive marginal effect on making decisions about the enterprise alone by herself.

These results strongly suggest that the apparent similarities of female and male decision-making processes within the entrepreneurial domain are driven by some features in the composition of the male and female population of micro-entrepreneurs in our sample (and, by extension, in Ecuador). In particular, our results call for attention on the relatively high proportion of single and self-employed women in the population of female entrepreneurs and point to the possibility of self-selection issues into female entrepreneurship.

This self-selection into female entrepreneurship may respond to the labor market structure that lacks conciliation policies in the work-family interface and a gendered division of labor in the Ecuadorian society. In fact, we found that female entrepreneurs make autonomous intra-household decision-making when it relates to decisions about their reproductive and nurturing roles while men delegate those decisions to someone else in the family. Furthermore, female entrepreneurs are the ones that assign to themselves major responsibility of taking care of the children and may found in entrepreneurship more flexibility to balance their productive and reproductive roles.

The difference among the patterns of decision-making requires further research to examine gender differences on how microentrepreneurs conciliate and balance the WFI. If the decision-making within the household is done mostly jointly with someone as found in this chapter and

in previous research (Deere & Twyman, 2012; Diana Deere et al., 2012), autonomous decisions within the microenterprise can cause tensions and bargaining over resource allocation in the WFI, where women may be prone to face double-burden and domestic violence.

Finally, the degree of perceived household-income contribution is highly correlated with making intra-household and entrepreneurial decision-making and is even more relevant than other objective factors such as the wealth of the household and formal education. This may be explaining by the notion of legitimacy propose by Sen (1987) where the perception of the household contribution (whether real or not) may influence their notion of legitimacy to participate over decisions within and outside the household. Our results raise many important questions about who to change the perceptions of both female and male entrepreneurs in a context where enterprises are embedded into social and family networks. The use of products of the enterprise for household consumption and the absence of basic accounting skills are the key challenges to make visible the contribution of entrepreneurship to the family household.

APPENDICES TO CHAPTER III

Table A3.1 Variable Definitions

Variable	Definition
Individual Level	
Age	Age of the respondent in years
Married/Consensual union	Marital status is equal to 1 if married or consensual union, 0 otherwise (single or widowed, separated or divorced).
Education	Includes for levels of education: less than primary education, primary education, secondary education and tertiary education
Household Level	
Children	Children is equal to 1 if the respondent have children, 0 otherwise
Other household members >18-years-old	Includes the number of other adults in the household besides the respondent
Household Wealth Index	Index constructed using Polychoric Factor Analysis (FA) to account for the common variance of 9 variables that includes: (i) main material of the residence; (ii) shower (number); (iii) type of fuel the household use for cooking; (iv) car (number); (v) refrigerator (number); (vi) color TV (number); (vii) blender (number); (viii) computer (number); and, (ix) Internet. Reliability of the index using Cronbach's alpha is 0.813, Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy of 0.864 and fist factor accounts for 92.72% of common variance.
Perceived Household Income Contribution	Includes respondent's perceived household income contribution equals to 1 if someone else makes the contribution, 2 if shares the contribution and 3 if the respondent is makes the contribution alone
Household Health Proxy	Includes the reasons for attending to the doctor in the last year: 1 if they have not attended to the doctor or attend only for control and prevention, 2 if the reason was health check-ups and illness and 4 if they went for illness treatment.

Table A3.1-b *(Continued)*

Variable	Definition
Institutional Level	
Sector – Index 2010	Index is a measure developed by (SENPLADES, 2013). The index captures the differences in socioeconomic conditions of parishes in Ecuador and represents 50.5% of the total variance from the 19 social indicators in areas of education, health, housing characteristics and basic services.
Gender Roles Perception Index	Index based on polychoric (FA) and includes information about who has the major responsibility (men, women or both) for 5 roles perception: (i) rising and bearing children; (ii) household breadwinner, (iii) traditional jobs, (iv) running business, (v) holding public offices. Reliability of the Index using Cronbach's alpha is 0.723, Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy of 0.803.
Assign monetary value to housework activities	Refers to whether the respondent recognizes the worth of their housework contribution to the household. Is equal to 1 if they answered yes, 0 otherwise
Enterprise Level	
Age – enterprise	Number of years running the business
Economic Sector	Refers to the economic sector of the main activity and includes: (i) Agriculture and others (5); (ii) Commerce/trade/retail; (iii) Manufacturing; and (iv) Service.
Type of enterprise	Type of enterprise refers to whether the respondent runs the business alone or has other people working/helping in the enterprise. It takes the value of 1 if is self-employed, 2 if is employer of family members, and 3 if is employer of no member relatives.
Innovation Index	Innovation Index refers to whether the entrepreneur experienced changes in the last year over a set of variables: (i) Increased sales of enterprise; (ii) Added new products; (iii) Improved the quality of product/add value; (iv) Reduced cost by volume; (v) Found cheaper sources of credit; (vi) Purchase tools/accessories; (vii) Invested in marketing; and (viii) Invested in technology. The index is constructed using polychoric factor analysis, reliability (Cronbach's alpha) is 0.72, Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy of 0.843 and fist factor account for 60.23% of common variance
Accounting Skill Component	Index using polychoric principal component analysis (PCA) that includes: (i) if the entrepreneurs keeps money separated from personal expenses; (ii) keep accounting records; and (iii) if they know which is/are the most profitable product(s) or service(s)? Fist component accounts for 75.36% of total variance.

Table A3.2 Summary of the relative contributions (%) of predictor variables of entrepreneurial decision-making patterns by sex.

	Male				Female			
	Purchases	Management	Credit	Profits	Purchases	Management	Credit	Profits
Individual Level								
Age	3.03	3.56	2.58	3.87	4.67	8.16	11.76	11.47
Marital Status	13.91	12.48	17.73	23.10	16.15	13.22	32.40	20.18
Education	2.61	3.19	5.52	1.61	2.36	3.84	0.55	1.11
Household Level								
Children	0.23	0.48	0.46	0.15	0.71	1.47	0.22	0.97
Other Adults HH Members (>18-years-old)	1.02	1.00	2.42	1.18	2.57	1.64	4.10	0.61
HH Wealth Index	2.13	4.22	5.38	6.72	2.74	3.56	3.06	3.74
HH Income Contribution	35.92	33.45	23.86	24.88	17.59	22.92	16.10	19.31
HH Health proxy	6.30	6.05	1.33	3.14	1.86	0.68	1.67	0.89
Institutional Level								
Social Comparative Sector	0.69	1.35	1.49	2.38	8.75	3.87	1.40	2.90
Roles Perception Index	12.22	11.47	13.04	9.64	3.99	4.10	7.22	3.61
Assign monetary value to HH Labor	1.43	1.58	3.28	1.58	7.45	6.04	5.93	6.81
Enterprise Level								
Economic Sector (Enterprise)	1.79	1.69	4.98	2.93	2.28	2.50	1.10	3.14
Type of enterprises	5.53	7.85	8.18	3.49	20.14	17.60	6.67	15.92
Age – enterprise	2.14	1.75	2.67	2.39	2.17	2.08	1.25	2.61
Innovation Index	7.11	4.23	2.28	8.44	2.72	3.56	2.54	2.27
Entrepreneurial Skills Component	1.20	2.77	1.29	2.27	1.50	2.37	1.85	2.49
Firm Exit (IMR)	2.75	2.89	3.53	2.23	2.36	2.38	2.17	1.97
N		**297**				**450**		
Best Iteration (Test method)	**2976**	**3504**	**2723**	**3796**	**2820**	**4146**	**3980**	**3241**

Note. Gradient boosted models with multinomial distribution. The boosted algorithm includes a subsampling parameter of .5 and shrinkage parameter of .005 for 20,000 iterations. Data was trimmed to 80% as stopping rule for the algorithm with three-way iterations and use a minimum size of 10 nodes for each iteration. IMR= Inverse Mills Ratio of firm exit probability.

Table A3.2 Summary of the relative contributions (%) of predictor variables of intra-household decision-making patterns by sex

	Male			Female		
	Dwelling	Expenditures	Leisure	Dwelling	Expenditures	Leisure
Individual Level						
Age	5.86	7.87	4.10	6.54	7.60	6.59
Marital Status	20.17	19.41	10.24	22.30	24.76	39.61
Education	2.96	6.97	3.37	1.83	1.18	2.75
Household Level						
Children	0.91	5.02	2.01	0.20	0.18	0.26
Other Adults HH Members (>18-years-old)	5.38	9.18	17.07	1.75	2.52	0.58
HH Wealth Index	18.55	19.54	18.94	2.82	2.47	2.71
HH Income Contribution	19.16	16.19	17.59	43.79	39.74	34.64
HH Health proxy	0.60	0.67	1.15	0.45	1.24	0.55
Institutional Level						
Social Comparative Sector	0.64	0.52	1.95	1.98	1.31	0.78
Roles Perception Index	15.00	6.49	4.43	7.25	5.09	6.19
Assign monetary value to HH Labor	0.11	0.08	0.25	0.27	0.05	0.03
Enterprise Level						
Economic Sector (Enterprise)	2.71	1.17	3.10	1.55	1.58	0.72
Type of enterprises	0.34	1.03	4.40	2.14	2.35	0.65
Age – enterprise	1.07	1.15	1.88	0.69	2.93	0.62
Innovation Index	2.49	2.15	2.57	1.53	1.67	1.53
Entrepreneurial Skills Component	0.80	1.07	2.12	1.24	1.85	0.40
Firm Exit (IMR)	3.24	1.49	4.83	3.67	3.47	1.38
N		**297**			**450**	
Best Iteration (Test method)	**2008**	**2468**	**2225**	**4716**	**6265**	**2653**

Note. Gradient boosted models with multinomial distribution. The boosted algorithm includes a subsampling parameter of .5 and shrinkage parameter of .005 for 20,000 iterations. Data was trimmed to 80% as stopping rule for the algorithm with three-way iterations and use a minimum size of 10 nodes for each iteration. IMR= Inverse Mills Ratio of firm exit probability.

Table A3.2 (Continued)

	Male				Female			
	Childbearing	Health	Fertility	Education	Childbearing	Health	Fertility	Education
Individual Level								
Age	6.10	5.67	10.15	6.05	4.30	5.90	7.87	8.37
Marital Status	31.67	26.96	25.51	35.85	22.13	19.05	10.97	30.10
Education	3.48	3.64	3.12	5.26	1.81	2.30	3.31	2.08
Household Level								
Children	1.77	1.51	2.10	9.03	0.10	0.07	0.14	0.92
Other Adults HH Members (>18-years-old)	6.01	6.63	4.76	6.29	0.84	2.60	3.74	4.82
HH Wealth Index	10.51	15.20	10.68	8.60	4.45	5.73	6.28	2.59
HH Income Contribution	3.52	16.16	3.67	2.88	35.59	43.65	36.80	29.90
HH Health proxy	1.42	2.00	0.89	1.28	1.54	1.75	4.51	1.42
Institutional Level								
Social Comparative Sector	5.15	2.16	7.88	2.61	1.06	1.45	1.05	1.09
Roles Perception Index	15.07	7.99	15.18	9.69	9.76	5.78	9.13	5.59
Assign monetary value to HH Labor	0.16	0.24	0.28	0.14	0.08	0.01	0.30	0.04
Enterprise Level								
Economic Sector (Enterprise)	2.31	2.82	2.10	1.00	1.47	3.84	1.61	2.86
Type of enterprises	1.08	1.19	2.20	2.42	1.46	0.59	1.24	1.00
Age – enterprise	3.00	2.19	4.31	2.58	8.67	1.77	4.69	1.35
Innovation Index	1.98	1.95	2.71	2.61	1.53	1.64	2.41	4.07
Entrepreneurial Skills Component	1.74	1.00	1.21	0.84	1.94	1.16	3.12	0.90
Firm Exit (IMR)	5.04	2.69	3.24	2.88	3.26	2.73	2.83	2.90
N		**297**				**450**		
Best Iteration (Test method)	**2082**	**2391**	**2012**	**2747**	**4215**	**3966**	**3446**	**5404**

Note. Gradient boosted models with multinomial distribution. The boosted algorithm includes a subsampling parameter of .5 and shrinkage parameter of .005 for 20,000 iterations. Data was trimmed to 80% as stopping rule for the algorithm with three-way iterations and use a minimum size of 10 nodes for each iteration. IMR= Inverse Mills Ratio of firm exit probability.

Table A3.3 Gender roles perception by sex

	Male	Female	p-value(a)
R: Raising & Bearing children (%)			.026*
Women	74 (24.9)	150 (33.3)	
Men	7 (2.4)	5 (1.1)	
Both	216 (72.7)	295 (65.6)	
R: Household Breadwinner (%)			< .001***
Women	8 (2.7)	40 (8.9)	
Men	115 (38.7)	111 (24.7)	
Both	174 (58.6)	299 (66.4)	
R: Jobs (carpentry, masonry & mechanics) (%)			.081
Women	9 (3.0)	23 (5.1)	
Men	219 (73.7)	299 (66.4)	
Both	69 (23.2)	128 (28.4)	
R: Running business (%)			.001**
Women	7 (2.4)	35 (7.8)	
Men	44 (14.8)	41 (9.1)	
Both	246 (82.8)	374 (83.1)	
R: Holding public offices (%)			.259
Women	6 (2.0)	18 (4.0)	
Men	31 (10.4)	53 (11.8)	
Both	260 (87.5)	379 (84.2)	
Roles perception Index (mean (sd))	0.81 (0.18)	0.79 (0.24)	.219
N	**297 (39.8)**	**450 (60.2)**	

Note. [(a)] Probability corresponds to Chi-square test for categorical variables and Mann-Whitney U test for continuous variables (non-normal). Author's own calculation based on field-work (CACMU, 2013).
Sig.: *** p < .001, ** p <.01, * p < .05.

CHAPTER IV:

Life satisfaction of microentrepreneurs in Ecuador: The role of financial inclusion

"Entrepreneurship is not only concerned with business success, as measured by profits, but also with subjective welfare and non-economic wellbeing"
- (Naudé, 2013) –

4.1 INTRODUCTION

Microfinance has been under the scope for several years. The initial euphoria from the microcredit proponents during the seventies was largely diminished with the mixed evidence from impact evaluations of microcredit programs in the later decades. Empirical researches using randomized controlled trials (RCT)[99] have only found 'modest' positive effects of the access to credit over objective and subjective outcomes (see among others, Banerjee & Mullainathan, 2010; Banerjee, Karlan et al., 2015) and shows that heterogeneity among entrepreneurs mask dispersion and the effect of microcredit programs (Karlan & Zinman, 2009; Bandiera et al., 2013; Angelucci et al., 2015; Banerjee et al., 2015a; Calderon et al., 2016). Criticism based on the empirical evidence highlight the limitations of microcredit programs to bring about microenterprise growth and to improve the well-being of microcredit recipients.

In this chapter, we focus our analysis on the effect of access to credit over the Satisfaction With Life Scale (SWLS) developed by (Diener et al., 1985) as a proxy of well-being.[100] The SWLS has long trajectory over satisfaction with life studies and shows good psychometric

[99] RCT is a methodology widely use among medical studies to explore causal relationship between the treatment and a set of different outcomes. Since the past decade, RCT have been extended for estimating causal effects of any policy or program in social sciences. The growing body of literature considers RCT as the 'gold standard' to estimate the 'real effect' of a policy or program (Duflo & Kremer, 2005). Despite the increasing effort to conduct impact evaluations using randomization, RCT implementation is difficult in regions where the intervention (microcredit program) has already begun, are highly expensive and have a limit external validity (Rosenbaum, 2002; Guo & Fraser, 2010). In addition, Boone et al. (2013) explore the limitations of implementing RCT in social sciences. The authors conducted a meta-analysis comparing 54 articles in the top economic journals with medicals RCT and found that economic RCT are not free from bias limiting even their internal validity. For a critical review of the implementation of RCT on social sciences see Bédécarrats et al. (2015).

[100] Objectives variables such as income, sales or benefits are difficult to assess among microenterprises in Ecuador. We also included objective measures in our questionnaire but observed during fieldwork that many of the entrepreneurs in our sample used the products of the enterprise for their consumption, particularly among wholesalers and retailers in grocery stores. In addition, as seen in chapter I, most of them lack basic accounting skills and are located near the household. Therefore, objective measures are unreliable outcomes to explore the effect of the access to credit among microenterprises in the country. This limitation raises questions about how monetary and non-monetary resources go from the enterprise to the family and vice versa. However, how the benefits in-kind (donations, consumption and payments in-kind) influence microenterprises in Ecuador is not under the scope of this thesis.

properties in a several studies worldwide (Pavot & Diener, 1993; Pavot & Diener, 2008). In the absence of both longitudinal and experimental data, we create a dataset through a cross-sectional survey conducted to 783 microentrepreneurs from the northern region of Ecuador in 2013, explained in the preface of this thesis.

Our empirical analysis includes the combination of the Multiple Indicator Multiple Causes (MIMIC) model and Propensity Score Weighting (PSW) to evaluate the effects of access to credit on the satisfaction with life of microentrepreneurs. Both methodologies have been widely used in observational and quasi-experimental designs but their combined use in empirical research is rather recent. The integration of the two analyses allows to simultaneously testing the hypothesized relations between the covariates and latent variable (SWLS) while controlling for selection bias on observed variables among different treatment conditions.

Based on the pioneer work of (Kaplan, 1999) that integrates propensity score sub-classification and the MIMIC model to account for group differences, (Guo & Fraser, 2014) propose to extend its application to a broader framework of Structural Equation Modeling (SEM) and propensity score methods. The underlying idea is to take advantage of the positive attributes of one methodology to account for the limitations of the other. First, SEM models allow evaluating and modeling the fit of relationships between means, variances and covariances of the variables in a theorized model while controlling for random and systematic measurement errors (Kaplan, 2008; Bollen & Noble, 2011; Guo & Fraser, 2014). However, SEM models fail to account for selection bias in intervention studies that may lead to bias and inconsistent coefficients since the strongly ignorable treatment assignment is often violated (Rosenbaum & Rubin, 1983; Imbens, 2000; Rubin, 2006).

On the other hand, propensity score analysis allows controlling for selection bias in examining causal effect between treatment and control groups when experimental studies are not possible (Rosenbaum & Rubin, 1983; Hirano & Imbens, 2001). Propensity score is the conditional probability of assignment given a vector of observed covariates to remove the bias associated with the problem of counterfactuals[101]. Thus, conditional on the propensity score, the distribution of all observed characteristics will ensure balance between the two samples

[101] In the potential outcome framework, given *n=2* treatment condition, each individual have *two* possible outcomes. One in which the individual is assign to the treatment condition and one in which the individual is assign to the control group instead. The effect of the treatment is given by the differences of the outcome under the treatment and control condition. However, only one of the values is observed for each individual, and thus the other value or counterfactual cannot be observed and have to be estimated.

(treatment and control) allowing for comparisons of an intervention or treatment condition over a given outcome. However, since propensity score analysis precedes the outcome analysis, it does not take into account measurement error; overidentification problems, latent variables analysis and multiple groups testing that are the main advantages of SEM models (Guo & Fraser, 2014).

A key aspect in propensity score analysis is the selection of covariates in estimating the probability of assignment. The selection of covariates should be done on the basis of theory and previous empirical studies and should include all the covariates that are expected to predict both the outcome and the treatment condition (see, e.g., (Heckman et al., 1997; Rubin, 1997; Caliendo & Kopeinig, 2008). In fact, the inclusion of irrelevant variables may increase the variance of the estimates and reduce balance properties resulting in substantial bias in the estimation of treatment effects (Imai & Ratkovic, 2014). More recently, (Cuong, 2013) using evidence from Monte Carlo simulations suggests that introducing all variables that are related with both the outcome and the treatment as well as those related only to the outcome may improve efficiency in estimating treatment effects.

In absence of a strong theory or of robust empirical evidence about the relevant characteristics that influence the satisfaction of entrepreneurs, we first explore determinants on the SWLS using a MIMIC model to identify the covariates that we will use on the second stage for the propensity score analysis. Once we have defined the reliability and validity of the construct as well as the goodness of fit of the hypothesized model we proceed to estimate the propensity scores using the covariates from the MIMIC analysis. We used propensity score weighting (PSW) using gradient boosting models proposed by (McCaffrey et al., 2004) for estimating of the probability of assignment. Finally, after assessing the balance properties of the scores estimated, we use the propensity scores as weights on the outcome in a multivariate analysis on treatment and covariates using again MIMIC models as suggested by (Guo & Fraser, 2014).

The remainder of this chapter is structured as follows. Section 4.2 includes a brief literature review the effects of the credit over the life satisfaction of the entrepreneurs. Section 4.3 presents the empirical model using Multiple Indicator Multiple Causes Model and Propensity Score Weighting. Section 4.4 describes the data structure and psychometric properties and characteristics of the SWLS. Section 4.5 reports the results of the determinants of life

satisfaction, the propensity score analysis and the outcome analysis. Finally, we conclude in section 4.6 with a summary of key findings of the chapter.

4.2 LITERATURE REVIEW

The empirical literature that explores the effect of the credit have rapidly expanded in the last years and initially focus only on the effect over objective well-being measures and social indicators such as female empowerment. Empirical evidence exploring of the effect of credit over objective measures found only 'modest' positive but not transformative effects of the access to credit over objective measures (see among others, Banerjee & Mullainathan, 2010; Banerjee, Karlan et al., 2015). Moreover, recent literature is showing that heterogeneity among entrepreneurs, mask dispersion and the effect of microcredit programs. For instance, Angelucci et al., (2015) using quintile regressions have found stronger effects at the upper end of the distribution (and thus the most growth-oriented enterprises) for revenues, profits and household decision-making power.

One notable exception in the impact evaluation literature refers to the effect of microcredit over consumption patterns and behaviour of microcredit recipients. Banerjee et al. (2015a) in their revisit of the effects among six randomized found that the consumption of temptation goods such as recreation, celebrations and entertainment declines whilst the consumption of durable goods increases after the microcredit intervention. Even though, researches were surprised to find that microcredit has a positive effect for smoothing consumption since it has not been identified as the main important goal by the microcredit proponents and practitioners, these results are not entirely unexpected. As described in the consolidated typology of Berner et al., (2012) in the first chapter of this thesis, many entrepreneurs using the logic of survivalist engage in entrepreneurship as mean for smoothing consumption. Therefore, it may be expected that entrepreneurship promotion policies such microcredit would enhance this changes in consumption patterns and behaviour.

There is a vast and extensive body of literature that have explored if microcredit can bring about female empowerment. Although, most of the measurements used to explore the impact of credit over female empowerment may fall into the category of subjective well-being measures, its analysis deserved a separate study. Duvendack et al. (2011) in an interesting review of the effects of microfinance using meta-analysis found only mixed results regarding female empowerment. The authors emphasize that empirical evidence using decision-making as a proxy of empowerment have shown modest effects of the microcredit over female

empowerment and the differences among methodologies does not allow to make any causal inferences. Specifically, they argue and we agree that there are some methodological challenges when measuring empowerment at an aggregated level limiting the analysis of 'true' effect over female empowerment. [102]

While exploring the effects of the credit over objective well-being measures and social indicators such as female empowerment has drawn the attention of most of the empirical evidence, the analysis over subjective well-being measures is fairly recent. In fact, we reviewed roughly 80 impact evaluations from experimental and observational studies and found that only six of them included subjective well-being outcomes in their impact evaluations.[103] In this section, we described in detail the main results of microcredit impact assessments and include only those studies that considered or focused primarily on subjective well-being measures. We focus our attention on the construction of the subjective measurement included in each study, the methodology of the impact evaluation as well as the main results of the six studies conducted so far. We conclude this section including a summary of the main empirical results of the credit over subjective well-being outcomes.

4.2.1 Effects of the credit over subjective well-being outcomes

Mohindra et al., (2008) were amongst the first authors to report the effect of the credit over subjective measures. Using a cross-section data collected on 2003 in a total sample of 928 women in the south Indian state of Kerala the study aimed to explore the associations between health and female participation in a self-help group. The authors included a variety of measures on health achievements such as exclusion to health care, decision-making agency, self-assessed health and markers of mental health. We identified that the main subjective well-being measures are emotional stress and life satisfaction. It is worthy of mention, that the last two measures were pretested in other countries and ensures the reliability and validity of the construct. The

[102] We explain in greater detail the complexities and challenges of exploring empowerment through decision-making analysis in the third chapter of this thesis. The main limitation of exploring the effect of the credit over empowerment is that it only includes female entrepreneurs in the analysis. Hence, a broader concept of decision-making should be introduced (such as the analysis in the work-family interface) to explore the differences on the effect among female and male entrepreneurs. Comparisons using the gender split are not common among the impact studies in microfinance.

[103] A thorough literature review on the effects of microcredit such as the work of Duvendack et al. (2011) may represent an entire doctoral thesis and is far beyond the scope of this analysis. It should be notice, however, that the most important contribution of this paper comes from the use innovative methodology and the data-driven analysis for the construction of theory. Particularly, through the implementation of the innovative methodology to overcome the limitations of exploring the effect of any policy using quasi-experiment data. Hence, the methodological and empirical approach and the reliability and validity of the measurement are the main concerns of this chapter. All these aspects are explained in greater detail through the entire chapter and are also included in the supplementary material of the chapter.

main result of this study is that early joiners are less likely to report emotional stress and poor life satisfaction compared to non-members. However, the main limitation in addition to the exploratory nature of the study is that it only includes female microcredit recipients, so we do not have evidence on how the credit may be influencing male microcredit recipients in the region of analysis.

Karlan & Zinman (2009, 2011) conducted a randomized control trial collected during 2006 and 2007 in the provinces of Rizal, Cavite and the National Capital Region of the Philippines. The experiment included in the design an innovative methodology to explore the effect of individual lending of a for-profit organization in the country. The total sample included 1601 individuals that received a credit using credit scoring to randomized the treatment and the control groups. The authors also include the gender split to explore differences on the effect of access to credit between male and female entrepreneurs. The inclusion of the gender as a category would allow exploring if the credit have a greater effect over microenterprises run by male entrepreneurs compared to the those run by the female counterparts. As described in the first chapter male entrepreneurs engage in entrepreneurship mostly under the growth-oriented logic. Therefore, it may be expected that the effect of the credit (if any) would be greater for male than for female entrepreneurs. The authors used many subjective well-being measures: life satisfaction, job stress and a summary of index of constructs of optimism, calmness, worry, job satisfaction, decision power, and socioeconomic status. Overall and without explaining information about the reliability and validity of the subjective well-being constructs, the authors found null effects in all measures of subjective well-being measures with the exception being the increases in stress experienced by male entrepreneurs.

Kundu (2010), using panel data collected between June- August 2008 to May- July 2009 to compare the effect of the credit over the happiness index of the village under individual and joint-liability lending in the West Bengal of India. The total sample included in the analysis where 344 responded including 107 individual that received a credit through individual lending, 126 credit recipients under joint-liability lending and 111 individuals as part of the control group. The author constructed a Happiness Index out of a battery of nine different questions. Although, there is no mention or reference to the validity and reliability of the measurement. The authors found positive Impacts over life satisfaction of joint liability credit compare to participants with individual liability credit and non-participants. The main limitation of this analysis is that it does not show a clear distinction between the lending methodology and the

sex of the owner since by design the programs that granted loans under join-liability methodologist target mainly women while the program that use individual lending granted mainly men in the villages, thus limiting the analysis since both sex of the credit recipient and lending methodology are highly correlate.

Following a chronological order of the studies that includes the effect of the credit over subjective well-being is the empirical work of Becchetti & Conzo (2013) conducted in Buenos Aires in Argentina. The authors explore the effect of credit using cross-section data of 359 entrepreneurs in a survey conducted from June to September of 2009. The sample included 150 microcredit recipients, 150 eligible non-participants and 59 entrepreneurs who have dropped out the program when the survey was conducted. The authors used a general life satisfaction assessment (single-item approach) to measure the satisfaction with life of entrepreneurs. Their results, after controlling for survivorship, selection and interview bias, microfinance membership has a significant and positive effect on life satisfaction of the entrepreneurs. However, the authors do not include sex as a category limiting comparisons on the effect across this variable.

Finally, Angelucci et al. (2015) using a clustered randomized control trial over 16000 households estimate the effects at a community level of the Microcredit Program of Comportamos Banco in Mexico. The experiment started in April 2009 until March 2012 with an average exposure to the microcredit program of 28 months. Treatment clusters received access to credit and door-to-door loan promotion targeting women under join-liability lending methodology. The authors included subjective well-being measures using multiple-items to construct index about: depression, job stress, life and harmony, satisfaction with their economic situation, locus of control and good health status. Overall, the authors found a positive albeit limited effect of well-being in all the outcomes and no evidence of adverse effects on average. The main limitation of this study is that the microcredit program target only women and there is no information about the effect at a community level when lending to men.

We present in Table 4.1 a summary of the principal characteristics and results of the effects of microcredit over subjective well-being described in previous paragraphs. As seen in the table, given the limited number of studies, the variety of methodological approaches and the differences in the design and implementation of the impact evaluations we cannot draw any conclusions about the effect of microcredit on subjective well-being. Overall, the initial evidence show a positive effect of microcredit over subjective well-being measures in five of

the six studies, particularly among programs that used group-lending to grant loans to their clients. In the next section, we present the empirical framework to estimate the treatment effects of access to credit over the Satisfaction with Life Scale for both male and female entrepreneurs to contribute to the scarce empirical evidence that have been presented in this brief literature review.

Table 4.1 Summary of Impact Evaluations that explore the effect of the microcredit over subjective well-being

Author	Treatment	Country	Impact Methodology	Sample	Exposure or Eligibility criteria	SWB Measures	Results
(Mohindra et al., 2008)	Microcredit Lending: • Self-Help Groups	India	Observational • Multinomial logistic Regression	Total: 928 T.: 592 C.: 336	Criteria: Members > 2 years	• Emotional Stress • Life Satisfaction	Early joiners are less likely to report emotional stress and poor life satisfaction compared to non-members.
(Karlan & Zinman, 2009, 2011)	Microcredit Lending: • Individual	Philippines	Experimental • RCT using credit scoring to randomize the treatment	Total: 1601 T.: 1272 C.: 329	Exposure: 11 to 22 months	• Optimism • Calmness • (lack) worry • Life Satisfaction • Work Satisfaction • Job Stress	No evidence of improvements in measures of subjective well-being. Increase stress for men.
(Kundu, 2010)	Microcredit & Job Program Lending: • Individual • Group	India	Observational • Panel data: Regression with fixed effects	Total: 334 T.: 233 C.: 111	Criteria: NS	• Happiness Index	Positive Impacts over life satisfaction of joint liability credit compare to participants with individual liability credit and non-participants.
(Becchetti & Conzo, 2013)	Microcredit Lending: • Group	Argentina	Observational • Propensity Score Analysis	Total: 300 T.: 150 C.: 150	Criteria: Ongoing economic activity > 6 months	• Life Satisfaction	Positive and significant effect independent of income and credit Cycles after controlling for survivorship, selection and interview bias.
(Angelucci et al., 2015)	Microcredit Lending: • Group	Mexico	Experimental • Clustered RCT	Clusters: 238 T.: 120 C.: 118 Respondents: 16560	Exposure: 27 months	• Depression Index • Stress • Locus of Control • Life Satisfaction • Financial Satisfaction	Positive albeit limited effect of well-being in all the outcomes. No evidence of adverse effects on average.

Note. SWB= Subjective well-being. RCT= Randomized controlled trial, T=Treatment, C=Control.

4.3 EMPIRICAL MODEL

In this section, we present the multi-group MIMIC model showing the hypothesized relationship between the Satisfaction with Life Scale and its potential determinants at the individual, household and enterprise levels. We also include the characteristics of Propensity Score Weighting using boosted regression for estimating the treatment effects. The section concludes showing the hypothesized MIMIC models to evaluate causal effects of access to credit on the Satisfaction with Life Scale (SWLS).

4.3.1 Determinants of SWLS using Multi-Group MIMIC model

The MIMIC model is a special case of structural equation modeling (SEM) proposed by Jöreskog & Goldberger (1975) that represents a system of simultaneous equations for the endogenous latent variables and is widely used in the social and behavioral sciences. The MIMIC model is open to incorporate different types of exogenous variables (continuous, binary and categorical) (Kaplan, 2008) and allows to estimate parameters in heterogeneous populations to examine group differences both on specific items as well as latent variables, that cannot be detected with regular multiple-groups analysis (Muthén, 1989).

The MIMIC model allows regressing both indicators as well as the factors to the exogenous variables and consists of two parts: (a) the measurement part, linking observed variables to each other via a confirmatory factor model and (b) the structural part, linking variables to each other via a system of simultaneous equations.[104] Kaplan (1999) emphasizes the importance of focusing on a factor or latent variable rather than on a single item to avoid biased standard errors when estimating the effect of the treatment condition in the population. The estimation of the MIMIC parameters uses maximum likelihood estimation with robust standard errors when the variable is continuous or if the number of categories for non-continuous endogenous variables ranges from five to seven categories.[105]

Following Muthén (1989) and Kaplan (1999, 2008), the MIMIC model can be defined for each independent group (g = male, female) as:

$$y_g = \tau_g + \Lambda_{yg}\eta_g + \varepsilon_g, \tag{4.19}$$

[104] In the case where is assumed that there is no measurement error in the observed variables, the general model reduces to an econometric simultaneous equation model (Kaplan, 2008).
[105] Evidence from Monte Carlo simulations suggest that when the categorical variable has from five to seven categories the use of Maximum Likelihood Estimator is more efficient and yields similar results than a Weighted Least Square estimator (Rhemtulla et al., 2012).

$$X_{jg} = \tau_g + \Lambda_{xg}\xi_g + \varepsilon_g, \tag{4.20}$$

and

$$\eta_g = \alpha + B\eta_g + \Gamma X_{jg} + \zeta_g, \qquad \zeta_g \sim N(0, \psi) \tag{4.21}$$

Equations (4.1) and (4.2) are the measurement part of the MIMIC model where τ_y and τ_y are vectors of measurement intercepts, Λ_y and Λ_x are matrices of factor loadings for the latent variables η and ξ, respectively, and ε and δ are vectors of unique variables. The endogenous latent variable η_g is a single vector that represents the construct of the Satisfaction with Life, α is a vector of structural intercepts, B is a matrix of regression coefficients relating the endogenous variables to each other, Γ is a matrix of regression coefficients relating the endogenous latent variables to the exogenous variables X_{jg} and ζ_g is a vector of disturbance terms (multivariate normal with zero mean).

Equation (4.3) represents the structural part of the model where the latent variable is regressed on observed covariates[106] X_{jg} at each level (j = individual, household, enterprise). Observed covariates at individual level include age, marital status, education and the perception of changes in the individual income over the last year. At the household level, characteristics included are whether there are children in the household, other adult members of the household (>18-years-old), a compound Household Wealth Index, a proxy of household health status, the relative household income contribution and a proxy of the socioeconomic characteristics of the place of residence. Finally, at the enterprise level we incorporate the economic sector of the enterprise; whether the respondent considers that his/her economic activity is stable, the type of enterprise (self-employed, employs family members or employers) and an indicator of basic accounting skills.

A path diagram of the hypothesized MIMIC model is given in Figure 4.1 The latent response variable for the Satisfaction with Life Scale over five Likert-scale items $(y_1,\cdots,y_5)$ are presented in circles or ellipses. Observed variables are represented with squares or rectangles and hypothesized directional effect of one variable on another (direct effect) with a line with a single arrowhead.

[106] Detail of definitions of the variables and the construction of indicators are presented in Table A4.1 in the appendix.

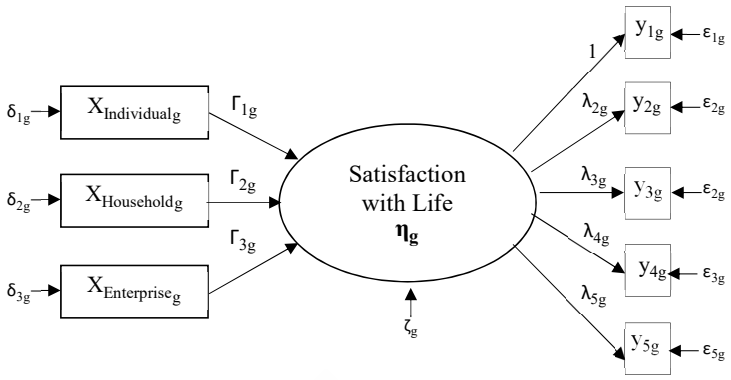

Figure 4.1 Path diagram of the MIMIC of Determinants of Life Satisfaction. The figure shows the hypothesized relationship between five Likert-scale items and the latent variable of Satisfaction with Life Scale (SWLS) regressed on individual, household and enterprise level sets of explanatory variables.

4.3.2 Propensity Score Weighting using Gradient Boosted Regression

In the potential outcome framework for estimating causal effects (Neyman-Rubin framework), there are two possible treatments (e.g., active treatment vs. control group) and an outcome (Satisfaction with Life). For each individual (entrepreneur) $i = 1, \dots, N$ there is a pair of potential outcomes: one in which the individual is assigned to the treatment condition $Y_i(1)$, and one in which the individual is assigned to the control group $Y_i(0)$. Thus, the estimated treatment effect is $Y_i(1) - Y_i(0)$. However, only one of the values is observed for each individual, and thus the other value or counterfactual have to be estimated.

Let t be an indicator of treatment $t = 1$ (if the entrepreneur has received a credit and 0 otherwise), then $E(Y_i(1)|t = 1)$ is the average treatment effect of a participant after receiving the treatment and $E(Y_i(0)|t = 1)$ is the average treatment effect if they have received the comparison condition instead. There are two possible treatment effects commonly estimated within this framework (Hirano & Imbens, 2001; Imbens, 2004): the *average treatment effect* (ATE) and the *average treatment effect on the treated* (ATT). The ATE measures how effective is the treatment on the entire population and can be defined as $E(Y_i(1) - Y_i(0))$ whilst the ATT measures the effect on those individuals that have actually received the treatment (intended target population) and is defined as $E(Y_i(1) - Y_i(0)|t = 1)$.

Drawing from (Hirano & Imbens, 2001; McCaffrey et al., 2004b; McCaffrey et al., 2013), given an X_j vector of observed covariates at each level (*j*=individual, household, enterprise), the propensity score, $p(X_j)$, is equal to the probability that an entrepreneur receives a credit rather than comparison condition. $Pr(t = 1|X_j)$, and X_j is independent on t. If $Y_i(1)$ and $Y_i(0)$ are independent on t conditional on X_j, then they are independent on t conditional on the propensity score, the observed values from the comparison group can be estimate as $E(Y_i(0)|t = 1, p(X_j))$.

The propensity scores are then used to weight the observation when estimating the treatment effect. Let the entrepreneur i in the comparison group have a weight w_i that shows the probability that a randomly selected participant with X_j characteristics would go to the treatment. The weighted mean of the observed outcomes for the comparison group is

$$\hat{E}(Y_i(0)|t = 1) = \frac{\sum_{i \in C} w_i Y_i}{\sum_{i \in C} w_i}, \tag{4.22}$$

where, $i \in C$ denotes the *i*th observation in the comparison group, the summation is over the set of observations in this group and $\hat{E}(Y_i(0)|t = 1)$ is the unbiased estimate of $E(Y_i(0)|t = 1, X_j)$. Letting N_T denote the number of entrepreneurs in the treatment group and $i \in T$, the mean of the treatment group is

$$\hat{E}(Y_i(1)|t = 1) = \frac{\sum_{i \in T} Y_i}{N_T}, \tag{4.23}$$

If $w_i = 1/\, p(X_{ij})$ then $\hat{E}(Y_i(1) - Y_i(0))$ estimates the average treatment effect (ATE) and if $w_i = p(X_{ij})/(1 - p(X_{ij}))$ then $\hat{E}(Y_i(1) - Y_i(0)|t = 1)$ estimates the average treatment effect on the treated. All weights are estimated using gradient boosting models (GBM).[107] The GBM is set to minimize the mean of the absolute standardized bias (SB) based on the difference between the weighted distribution of covariates between the two treatment conditions. Thus, for each covariate *k (k = 1, …, K)* of X_j, SB_k in estimating ATE, can be defined as:

$$SB_k = |\bar{X}_{k1} - \bar{X}_{k0}|/\hat{\sigma}_k, \tag{4.24}$$

[107] (McCaffrey et al., 2004b; McCaffrey et al., 2013) use GBM consisting of many simple regression trees that are iteratively combine to create an overall function. They use the iterative process to define an "optimal" number of iterations defined by four stopping rules: maximum or mean of two statistics the standardized mean difference (also known as standardize bias) and the Kolmogorov-Smirnov (KS) statistic. They suggest choosing the method that yields better results in minimizing the difference between weighted samples while retaining the maximum number of the effective sample size after weighing.

where, $\bar{X}_{k1}$ equals the weighted mean for the treatment group, $\bar{X}_{k0}$ is the weighted mean for the control group and $\hat{\sigma}_k$ is the unweighted standard deviation of the pooled sample. Whilst, for estimating ATT, the numerator is divided by the unweighted standard deviation for the treatment group $\hat{\sigma}_{k1}$ such as:

$$SB_k = |\bar{X}_{k1} - \bar{X}_{k0}|/\hat{\sigma}_{k1}, \tag{4.25}$$

4.3.3 MIMIC models in estimating treatment effects

Our analysis integrates the propensity score weights for estimating ATE and ATT into the MIMIC model. The potential outcome approach treats propensity score weights in a way similar to sampling weights to adjust for observations with unequal probabilities of receiving a treatment (credit) as proposed by (McCaffrey et al., 2004b; Guo & Fraser, 2014). In the case that the propensity scores balance all covariates between treatment and control groups, then treatment effects can be estimating using a first model (Model I) that compares weighted latent variable means differences. Model I includes the treatment condition (t) as the only predictor of the Life Satisfaction or latent factor (η_g), where γ is the parameter that captures the differences for the estimated treatment and control groups in the latent variable means, as shown in Equation (4.8).

$$\eta_g = \alpha + B\eta_g + \gamma t + \zeta_g, \qquad \zeta_g \sim N(0, \psi) \tag{4.26}$$

Alternatively, if the covariates remain imbalanced after weighting then we use a 'doubly robust approach' in a second model (Model II) as suggested by (McCaffrey et al., 2013). The doubly robust estimation fits the weighted MIMIC model introducing all covariates that remain imbalanced after the propensity score analysis. Hence, the estimators are unbiased and consistent if either the regression (in our case the MIMIC model) or the propensity analysis is correctly specified (Robins et al., 1994). Model II is presented in Equation (4.9), where γ accounts for the effect of credit after controlling for all remaining unbalanced covariates:

$$\eta_g = \alpha + B\eta_g + \gamma t + \Gamma X_{jg} + \zeta_g, \qquad \zeta_g \sim N(0, \psi) \tag{4.27}$$

Figure 4.2 shows the path diagrams for estimating the average effect of access to credit for the two hypothesized models. The latent response variable for the Satisfaction with Life Scale over five Likert-scale items $(y_1, \cdots, y_5)$ is represented by an ellipse. The treatment variable and

covariates are represented by squares or rectangles and hypothesized directional effects of one variable on another (direct effects) by lines with a single arrowhead.

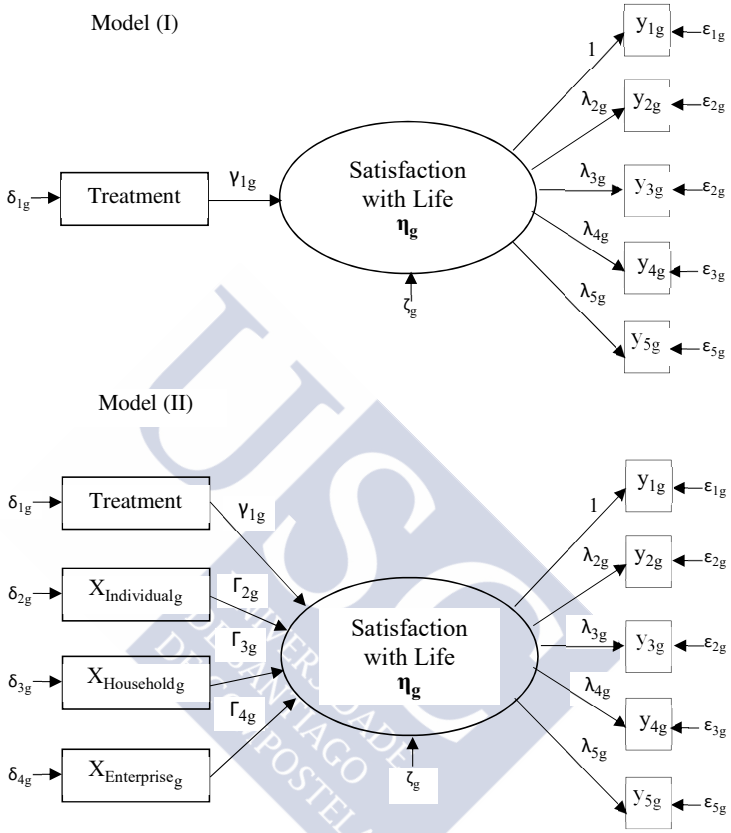

Figure 4.2 Path diagram of the MIMIC models for estimating the average effects of access to credit on Life Satisfaction. The graph shows the hypothesized relationship between five Likert-scale items and the latent variable of Satisfaction with Life Scale (SWLS). Model (I) shows the effect of access to credit to compare the differences for the estimated treatment and control groups in the latent variable means. Model (II) follows the 'doubly robust approach' and estimate the effect of credit after controlling for unbalanced covariates.

4.4 Data and Settings

4.4.1 The Satisfaction with Life Scale (SWLS)

We use the Satisfaction with life Scale developed by Diener et al. (1985) that uses a multi-item approach and comprises five statements: (i) In most ways my life is close to ideal; (ii) The conditions of my life are excellent; (iii) I am satisfied with my life; (iv) So far, I have gotten

the important things I want in life; and (v) If I could live my life over, I would change almost nothing. Answers were rated on a seven-point Likert scale where higher scores indicate higher levels of satisfaction: 1=strongly disagree, 2=disagree, 3= slightly disagree, 4=neither agree nor disagree, 5 =slightly agree, 6=agree, and 7=strongly agree. Summary of the items of the scale is presented in Table 4.2 and all items are statistically significant for male and female samples after listwise deletion.[108]

Table 4.2 Summary of Correlations, Means, and Standard Deviations for Scores on the items of SWLS by Sex

Item	1	2	3	4	5	M	SD
1. In most ways my life is close to my ideal	—	0.60*	0.51*	0.47*	0.32*	5.27	1.38
2. The conditions of my life are excellent	0.59*	—	0.54*	0.54*	0.39*	5.21	1.38
3. I am satisfied with my life	0.60*	0.63*	—	0.63*	0.37*	5.63	1.35
4. So far, I have gotten the important things I want in life	0.62*	0.58*	0.63*	—	0.45	5.54	1.37
5. If I could live my life over, I would change almost nothing	0.36*	0.26*	0.40*	0.43*	—	4.99	1.86
M	5.37	5.26	5.74	5.60	4.96		
SD	1.31	1.36	1.44	1.41	1.95		

Note. Correlations for women sample (n=447) are presented above the diagonal, and correlations for the male sample (n=297) are presented below the diagonal. Means and standard deviations for women entrepreneurs are presented in the vertical columns, and means and standard deviations for men entrepreneurs are shown in horizontal rows. For all items, higher scores are indicative of higher levels of satisfaction.
Sig.: * $p < .001$.

The SWLS scale shows good psychometric properties that ensures the reliability and validity of the construct of life satisfaction. First, the internal consistency coefficient (α of Cronbach) of the scale is .812 for the total sample, while for each sample the coefficient is .820 and .807 for the female and male samples, respectively.[109] Second, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy is .837 for the total sample (male: .842, female: .819) and show levels of factorial simplicity considered meritorious to ensure a factor analysis (Kaiser, 1974).[110] We used a confirmatory factor analysis (CFA) to test the single factor

[108] Total sample size was 783, but 30 enterprises had closed their business at the time the survey was conducted. Therefore, we do not have information about the enterprise characteristics that are relevant for determining the covariates and determinants of the SWLS. In addition, we do not have complete information about the SWLS for three respondents. Hence, we include only complete information in our analysis. We tested for attrition using the probability of firm exit and included the Inverse Mills Ratio (IMR) as another predictor of the SWLS and the IMR was not statistically significant. We also estimate the model using Full Information Maximum Likelihood (FIML) estimator and the results presented in this chapter remained unchanged. Hence, we excluded the 33 observations from the analysis. Results are presented in Tables A4.2 and A4.3 of the appendix.

[109] The alpha of Cronbach takes values from 0 to 1 where values close to 1 are preferred (Cronbach, 1951). However, there is no consensus about the thresholds for alpha of Cronbach. Several authors argue that values >.70 are require to ensure the reliability of the construct. For a further discussion about the thresholds see among others Ponterotto & Ruckdeschel (2007) and Panayides (2013).

[110] The KMO takes values from 0 to 1 where values closer to 1 reflect that variables may guarantee a factor analysis (Kaiser, 1974).

structure of the scale, and we estimated the model using the maximum likelihood estimation with robust standard errors and a Satorra-Bentler scaled test statistic. The results of the CFA show adequate overall model fit measures[111] for the male sample (χ^2(df)= 11.738(5); p= .039, CFI= .979; TLI=.958; RMSEA= 0.067, SRMR=.029), and for the female sample (χ^2(df) = 18.512(5); p= .002, CFI=.969; TLI= .937; RMSEA= .078, SRMR=.031), separately. Finally, we performed a multi-group analysis to test the measurement invariance of the SWLS across sex and our results shows strict invariance for the SWLS, so that using a multi-group MIMIC model would yield unbiased estimators.[112]

4.4.2 Sample Characteristics

The main characteristics of our sample are shown in Table 4.4. Differences by sex were explained in the Chapter III. It is noteworthy, that when comparing the differences between target clients of CACMU and non-clients, we observed more heterogeneity between the treatment and control groups for the female sample.[113] For the female sample, entrepreneurs in the treatment group are less educated, live in poorer households and have receive medical attention mainly for control and prevention. In addition, female in the treatment group are concentrated in commercial and agriculture activities, consider their economic activity more instable they more rely on family employment in comparison with female entrepreneurs in the control group. For the male sample, the treatment and control groups are more homogeneous and only in the household health proxy, in the type of activity and the type of the enterprise.

[111] Muthén (2004) and Saris et al. (2009) identified certain cutoffs values (in parenthesis) for the goodness fit index included in our analysis: CFI = Comparative Fit Index (>.95); TLI = Tucker-Lewis Index (>.95); RMSEA = Root Mean Square Error of Approximation (<.05); and, SRMR=Standardized Root Mean Square Residual (<.05).

[112] Invariance tests consist in measuring a series of comparisons of nested models to test whether the constrains imposed on the baseline model significantly worsen goodness of fit using scaled χ^2 difference test (Bentler & Satorra, 2010). We tested for measurement invariance by sex and the results are shown in table A4.4 in the appendix. Overall, the Configural model and less restrictive model (M1) showed acceptable model fit indicating that factorial structure of the construct is equal across gender. Further tests, indicate that strict invariance holds since the χ^2 difference test is not statistically significant and the restrictions imposed improve the model fit.

[113] The differences among the profiles of members of CACMU respond to their target population. CACMU target vulnerable

Table 4.3 Descriptive statistics for treatment and control groups by sample

	Male			Female		
	Y0|t=0	Y1|t=1	$p^{(a)}$	Y0|t=0	Y1|t=1	$p^{(a)}$
Age (median [IQR])	42.50 [32.00, 57.25]	45.00 [35.00, 54.00]	.459	44.00 [32.00, 54.00]	41.00 [32.00, 52.00]	.323
Marital Status (%)			.909			.172
Married/free union	118 (73.8)	99 (72.3)		127 (55.9)	142 (64.5)	
Separated/divorced/widowed	14 (8.8)	14 (10.2)		53 (23.3)	43 (19.5)	
Single/never married	28 (17.5)	24 (17.5)		47 (20.7)	35 (15.9)	
Education Level (%)			.077			.001**
Less than primary education	28 (17.5)	23 (16.8)		54 (23.8)	60 (27.3)	
Primary education	44 (27.5)	55 (40.1)		53 (23.3)	82 (37.3)	
Secondary education	55 (34.4)	42 (30.7)		85 (37.4)	60 (27.3)	
Tertiary education	33 (20.6)	17 (12.4)		35 (15.4)	18 (8.2)	
Individual Income Change (P) (%)			.137			.085
Decreased	31 (19.4)	20 (14.6)		64 (28.2)	49 (22.3)	
Increased	45 (28.1)	53 (38.7)		45 (19.8)	62 (28.2)	
Stayed the same	84 (52.5)	64 (46.7)		118 (52.0)	109 (49.5)	
HH size (No.) (median [IQR])	4.00 [3.00, 5.00]	4.00 [3.00, 5.00]	.776	4.00 [3.00, 5.00]	4.00 [3.00, 5.00]	.001**
Children = Yes (%)	97 (60.6)	88 (64.2)	.603	160 (70.5)	175 (79.5)	.036
HH Wealth Index (median [IQR])	0.42 [0.26, 0.54]	0.36 [0.26, 0.55]	.159	0.36 [0.24, 0.47]	0.29 [0.20, 0.43]	.006**
HH Income Contribution (%)			.191			.099
Alone	93 (58.1)	81 (59.1)		99 (43.6)	75 (34.1)	
Shared	44 (27.5)	45 (32.8)		58 (25.6)	71 (32.3)	
Someone else	23 (14.4)	11 (8.0)		70 (30.8)	74 (33.6)	
HH Health (proxy) (%)			.001**			<.001***
No attention/Control-Prevention	34 (21.2)	50 (36.5)		43 (18.9)	96 (43.6)	
Health Check-up & Illness	66 (41.2)	31 (22.6)		103 (45.4)	56 (25.5)	
Illness	60 (37.5)	56 (40.9)		81 (35.7)	68 (30.9)	

Table 4.3 (Continued)

	Male			Female		
	Y0|t=0	Y1|t=1	$p^{(a)}$	Y0|t=0	Y1|t=1	$p^{(a)}$
Sector (Index 2010) (median [IQR])	0.72 [0.51, 0.77]	0.69 [0.50, 0.77]	.490	0.68 [0.55, 0.77]	0.61 [0.54, 0.77]	.065
Economic Activity (%)			<.001***			<.001***
Commerce/trade/retail	70 (43.8)	26 (19.0)		130 (57.3)	71 (32.3)	
Agriculture & Other(5)	32 (20.0)	50 (36.5)		16 (7.0)	87 (39.5)	
Manufacturing	15 (9.4)	13 (9.5)		8 (3.5)	32 (14.5)	
Service	43 (26.9)	48 (35.0)		73 (32.2)	30 (13.6)	
Stability = Yes (%)	126 (78.8)	120 (87.6)	.063	186 (81.9)	150 (68.2)	.001**
Type of enterprise (%)			.001**			<.001***
Employer (no family members)	21 (13.1)	23 (16.8)		19 (8.4)	26 (11.8)	
Employer (family members)	44 (27.5)	62 (45.3)		42 (18.5)	73 (33.2)	
Self-employed	95 (59.4)	52 (38.0)		166 (73.1)	121 (55.0)	
Acct. Skills (Comp.) (median [IQR])	0.68 [0.33, 1.00]	0.68 [0.35, 1.00]	.223	0.68 [0.33, 1.00]	0.68 [0.33, 1.00]	.083
n	160	137		227	220	

Note. [(a)] Probability correspond to Chi-square test for categorical variables and Mann-Whitney U test for continuous variables (non-normal). IQR = interquartile range; ESS=Effective sample size after weighting. The average standardized mean differences are estimating using package *tableone* in R. Author's own calculation base on fieldwork CACMU (2013).
Sig.: *** p<0.001, ** p< 0.01, * p<0.05.

4.5 RESULTS

4.5.1 Determinants of life Satisfaction using a MIMIC Model

The MIMIC model described in section 4.3.2 was estimated through maximum likelihood estimation with robust standard errors and a Satorra-Bentler scaled test statistic (MLM) using the *lavaan* package in R (Rosseel, 2012). Table 4.4 presents the goodness of fit (GOF) measures of the multi-group MIMIC model and shows adequate goodness-of-fit indexes to the overall model and for each sample estimated separately. The table includes in Column 5 the specified cutoffs to assess model misspecification (Muthén, 2004; Saris et al., 2009). As seen in the table, our results show that the hypothesized MIMIC model for exploring the determinants for the SWLS fits the data properly since all the GOF measures meet the cutoffs identified in column 5. Moreover, we also observed that when performing a separate analysis for each sample (male and female) the results do not show inconsistencies with the multi-group MIMIC model. Thus, the models adjust to data properly even if we consider the sub-samples as separate samples.

Table 4.4 Goodness of fit for the MIMIC model

Fit Indices[(a)]	Overall Fit	Male	Female	Cutoff[(b)]
$\chi 2$ - Robust (df)	206.52(194)	98.23(97)	108.18(97)	
Pr($\chi 2$)	0.256	0.446	0.206	>0.05
RMSEA	0.014	0.007	0.017	
(90%CI)	(0-0.027)	(0-0.032)	(0-0.030)	<0.06
CFI	0.991	0.998	0.986	>0.95
TLI	0.989	0.997	0.982	>0.95
SRMR	0.017	0.020	0.016	<0.05

Note. Robust Maximum Likelihood Estimates for the MIMIC Model (MLM) using *lavaa*n package in R. [(a)] RMSEA = Root Mean Square Error of Approximation; CFI = Comparative Fit Index; TLI = Tucker-Lewis Index. [(b)] Based on (Muthén, 2004; Saris et al., 2009). Author's own calculation base on fieldwork CACMU (2013).

The results of the MIMIC model are summarized in Table 4.5. The coefficients of the SWLS have the expected signs and are statistically significant ($p < .001$). The standardized coefficients can be interpreted as follows: for the female sample the standardized coefficient of, e.g., .755 means that for a standard deviation increase in the item (ii) *the conditions of my life are excellent*, the SWLS index increases by .755 standard deviations. In contrast, the unstandardized coefficient shows that given a unit increase the item (ii), there is a 1.086 increase in logarithmic units in female life satisfaction.

The structural part of the model contains the coefficients for all covariates at individual, household, institutional and enterprise level. There are two common variables that affect the satisfaction with life scale of both male and female entrepreneurs: living in a wealthier household and the employment stability at the enterprise. Both characteristics have a positive and statistically significant effect over life satisfaction.[114]

There are other covariates that influence the satisfaction with life scale, but their influence is significantly different for male than for female entrepreneurs. Considering the male sample, being an employer (whether the employees are relatives or not) increases the life satisfaction of male entrepreneurs while having visited the doctor because of illness decreases it. For the female sample, the indicators of having basic accounting skills to manage the enterprise and having primary and secondary education are positively associated with the satisfaction with life index in a statistically significant way. On the other side, owning enterprises in the commercial and service sectors shows a negative and statistically significant effect over life satisfaction compared with owning an enterprise in the agriculture sector.

[114] The order of the effect over the life satisfaction among male and female entrepreneurs. The standardize coefficient for living in a wealthier household is higher for male (.308, p<.001) than for female (.138, p<.05%) entrepreneurs while the standardize coefficient for the employment stability at the enterprises is higher for female (.261, p<.001) than for male (.219, p<.01) entrepreneur.

Table 4.5 Determinants of the Satisfaction with Life Scale – Multi-group MIMIC Model

	Men			Women		
	Coef.	Std. Coef.	Sig.	Coef.	Std. Coef.	Sig.
Satisfaction With Life Scale (Measurement Part)						
In most ways, my life is close to my ideal [(a)]	1.000	0.776		1.000	0.692	
The conditions of my life are excellent	0.994	0.739	***	1.086	0.755	***
I am satisfied with my life	1.136	0.801	***	1.066	0.757	***
So far, I have gotten the important things I want in life	1.112	0.799	***	1.087	0.759	***
If I could live my life over, I would change almost nothing	0.889	0.463	***	1.006	0.516	***
Determinants of SWLS (Structural Part)						
Individual Level						
Age (ln)	0.327	0.112		0.034	0.011	
Marital Status (Ref.: Married)						
Separated/divorced/widowed	0.048	0.014		-0.177	-0.076	
Single/never married	-0.180	-0.068		-0.181	-0.073	
Level of education (Ref.: Less than primary)						
Primary education	0.230	0.107		0.302	0.145	*
Secondary education	0.081	0.038		0.321	0.157	*
Tertiary education	-0.212	-0.078		0.216	0.073	
Individual Income Changes (Ref.: Decreased)						
Stayed the same	0.239	0.118		0.144	0.075	
Increase	0.215	0.100		0.281	0.126	*
Household Level						
Household size (ln)	-0187	-0.092		-0.151	-0.077	
Children (Ref.: No)	0.104	0.050		-0.010	-0.004	
HH Wealth Index	1.570	0.308	***	0.771	0.138	*
HH Health proxy (Ref.: No attention/Control or Prevention)						
Health Check-ups & Illness	-0.178	-0.079		-0.012	-0.006	
Illness	-0.544	-0.252	***	-0.168	-0.084	
Household Income Contribution (Ref.: Someone else)						
Shared	0.049	0.022		0.009	0.004	
Alone	-0.047	-0.023		-0.080	-0.041	
Social Comparative Index 2010	-0.196	-0.023		-0.078	-0.009	
Enterprise Level						
Economic Sector (Ref.: Agriculture & Other(5))						
Commerce/trade/retail	-0.239	-0.110		-0.450	-0.234	**
Manufacturing	-0.170	-0.049		-0.249	-0.074	
Service	0.069	0.031		-0.505	-0.223	**
Employment stability (Ref.: No)	0.587	0.219	**	0.577	0.261	***
Type of enterprise (Ref.: Self-employed)						
Employer (family members)	0.619	0.217	***	0.228	0.072	
Employer (no family members)	0.395	0.187	**	-0.194	-0.089	
Accounting Skills Component	0.202	0.067		0.745	0.267	***
R^2	0.328			0.330		
N	297			447		

Note. Estimator: Robust Weighted Least Square (WLSMV). [(a)] The item is fixed to one to identify factor metric. Sig.: *** p < .001, ** p < .01, * p < .05.

4.5.2 Propensity Score Weighting using Gradient Boosting Models

After we have identified the determinants of SWLS we proceed to obtain the propensity scores and weights for estimating the average treatment effect (ATE) and the average treatment effect on the treated (ATT) using GBM as described in section 4.3.3. The boosting algorithm iterates until the average standardized mean differences between treatment and control groups are minimized.[115] Table 4.6 includes the relative influence in percentages of all the covariates included in the model for estimating the probability of assignment (access to credit) and weights for each sample. We can observe that three variables account for roughly 50% of the total variance in estimating ATE and ATT for male and female samples: the household wealth index, the age of the entrepreneur and the type of economic activity.[116]

[115] We estimate the propensity scores and weights using *twang* package in R (Ridgeway et al., 2008). We also use other stopping rules included in *twang* package but the mean of the absolute standardize method yielded better balancing properties among the treatment and control groups for both samples. The regularization process incudes a subsampling parameter of .5 and shrinkage parameter of .005 for 25,000 iterations. We also trimmed the data and used 80% with three-way iterations and a minimum size of 10 nodes in each iteration. Overall, our results show good quality of propensity score weights defined by the level of convergence of the algorithm, the overlap assessment and the balance between treatment and comparison groups. We include the results of the balance properties in detail in the online supplementary material of Chapter IV.

[116] the order of the relevance change among the two samples: for the male sample the probability of receiving a credit is mainly explained by the household wealth index whereas for the female sample the most relevant predictor is the economic activity

Table 4.6 Relative influence (%) of the covariates on the GBM propensity scores

	Male			Female	
Covariate	ATE	ATT	Covariate	ATE	ATT
HH Wealth Index	11.96	22.53	Economic Activity	32.63	25.97
Age	12.75	15.39	HH Wealth Index	11.96	15.24
Economic Activity	32.63	12.45	Age	12.75	13.97
Type of enterprise	5.07	8.88	HH Health (proxy)	9.68	8.38
HH Health (proxy)	9.68	7.44	Sector (Index 2010)	5.28	6.39
Education Level	5.01	6.48	Household size (No.)	5.34	5.80
Sector (Index 2010)	5.28	6.32	Education Level	5.01	5.62
Skill Component	4.43	4.82	Type of enterprise	5.07	4.92
Household size (No.)	5.34	3.98	Skill Component	4.43	4.53
Individual Income (Chg.)	2.59	3.93	Individual Income (Chg.)	2.59	2.89
Marital status	1.61	2.65	Stability	2.03	2.11
Stability	2.03	2.41	Marital status	1.61	2.02
HH Income Contribution	1.34	2.06	HH Income Contribution	1.34	1.73
Children	0.27	0.65	Children	0.27	0.42
N. Iterations	13279	18018	N. Iterations	10779	19412

Note. Table shows the influence for the GBM propensity scores using a Bernoulli distribution for estimating the average treatment effect (ATE) and the average treatment effect on the treated (ATT) for each sample. The boosting algorithm iterates until the mean of the absolute standardized differences is minimized. Author's own calculation base on fieldwork CACMU (2013).

We use the propensity scores resulting from the GBM analysis to weight both the treatment and control groups when estimating the ATE and to weight the control group when estimating ATT. Weighting the samples allows controlling for selection bias and thus reducing the differences among treatment and control groups. After weighting, we found a major reduction on the differences among the treatment and control groups for both samples. For the male sample, the average standardized mean difference dropped from .165 before weighting to .095 in the ATE estimation and to .082 in the ATT estimation. In comparison, we found that for the female sample the average standardized difference went from .248 before weighting to .097 and .067 after applying weights for estimating ATE and ATT, respectively. However, the bias reduction between treatment and control groups is achieved at the expense of losing effective sample size (ESS). Consequently, for the male sample, the ESS was reduced by 11% for estimating the ATE and 31% for estimating the ATT. In the female sample, the reductions amounted to 19% for estimating ATE and 36% when estimating ATT.

Figure 4.3 shows the graphical assessment of balance among treatment and control groups for both male and female samples.[117] Assessing balance among both groups is an important feature of the propensity score analysis which defines the models for the outcome analysis as explained in section 4.3.4. The figure illustrates the standardized mean difference of all the characteristics included in the model before and after weighting.[118] Following the thresholds propose by (Cohen, 1992) we can identify the effect size corresponding to small (SMD=.20), medium (SMD=.50) and large(SMD=.80) differences among treatment and control groups.[119] As seen in the figure, we observed greater differences among the treatment and control groups for the female sample compared with the male sample. In fact, we observed that most of the variables have effect sizes greater than 0.2 in the female sample, whereas for the male sample all effect sizes are below that threshold.[120]

[117] We also used the significance tests to explore the differences among treatment and control groups before and after propensity score weighting. However, since significance test consider both sample and effect size (Flury & Riedwyl, 1986; Coe, 2002; Sullivan & Feinn, 2012) we rely on the standardized mean difference to assess the balance between groups. We included the significance test for each sample in tables A4.5 and A4.6 in the appendix of this chapter.
[118] We use dummy variables for all categorical variables to explore the differences among treatment and control groups in each sample.
[119] Cohen (1992) and Coe (2002) argue that these cutoffs are not rule of thumbs since small differences may be relevant for policy design but we use them as reference to assess the balance properties among the treatment and control groups.
[120] We can observe some lingering bias among treatment and control groups. We assume that there is lingering bias among the covariates when the absolute standardize mean difference is (>.10) as suggested by (Normand et al., 2001; Austin, 2011)

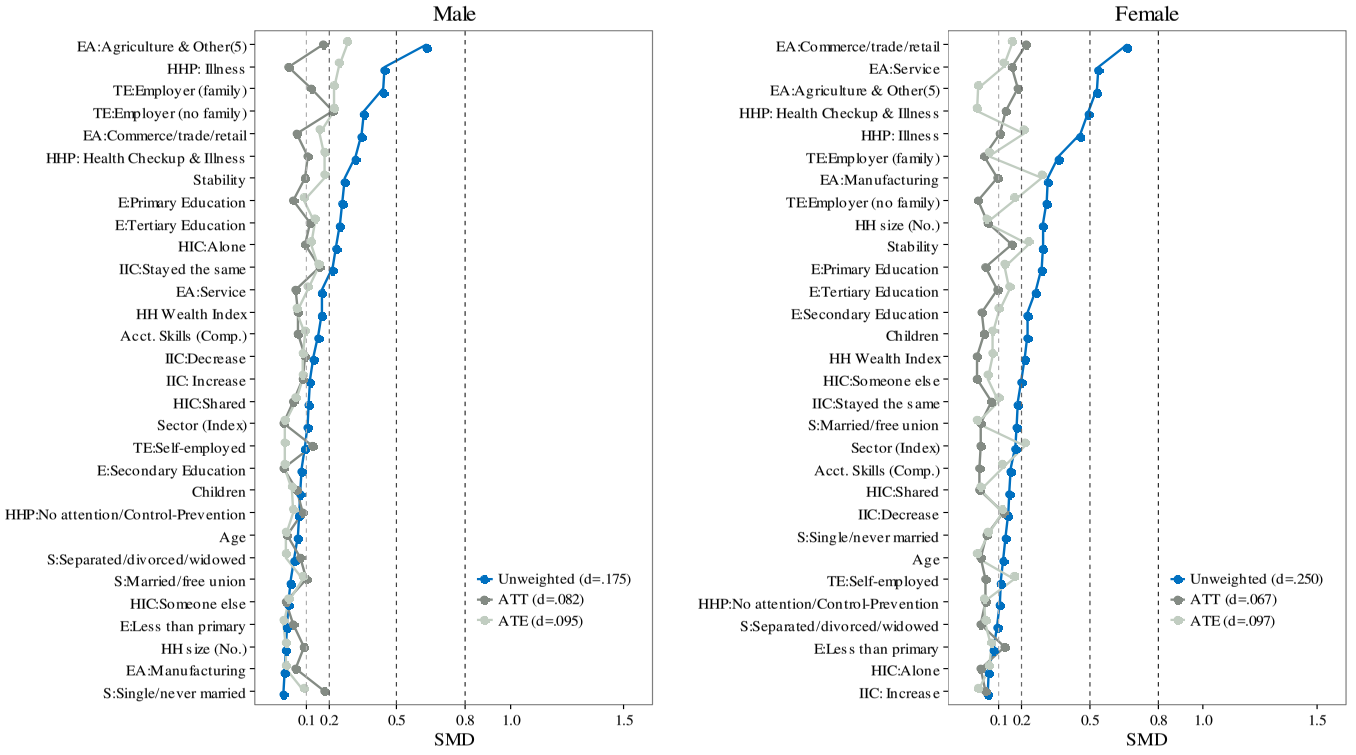

Figure 4.3 Standardized mean difference (SMD) among treatment and control groups for both male and female. The graph shows the SMD before and after propensity score weighting for estimating the average treatment effect (ATE) and average treatment effect on the treated (ATT). HHP= Household Health Proxy; EA=Economic Activity; TE=Type of enterprise; E=Education; HH=Household; HIC= Household Income Contribution; IIC= Individual Income Change, S=Marital Status. Author's own calculation base on fieldwork CACMU (2013).

4.5.3 MIMIC models in estimating treatment effects: ATE and ATT

Table 4.7 shows the results of the effect of access to credit on the Satisfaction With Life Scale for each sample. For comparison, we include the effect of access to credit on the SWLS without controlling for selection bias and the results of the weighted MIMIC models hypothesized in section 4.3.4.[121] As seen in the table, we estimate both the ATE and ATT. Based on these analyses, the population factor means differ between treatment and control groups for both male and female entrepreneurs in all the models specifications. In all the estimations, the effect of the treatment on the SWLS is positive and statistically significant. However, there are differences between the two samples when controlling for selection bias. Compared to the unweighted model, we found that both ATE and ATT decrease for male entrepreneurs while for female entrepreneurs the effect increases in all the models specifications with the exception being the ATE in Model I.

Table 4.7 Treatment effects of access to credit on the SWLS by sample

Sample	Unweighted		Model I				Model II			
			ATE		ATT		ATE		ATT	
	Coef. (SE)	Std. Coef.	Coef. (SE)	Std. Coef.	Coef. (SE)	Std. Coef.	Coef. (SE)	Std. Coef.	Coef. (SE)	Std. Coef.
Male	.586 (.124)	.291 ***	.497 (.134)	.246***	.427 (.142)	.218**	.353 (.132)	.173**	.400 (.124)	.203 **
Female	.292 (.099)	.154**	.281 (.108)	.149**	.303 (.130)	.156*	.316 (.105)	.167**	.339 (.115)	. 171**

Note. Unweighted estimation shows the effect of access to credit without controlling for selection bias. The Model I compares weighted latent variable means differences introducing the treatment condition as the only predictor in the model. Model II uses a 'doubly robust approach' and fits the weighted MIMIC model introducing all covariates that remain imbalance after the propensity score analysis. ATE= average treatment effect; ATT= average treatment effect on the treated. Author's own calculation base on fieldwork CACMU (2013).
Sig.: * p < .05, ** p < .01, *** p < .001

We then identify the effect size of the treatment condition over the life satisfaction. The effect size allows comparisons among groups and shows how strong or weak is the effect of the treatment on the output variable. We estimate the standardized effect size in MIMIC models using (Hancock, 2001; Hancock & Mueller, 2013) approaches.[122] We rely on the results of Model II that includes a doubly robust approach that is more appropriate when some covariates

[121] Overall, the models show acceptable goodness of fit indices and the results for each estimation are shown from tables A4.7 to A4.12 of the appendix.
[122] Following (Hancock, 2001; Hancock & Mueller, 2013) we divided the unstandardized weights between the treatment variable and the construct of life satisfaction (factor) by the square root of the disturbance variance. This approach works under the assumption of equivalence among observed variables in the MIMIC model. We tested for measurement invariance and found that strict invariance between treatment and control groups holds for both women and men sample.

remain imbalanced after the propensity analysis as shown in section 4.5.2.[123] Figure 4.4 shows the effect size for the ATT and ATE for both samples. As seen in the figure, the effect of access to credit on the life satisfaction is greater for male than for female entrepreneurs. Moreover, we observed that heterogeneity masked the effects for the female sample. In fact, after controlling for selection bias, the effect increases for both ATE and ATT.

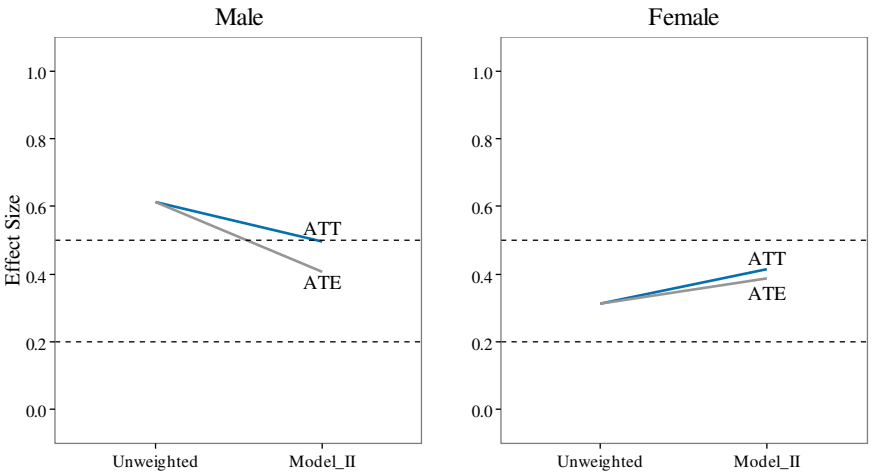

Figure 4.4 Effect size of access to credit on the Satisfaction with Life Scale by sample. The graph shows the effect size estimates for the Average Treatment Effect (ATE) and Average Treatment effect on the Treated (ATT) using (Hancock, 2001) approach for comparing mean differences among groups using a doubly robust approach.

Even though we estimate both ATE and ATT, as presented above, we are more interested in the ATT since not all microenterprises might have access to credit or meet the target population criteria of the MFI in study.[124] Accordingly, using the cutoffs proposed by (Cohen, 1992) for the effect size we observed that the effects might be considered from small to moderate for male sample and a small effect for the female sample.[125] Moreover, we found that the score of the SWLS of the average male entrepreneur that had access to credit is .495 ($p<.01$) standard deviations above the average male entrepreneur in the control group, whereas the score

[123] We also include the effect size for Model I in table A4.13 in the appendix.
[124] Heckman et al. (1998) argue that in some context ATT is more relevant than ATE since the interest is not on the average effect over the entire population but only over the intended target population that could potentially receive the treatment. As shown in Chapter I, we identified that microenterprises in Ecuador are highly heterogeneous and require different programs and policies to better target to the needs of each type or group of microenterprise. Thus, the assumption that all microenterprises might have access to credit might be mistaken.
[125] (Cohen, 1992; Coe, 2002) argue that these cutoffs should be taken with caution since small differences may be relevant for policy design but we use them as reference for comparisons among the two samples and among models.

of the average female entrepreneur that had access to credit is .415 ($p<.01$) standard deviations above the average female entrepreneur who did not have such access.

4.6 CONCLUSION

The main result of this chapter is that in the context of financial exclusion having access to a credit has a positive but modest effect of the life satisfaction of entrepreneurs but the effect is greater for male than for female entrepreneurs. Even more startling, we show that heterogeneity among female entrepreneurs mask the effects of microcredit programs. However, further research should explore if the modest effect decline after controlling for credit cycles. Preliminary results using the dosage of treatment methodology show positive and significant effects but point to the hedonic adaptation hypothesis after three credit cycles for the female sample. While access to financial services and to capital appears to have positive effects over the life satisfaction of entrepreneurs, it seems that inclusion have a temporary effect. However, further research should explore the effect of the credit over financial, work, family and/or social networks satisfaction, to detect if the effects found for the average construct remain in other domains of satisfaction.

We also make several contributions to the literature of entrepreneurship and of happiness studies. We tested the psychometric properties of the construct of life satisfaction among entrepreneurs in Ecuador and show that male and female entrepreneurs ascribe the same meanings to scale items of the SWLS. Thus, SWLS is a valid construct to explore life satisfaction among entrepreneurs and the estimations from the multi-group MIMIC analysis yield unbiased estimators. We provide empirical evidence on how individual, household and enterprise characteristics influence the satisfaction with life of both female and male entrepreneurs. Overall, we found two common variables affecting the satisfaction with life scale of both male and female entrepreneurs: living in a wealthier household and the employment stability at the enterprise. More interesting, having employees improves the life satisfaction of male entrepreneurs while the economic sector improves the life satisfaction of female entrepreneurs.

Finally, despite the limitations and the observational nature of our data, the implementation of the newest advances in methodology combining Structural Equation Modeling (SEM) and Propensity Score Weighting (PSW) ensure reliability of the construct of Life Satisfaction while controlling for selection bias on observed variables among different treatment conditions. To

the best of our knowledge this is amongst the first empirical application that implements the combination of both methodologies when estimating treatment effect on subjective constructs in observational studies.

APPENDICES TO CHAPTER IV

Table A4.1 Variables definition

Variable	Definition
Individual Level	
Age	Age of the respondent in years
Age (ln)	Includes the logarithmic transformation of age of the respondent.
Marital Status	Marital status is equal to 1 if married or consensual union, 2 if widowed, separated or divorced and 3 otherwise (single/never married).
Education	Includes for levels of education: less than primary education, primary education, secondary education and tertiary education.
Individual Income	Includes the perception of individual income changes over the last 12 months. Is equal to 1 if income has decreased, 2 if stayed the same and 3 if increased.
Household Level	
Household size	Number of household members.
Household size (ln)	Includes the logarithmic transformation of the number of household members.
Children	Children are equal to 1 if the respondent has children, 0 otherwise.
Household Wealth Index	Index constructed using Polychoric Factor Analysis (FA) to account for the common variance of 9 variables that includes: (i) main material of the residence; (ii) shower (number); (iii) type of fuel the household use for cooking; (iv) car (number); (v) refrigerator (number); (vi) color TV (number); (vii) blender (number); (viii) computer (number); and, (ix) Internet. Reliability of the index using Cronbach's alpha is 0.813, Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy of 0.864 and fist factor accounts for 92.72% of common variance.
Household Health Proxy	Includes the reasons for attending to the doctor in the last year: 1 if they did not attend to the doctor, 2 if they went for control and prevention, 3 if the reason was health checkups and illness and 4 if they went for illness treatment.
Household Income Contribution	Includes respondent's perceived household income contribution equals to 1 if someone else makes the contribution, 2 if shares the contribution and 3 if the respondent is makes the contribution alone.
Sector – Index 2010	Index is a measure developed by (SENPLADES, 2013) and captures the differences in socioeconomic conditions of parishes in Ecuador and represents 50.5% of the total variance from the 19 social indicators in areas of education, health, housing characteristics and basic services.

Table A4.1 *(Continued)*

Variable	Definition
Enterprise Level	
Economic Sector	Refers to the economic sector of the main activity and includes: (i) Agriculture and others (5); (ii) Commerce/trade/retail; (iii) Manufacturing; and (iv) Service.
Employment Stability	Is equal to 1 if the respondent considered stable their main economic activity, 0 otherwise.
Type of enterprise	Type of enterprise refers to whether the respondent runs the business alone or has other people working or 'helping' in the enterprise. It takes the value of 1 if is self-employed, 2 if is employer of family members, and 3 if is employer of no member relatives.
Accounting Skills Component	Index using polychoric principal component analysis (PCA) that includes: (i) if the entrepreneurs keeps money separated from personal expenses; (ii) keep accounting records; and (iii) if they know which is/are the most profitable product(s) or service(s)? Fist component accounts for 75.36% of total variance.

Table A4.2 Determinants of SWLS using MIMIC (testing attrition and missing data)

	Model 1						Model 2					
	Men			Women			Men			Women		
	Coef.	Std. Coef.	Sig.	Coef.	Std. Coef.	Sig.	Coef.	Std. Coef.		Coef.	Std. Coef.	
Satisfaction With Life Scale (Measurement Part)												
In most ways, my life is close to my ideal[(a)]	1.000	0.776		1.000	0.691		1.000	0.774		1.000	0.684	
The conditions of my life are excellent	0.994	0.739	***	1.087	0.755	***	0.997	0.734	***	1.072	0.746	***
I am satisfied with my life	1.136	0.801	***	1.066	0.757	***	1.142	0.805	***	1.076	0.758	***
So far, I have gotten the important things I want in life	1.112	0.799	***	1.087	0.759	***	1.120	0.806	***	1.103	0.762	***
If I could live my life over, I would change almost nothing	0.888	0.463	***	1.006	0.516	***	0.906	0.472	***	0.996	0.513	***
Determinants of SWB Scale (Structural Model)												
Individual Level												
Age (ln)	0.328	0.112		0.035	0.012		0.251	0.086		0.047	0.016	
Married/Consensual union (Ref.: Married)												
Separated/divorced/widowed	0.048	0.014		-0.178	-0.076		0.123	0.037		-0.190	-0.083	
Single/never married	-0.179	-0.067		-0.181	-0.073		-0.223	-0.084		-0.135	-0.055	
Level of education (Ref.: Less than primary)												
Primary education	0.234	0.109		0.309	0.148	*	0.261	0.122		0.299	0.145	*
Secondary education	0.087	0.040		0.329	0.161	*	0.067	0.031		0.280	0.137	*
Tertiary education	-0.207	-0.077		0.221	0.075		-0.200	-0.074		0.189	0.064	
Individual Income Changes (Ref.: Decreased)												
Stayed the same	0.241	0.119		0.149	0.078		0.325	0.162		0.104	0.055	
Increase	0.222	0.103		0.290	0.130	*	0.280	0.131		0.262	0.117	
Household Level												
Household size (ln)	-0.188	-0.093		-0.152	-0.077		-0.147	-0.073		-0.118	-0.061	
Children (Ref.: No)	0.103	0.049		-0.012	-0.005		0.106	0.051		-0.008	-0.004	
HH Wealth Index	1.569	0.308	***	0.777	0.139	*	1.404	0.274	***	0.694	0.125	*

Table A4.2 (Continued)

	Model 1						Model 2					
	Men			Women			Men			Women		
	Coef.	Std. Coef.	Sig.	Coef.	Std. Coef.	Sig.	Coef.	Std. Coef.		Coef.	Std. Coef.	
Determinants of SWB Scale (Structural Model)												
Household Level												
HH Health proxy (Ref.: No attention/Control or Prevention)												
Health Check-up & Illness	-0.176	-0.078		-0.013	-0.006		-0.205	-0.092		-0.028	-0.013	
Illness	-0.542	-0.251	***	-0.169	-0.084		-0.534	-0.248	***	-0.155	-0.079	
Household Income Contribution (Ref.: Someone else)												
Shared	0.048	0.022		0.007	0.003		0.125	0.056		-0.026	-0.012	
Alone	-0.048	-0.023		-0.082	-0.042		0.015	0.007		-0.119	-0.061	
Social Comparative Index 2010	-0.227	-0.026		-0.149	-0.017		0.058	0.007		0.040	0.005	
Enterprise Level												
Economic Sector (Ref.: Agriculture & Other(5))												
Commerce/trade/retail	-0.238	-0.110		-0.448	-0.233	**	-0.244	-0.114		-0.397	-0.208	**
Manufacturing	-0.170	-0.049		-0.248	-0.074		-0.185	-0.053		-0.281	-0.084	
Service	0.070	0.032		-0.502	-0.221	**	0.108	0.049		-0.444	-0.197	**
Employment stability (Ref.: No)	0.597	0.223	*	0.595	0.269	***	0.471	0.187	**	0.507	0.235	***
Type of enterprise (Ref.: Self-employed)												
Employer (family members)	0.619	0.217	***	0.228	0.072		0.616	0.217	***	0.231	0.073	
Employer (no family members)	0.396	0.187	**	-0.194	-0.089		0.395	0.188	**	-0.197	-0.090	
Entrepreneurial Skill Component	0.201	0.067		0.745	0.268	***	0.201	0.068		0.752	0.272	***
Inverse Mills Ratio (Probablity of Firm Exit)	-0.010	-0.008		-0.018	-0.015							
R^2	0.33			0.328			0.326			0.311		
n	297			447			312			465		

Note. The model 1 includes the Inverse Mills Ratio (IMR) of the probability of firm exit to account for attrition and missing values with Robust Maximum Likelihood whilst the model 2 estimate the model using Full Information Maximum Likelihood (FIML) estimator. Both models are estimated using *lavaan* package in R.
[(a)] The item is fixed to one to identify factor metric. Sig.: * p < .05, ** p < .01, *** p < .001.

Table A4.3 Goodness of fit accounting for attrition and missing data – MIMIC Model

	Model 1			Model 2			Cut-off[(a)]
	Overall Fit	Men	Women	Overall Fit	Men	Women	
Fit Indices [(a)]							
χ^2 – Robust	21.68	98.42	112.19	203.33	94.65	108.51	
(df)	202	101	101	194	97	97	
Pr(χ^2)	0.323	0.554	0.210	0.309	0.548	0.200	>.05
RMSEA (90%CI)	0.011 (0-.025)	0.000 (.019-.019)	0.000 (.016-.016)	0.011 (0-.025)	0.000 (0-.028)	0.016 (0-.03)	<.06
CFI	0.994	1.000	0.986	0.994	1.000	0.986	>.95
TLI	0.992	1.006	0.982	0.992	1.005	0.982	>.95
SRMR	0.017	0.019	0.016	0.017	0.019	0.016	<.05

Note. The model 1 includes the Inverse Mills Ratio (IMR) of the probability of firm exit to account for attrition and missing values with Robust Maximum Likelihood whilst the model 2 estimate the model using Full Information Maximum Likelihood (FIML) estimator. Both models are estimated using *lavaan* package in R.
[(a)] Based on (Muthén, 2004; Saris et al., 2009).
[(b)] RMSEA = Root Mean Square Error of Approximation; CFI = Comparative Fit Index; TLI = Tucker-Lewis Index.

Table A4.4 Fit Indices for Invariance Test of SWLS by Sex

Model	χ^2 (df)	χ^2 /df	RMSEA (90%CI)	SRMR	CFI	Comp.	$\Delta\chi^2$ (Δdf)	Pr(χ^2)
1. Full configural Invariance	52.66 (10)	5.27	.075 (.053-.099)	.030	.972	-	- (-)	-
2. Full Weak Invariance	55.14 (14)	3.94	.064 (.043-.085)	.036	.972	1 vs. 2	2.49 (4)	.746
3. Full Strong invariance	56.34 (18)	3.13	.056 (.036-.076)	.037	.972	2 vs. 3	1.2 (4)	.877
4. Full Strict Invariance	67.69 (23)	2.94	.049 (.031-.067)	.042	.972	3 vs. 4	11.35 (5)	.316
5. Full Factor Mean Invariance	68.46 (24)	2.85	.048 (.03-.066)	.043	.972	4 vs. 5	0.77 (1)	.380

Note. Estimator: Maximum likelihood estimation with robust standard errors and a Satorra-Bentler scaled test statistic (MLM). Fit Indices: RMSEA = Root Mean Square Error of Approximation; CFI = Comparative Fit Index; SRMR=Standardized Root Mean Square Residual.
* p < .05, ** p < .01, *** p < .001

Table A4.5 Caracteristics and differences between treatment and control groups before and after propensity score weighting for male sample

	Unweighted			ATE			ATT		
	Y0|t=0	Y1|t=1	$p^{(a)}$	E(Y0)	E(Y1)	$p^{(a)}$	E(Y0|t=1)	E(Y1|t=1)	$p^{(a)}$
Age (median [IQR])	42.50 [32.00, 57.25]	45.00 [35.00, 54.00]	.459	43.29 [33.00, 55.04]	45.00 [34.00, 54.00]	.810	45.00 [37.00, 53.42]	45.00 [35.00, 54.00]	.881
Marital Status (%)			.909			.741			.400
Married/free union	118 (73.8)	99 (72.3)		105.9 (75.1)	89.1 (71.3)		52.2 (76.8)	99.0 (72.3)	
Separated/divorced/widowed	14 (8.8)	14 (10.2)		13.8 (9.8)	12.6 (10.1)		8.5 (12.5)	14.0 (10.2)	
Single/never married	28 (17.5)	24 (17.5)		21.3 (15.1)	23.3 (18.6)		7.3 (10.7)	24.0 (17.5)	
Education Level (%)			.077			.732			.887
Less than primary education	28 (17.5)	23 (16.8)		23.7 (16.8)	21 (16.8)		10.3 (15.2)	23.0 (16.8)	
Primary education	44 (27.5)	55 (40.1)		43.9 (31.1)	44.5 (35.6)		25.8 (38)	55.0 (40.1)	
Secondary education	55 (34.4)	42 (30.7)		46.4 (32.9)	41.6 (33.3)		20.8 (30.6)	42.0 (30.7)	
Tertiary education	33 (20.6)	17 (12.4)		27.1 (19.2)	18 (14.4)		11 (16.2)	17.0 (12.4)	
Individual Income Change (P) (%)			.137			.423			.515
Decreased	31 (19.4)	20 (14.6)		26.9 (19.1)	19.9 (15.9)		12.2 (18)	20.0 (14.6)	
Increased	45 (28.1)	53 (38.7)		40.7 (28.9)	45.5 (36.4)		21.1 (31)	53.0 (38.7)	
Stayed the same	84 (52.5)	64 (46.7)		73.3 (52)	59.8 (47.8)		34.7 (51)	64.0 (46.7)	
HH size (No.) (median [IQR])	4.00 [3.00, 5.00]	4.00 [3.00, 5.00]	.776	4.00 [3.00, 5.00]	4.00 [3.00, 5.00]	.835	4.00 [2.00, 5.00]	4.00 [3.00, 5.00]	.456
Children = Yes (%)	97 (60.6)	88 (64.2)	.603	86 (61)	78.4 (62.7)	.772	41.7 (61.3)	88.0 (64.2)	.690
HH Wealth Index (median [IQR])	0.42 [0.26, 0.54]	0.36 [0.26, 0.55]	.159	0.38 [0.26, 0.53]	0.37 [0.26, 0.55]	.643	0.37 [0.25, 0.53]	0.36 [0.26, 0.54]	.706
HH Income Contribution (%)			.191			.632			.802
Alone	93 (58.1)	81 (59.1)		82.2 (58.3)	74.3 (59.4)		39.8 (58.6)	81.0 (59.1)	
Shared	44 (27.5)	45 (32.8)		40.2 (28.5)	38.9 (31.1)		20.9 (30.7)	45.0 (32.8)	
Someone else	23 (14.4)	11 (8.0)		18.6 (13.2)	11.9 (9.5)		7.3 (10.7)	11.0 (8.0)	
HH Health (proxy) (%)			.001**			.133			.733
No attention/Control-Prevention	34 (21.2)	50 (36.5)		34.7 (24.6)	41.4 (33.1)		21.4 (31.4)	50.0 (36.5)	
Health Check-up & Illness	66 (41.2)	31 (22.6)		50.1 (35.5)	31 (24.8)		16 (23.6)	31.0 (22.6)	
Illness	60 (37.5)	56 (40.9)		56.3 (39.9)	52.5 (42.1)		30.6 (45)	56.0 (40.9)	

Table A4.5 (Continued)

	Unweighted			ATE			ATT		
	Y0|t=0	Y1|t=1	$p^{(a)}$	E(Y0)	E(Y1)	$p^{(a)}$	E(Y0|t=1)	E(Y1|t=1)	$p^{(a)}$
Sector (Index 2010) (median [IQR])	0.72 [0.51, 0.77]	0.69 [0.50, 0.77]	.490	0.70 [0.51, 0.77]	0.72 [0.51, 0.77]	.850	0.68 [0.50, 0.77]	0.69 [0.50, 0.77]	.979
Economic Activity (%)			<.001***			.186			.675
Commerce/trade/retail	70 (43.8)	26 (19.0)		53 (37.6)	31.9 (25.5)		17.6 (25.9)	26.0 (19.0)	
Agriculture & Other(5)	32 (20.0)	50 (36.5)		34.4 (24.4)	39.8 (31.8)		23 (33.8)	50.0 (36.5)	
Manufacturing	15 (9.4)	13 (9.5)		12.7 (9)	10.8 (8.6)		5.4 (7.9)	13.0 (9.5)	
Service	43 (26.9)	48 (35.0)		40.7 (28.9)	42.5 (34)		22.1 (32.5)	48.0 (35.0)	
Stability = Yes (%)	126 (78.8)	120 (87.6)	.063	113.4 (80.4)	108.3 (86.6)	.174	57.4 (84.4)	120.0 (87.6)	.488
Type of enterprise (%)			.001**			.161			.369
Employer (no family members)	21 (13.1)	23 (16.8)		22.1 (15.7)	19.9 (15.9)		14.7 (21.6)	23.0 (16.8)	
Employer (family members)	44 (27.5)	62 (45.3)		42.2 (29.9)	51 (40.8)		23.4 (34.4)	62.0 (45.3)	
Self-employed	95 (59.4)	52 (38.0)		76.7 (54.4)	54.1 (43.3)		29.9 (43.9)	52.0 (38.0)	
Acct. Skills (Comp.) (median [IQR])	0.68 [0.33, 1.00]	0.68 [0.35, 1.00]	.223	0.68 [0.33, 1.00]	0.68 [0.33, 1.00]	.516	0.68 [0.47, 1.00]	0.68 [0.33, 1.00]	.751
n (ESS)	160	137		141	125		68	137	

Note. Propensity score weighting using gradient boosting models with Bernoulli distribution. [(a)] Probability correspond to Chi-square test for categorical variables and Mann-Whitney U test for continuous variables (non-normal). IQR = interquartile range; ESS=Effective sample size after weighting. Author's own calculation base on fieldwork CACMU (2013).
Sig.: *** p<0.001, ** p< 0.01, * p<0.05.

Table A4.6 Caracteristics and diffrences between treatment and control groups before and after propensity score weighting for female sample

	Unweighted			ATE			ATT		
	Y0|t=0	Y1|t=1	$p^{(a)}$	E(Y0)	E(Y1)	$p^{(a)}$	E(Y0|t=1)	E(Y1|t=1)	$p^{(a)}$
Age (median [IQR])	44.00 [32.00, 54.00]	41.00 [32.00, 52.00]	.323	43.00 [33.00, 53.00]	42.00 [32.41, 53.00]	.990	41.00 [33.00, 48.75]	41.00 [32.00, 52.00]	.899
Marital Status (%)			.172			.848			.918
Married/free union	127 (55.9)	142 (64.5)		106 (59.9)	112.4 (60.1)		44.5 (65.4)	142.0 (64.5)	
Separated/divorced/widowed	53 (23.3)	43 (19.5)		38.4 (21.7)	43.9 (23.5)		13.9 (20.4)	43.0 (19.5)	
Single/never married	47 (20.7)	35 (15.9)		32.6 (18.4)	30.9 (16.5)		9.7 (14.2)	35.0 (15.9)	
Education Level (%)			.001**			.347			.705
Less than primary education	54 (23.8)	60 (27.3)		41.1 (23.2)	49 (26.2)		14.7 (21.6)	60.0 (27.3)	
Primary education	53 (23.3)	82 (37.3)		50.8 (28.7)	64.7 (34.6)		26.7 (39.2)	82.0 (37.3)	
Secondary education	85 (37.4)	60 (27.3)		60.2 (34)	55.2 (29.5)		19.3 (28.4)	60.0 (27.3)	
Tertiary education	35 (15.4)	18 (8.2)		25 (14.1)	18.1 (9.7)		7.3 (10.7)	18.0 (8.2)	
Individual Income Change (P) (%)			.085			.478			.693
Decreased	64 (28.2)	49 (22.3)		49.9 (28.2)	43.9 (23.5)		18.6 (27.3)	49.0 (22.3)	
Increased	45 (19.8)	62 (28.2)		38.4 (21.7)	48.6 (26)		17.2 (25.3)	62.0 (28.2)	
Stayed the same	118 (52.0)	109 (49.5)		88.7 (50.1)	94.4 (50.5)		32.2 (47.4)	109.0 (49.5)	
HH size (No.) (median [IQR])	4.00 [3.00, 5.00]	4.00 [3.00, 5.00]	.001**	4.00 [3.00, 5.00]	4.00 [3.00, 5.00]	.448	4.00 [3.00, 5.00]	4.00 [3.00, 5.00]	.616
Children = Yes (%)	160 (70.5)	175 (79.5)	.036*	129.7 (73.3)	142.9 (76.4)	.507	53 (78)	175.0 (79.5)	.771
HH Wealth Index (median [IQR])	0.36 [0.24, 0.47]	0.29 [0.20, 0.43]	.006**	0.33 [0.24, 0.46]	0.30 [0.22, 0.46]	.490	0.29 [0.20, 0.42]	0.29 [0.20, 0.43]	.938
HH Income Contribution (%)			.099			.870			.988
Alone	99 (43.6)	75 (34.1)		70.6 (39.9)	72.9 (39)		23.1 (33.9)	75.0 (34.1)	
Shared	58 (25.6)	71 (32.3)		48.5 (27.4)	55.9 (29.9)		21.5 (31.6)	71.0 (32.3)	
Someone else	70 (30.8)	74 (33.6)		58.1 (32.8)	58.2 (31.1)		23.5 (34.5)	74.0 (33.6)	
HH Health (proxy) (%)			<.001***			.079			.589
No attention/Control-Prevention	43 (18.9)	96 (43.6)		45 (25.4)	66.2 (35.4)		25.3 (37.2)	96.0 (43.6)	
Health Check-up & Illness	103 (45.4)	56 (25.5)		71.2 (40.2)	56.8 (30.4)		20.5 (30.1)	56.0 (25.5)	
Illness	81 (35.7)	68 (30.9)		60.9 (34.4)	64 (34.2)		22.2 (32.7)	68.0 (30.9)	

Table A4.6 (Continued)

	Unweighted			ATE			ATT		
	Y0|t=0	Y1|t=1	$p^{(a)}$	E(Y0)	E(Y1)	$p^{(a)}$	E(Y0|t=1)	E(Y1|t=1)	$p^{(a)}$
Sector (Index 2010) (median [IQR])	0.68 [0.55, 0.77]	0.61 [0.54, 0.77]	.065	0.66 [0.55, 0.77]	0.62 [0.55, 0.77]	.905	0.62 [0.51, 0.77]	0.61 [0.54, 0.77]	.891
Economic Activity (%)			<.001***			.018*			.275
Commerce/trade/retail	130 (57.3)	71 (32.3)		89.7 (50.7)	80.4 (43)		27.9 (41)	71.0 (32.3)	
Agriculture & Other(5)	16 (7.0)	87 (39.5)		26.9 (15.2)	52.7 (28.2)		19.5 (28.7)	87.0 (39.5)	
Manufacturing	8 (3.5)	32 (14.5)		12.2 (6.9)	19.8 (10.6)		7.7 (11.3)	32.0 (14.5)	
Service	73 (32.2)	30 (13.6)		48 (27.1)	33.8 (18.1)		13 (19.1)	30.0 (13.6)	
Stability = Yes (%)	186 (81.9)	150 (68.2)	.001**	140.2 (79.2)	134.1 (71.7)	.103	51.3 (75.4)	150.0 (68.2)	.263
Type of enterprise (%)			<.001***			.386			.930
Employer (no family members)	19 (8.4)	26 (11.8)		16.1 (9.1)	20.4 (10.9)		7.1 (10.5)	26.0 (11.8)	
Employer (family members)	42 (18.5)	73 (33.2)		41.6 (23.5)	53.9 (28.8)		22.2 (32.7)	73.0 (33.2)	
Self-employed	166 (73.1)	121 (55.0)		119.3 (67.4)	112.9 (60.4)		38.6 (56.8)	121.0 (55.0)	
Acct. Skills (Comp.) (median [IQR])	0.68 [0.33, 1.00]	0.68 [0.33, 1.00]	.083	0.68 [0.33, 1.00]	0.68 [0.33, 1.00]	.286	0.68 [0.33, 1.00]	0.68 [0.33, 1.00]	.823
n (ESS)	227	220		177	185		68	220	

Note. Propensity score weighting using gradient boosting models with Bernoulli distribution. [(a)] Probability correspond to Chi-square test for categorical variables and Mann-Whitney U test for continuous variables (non-normal). IQR = interquartile range; ESS=Effective sample size after weighting. Author's own calculation base on fieldwork CACMU (2013).
Sig.: *** p<0.001, ** p< 0.01, * p<0.05.

Table A4.7 Goodness of Fit Index for estimating treatment effects for the male sample

	Unweighted	Model I		Model II		Cut-off Value [(a)]
		ATT	ATE	ATT	ATE	
χ^2 – Robust (df)	15.39(9)	11.46(9)	13.8(9)	28.07(65)	27.04(69)	
Pr(χ^2)	.081	.246	.130	1.000	1.000	>.05
RMSEA (90%CI)	.055 (0-.101)	.061 (0-.154)	.064 (0-.126)	0(0-0)	0(0-0)	<.05
CFI	.987	.978	.981	1.000	1.000	>.95
TLI	.978	.964	.968	1.695	1.458	>.95
SRMR	.027	.047	.035	.033	.026	<.05

Note. Estimation using Robust Maximum Likelihood Estimates for the MIMIC Model (MLM) using lavaan package in R. RMSEA = Root Mean Square Error of Approximation; CFI = Comparative Fit Index; TLI = Tucker-Lewis Index. [(a)] Based on (Muthén, 2004; Saris, Satorra, & Van der Veld, William M, 2009).

Table A4.8 Goodness of Fit Index for estimating treatment effects for the female sample

	Unweighted	Model I		Model II		Cut-off Value [(a)]
		ATT	ATE	ATT	ATE	
χ^2 – Robust (df)	25.42(9)	13.71(9)	22.31(9)	24.27(53)	27.1(53)	
Pr(χ^2)	.003	.133	.008	1.000	.999	>.05
RMSEA (90%CI)	.080 (.044-.117)	.054 (0-.108)	.084 (.04-.128)	0(0-0)	0(0-0)	<.05
CFI	.967	.986	.963	1.000	1.000	>.95
TLI	.945	.977	.938	1.194	1.160	>.95
SRMR	.030	.027	.033	.024	.023	<.05

Note. Estimation using Robust Maximum Likelihood Estimates for the MIMIC Model (MLM) using lavaan package in R. RMSEA = Root Mean Square Error of Approximation; CFI = Comparative Fit Index; TLI = Tucker-Lewis Index.

(a) Based on (Muthén, 2004; Saris, Satorra, & Van der Veld, William M, 2009).

Table A4.9 Treatment effect estimates using Model I for the male sample

	Unweighted			ATT			ATE		
	Coef.	**Std. Coef.**		**Coef.**	**Std. Coef.**		**Coef.**	**Std. Coef.**	
In most ways, my life is close to my ideal[(a)]	1.000	0.767		1.000	0.735		1.000	0.772	
The conditions of my life are excellent	1.008	0.741	***	0.970	0.693	***	0.993	0.738	***
I am satisfied with my life	1.158	0.808	***	1.029	0.767	***	1.107	0.797	***
So far, I have gotten the important things I want in life	1.119	0.796	***	1.054	0.702	***	1.085	0.758	***
If I could live my life over, I would change almost nothing	0.905	0.468	***	1.017	0.493	***	0.933	0.478	***
Treatment	**0.586**	**0.291**	***	**0.427**	**0.218**	**	**0.497**	**0.246**	***
n (ESS)		297			266			205	

Note. Weighted MIMIC Model with Robust Maximum Likelihood Estimates for the MIMIC Model (MLM) using *lavaan.survey* package in R.
[(a)] Fixed to one to identify factor metric.
* p < .05, ** p < .01, *** p < .001

Table A4.10 Treatment effect estimates using Model II for the male sample

	ATT			ATE		
	Coef.	Std. Coef.		Coef.	Std. Coef.	
In most ways, my life is close to my ideal[(a)]	1.000	0.738		1.000	0.778	
The conditions of my life are excellent	0.971	0.697	***	0.981	0.735	***
I am satisfied with my life	1.030	0.770	***	1.095	0.794	***
So far, I have gotten the important things I want in life	1.044	0.698	***	1.079	0.759	***
If I could live my life over, I would change almost nothing	0.981	0.478	***	0.916	0.473	***
Treatment	**0.400**	**0.203**	**	**0.353**	**0.173**	**
Imbalance Covariates						
Individual Level						
Married/Consensual union (Ref.: Married)						
Separated/divorced/widowed	0.119	0.039				
Single/never married	-0.284	-0.108				
Level of education (Ref.: Less than primary)						
Primary education	0.356	0.184		0.353	0.163	
Secondary education	0.096	0.047		0.202	0.093	
Tertiary education	0.081	0.030		0.187	0.069	
Individual Income Changes (Ref.: Decreased)						
Stayed the same	0.561	0.297	**	0.324	0.159	
Increase	0.582	0.297	**	0.263	0.122	
Household Level						
HH Health proxy (Ref.: No attention/Control or Prevention)						
Health Check-ups & Illness	-0.037	-0.019		-0.221	-0.098	
Illness	-0.300	-0.134		-0.444	-0.201	**
Household Income Contribution (Ref.: Someone else)						
Shared				0.175	0.079	
Alone				0.096	0.046	
Enterprise Level						
Economic Sector (Ref.: Agriculture & Other(5))						
Commerce/trade/retail	0.091	0.040		0.097	0.044	
Manufacturing	0.133	0.040		0.044	0.012	
Service	0.364	0.183	*	0.296	0.135	
Employment stability (Ref.: No)				0.683	0.248	**
Type of enterprise (Ref.: Self-employed)						
Employer (family members)	0.758	0.313	***	0.639	0.230	***
Employer (no family members)	0.476	0.249	**	0.459	0.215	**
n (ESS)	266			205		

Note. Weighted MIMIC Model with Robust Maximum Likelihood Estimates for the MIMIC Model (MLM) using *lavaan.survey* package in R. ESS=Effective sample size after weighting. Author's own calculation base on fieldwork CACMU (2013).

[(a)] Fixed to one to identify factor metric.

* p < .05, ** p < .01, *** p < .001

Table A4.11 Treatment effect estimates using Model I for female sample

	Unweighted			ATT			ATE		
	Coef.	Std. Coef.		Coef.	Std. Coef.		Coef.	Std. Coef.	
In most ways, my life is close to my ideal[(a)]	1.000	0.687		1.000	0.687		1.000	0.679	
The conditions of my life are excellent	1.084	0.748	***	1.120	0.747	***	1.097	0.733	***
I am satisfied with my life	1.083	0.764	***	1.197	0.806	***	1.113	0.770	***
So far, I have gotten the important things I want in life	1.097	0.761	***	1.160	0.789	***	1.113	0.760	***
If I could live my life over, I would change almost nothing	1.019	0.520	***	1.083	0.552	***	1.041	0.516	***
Treatment	**0.292**	**0.154**	**	**0.303**	**0.156**	*	**0.281**	**0.149**	**
n (ESS)		447			362			288	

Note. Weighted MIMIC Model with Robust Maximum Likelihood Estimates for the MIMIC Model (MLM) using *lavaan.survey* package in R. ESS=Effective sample size after weighting. Author's own calculation base on fieldwork CACMU (2013).

[(a)] Fixed to one to identify factor metric.

* p < .05, ** p < .01, *** p < .001

Table A4. 12 Treatment effect estimates using Model II for sample of women

	ATT			ATE		
	Coef.	Std. Coef.		Coef.	Std. Coef.	
In most ways, my life is close to my ideal[(a)]	1.000	0.697		1.000	0.684	
The conditions of my life are excellent	1.117	0.756	***	1.107	0.744	***
I am satisfied with my life	1.168	0.797	***	1.092	0.761	***
So far, I have gotten the important things I want in life	1.133	0.782	***	1.094	0.753	***
If I could live my life over, I would change almost nothing	1.069	0.553	***	1.037	0.518	***
Treatment	**0.339**	**0.171**	**	**0.316**	**0.167**	**
Imbalance Covariates						
Level of education (Ref.: Less than primary)						
Primary education	0.289	0.149	*	0.435	0.213	**
Secondary education	0.339	0.161	*	0.563	0.276	***
Tertiary education	0.507	0.154	**	0.635	0.217	***
Individual Income Changes (Ref.: Decreased)						
Stayed the same	0.197	0.104		0.126	0.066	
Increase	0.449	0.212	**	0.318	0.143	*
Household Level						
HH Health proxy (Ref.: No attention/Control or Prevention)						
Health Check-ups & Illness	-0.103	-0.054		-0.073	-0.035	
Illness	-0.208	-0.098		-0.166	-0.084	
Economic Sector (Ref.: Agriculture & Other(5))						
Commerce/trade/retail	-0.134	-0.068		-0.102	-0.054	
Manufacturing	0.006	0.002		0.061	0.018	
Service	-0.208	-0.080		-0.156	-0.069	
Employment stability (Ref.: No)	0.740	0.357	***	0.723	0.328	***
n (ESS)		362			288	

Note. Weighted MIMIC Model with Robust Maximum Likelihood Estimates for the MIMIC Model (MLM) using *lavaan.survey* package in R. ESS=Effective sample size after weighting. Author's own calculation base on fieldwork CACMU (2013).

[(a)] Fixed to one to identify factor metric.

* p < .05, ** p < .01, *** p < .001

Table A4.13 Effect size for all model specifications

Sample	Unweighted	Model I	Model II	Effect
Male	0.61088	0.46668	0.49493	ATT
		0.50701	0.40785	ATE
Female	0.31089	0.33011	0.41502	ATT
		0.30208	0.38582	ATE

Note. Unweighted estimation shows the effect of access to credit without controlling for selection bias. The Model I compare weighted latent variable means differences introducing the treatment condition as the only predictor in the model. Model II uses a 'doubly robust approach' and fits the weighted MIMIC model introducing all covariates that remain imbalance after the propensity score analysis. ATE= average treatment effect; ATT= average treatment effect on the treated. Author's own calculation base on fieldwork CACMU (2013).

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CONCLUDING REMARKS

In this thesis, we have made several contributions to the literature of entrepreneurship in developing countries:

In **Chapter I,** we make two relevant contributions to the literature. First, we provided an empirical framework to explore heterogeneity among enterprises using an innovative statistical method that can be replicated to other countries and datasets. To the best of our knowledge, this is the first empirical application that uses model-based clustering and generalized boosted classification to explore heterogeneity among enterprises. We empirically tested heterogeneity among microenterprises and confirmed that the characteristics defined in the typology of entrepreneurs proposed by Berner et al. (2012). We explored the data structure and identified six different types of enterprises within the two logics of entrepreneurs (survivalist and growth-oriented) using data from the second phase of the National Economic Census in Ecuador collected during 2013. Moreover, we found that these types of enterprises differ mainly on three characteristics: its capacity to generate monthly income to satisfy the basic needs of their owners, the type of economic activity they perform, and the percentage of paid employees.

In **Chapter II** our results show that in a context of maximum legal interest rate and regulatory changes, Cooperatives and Credit Unions have moved up-market to segments that are more profitable, non-government organization are more efficient in terms of outreach but their sustainability is not ensured, and Banks even though they are the major providers of financial services are not the most efficient ones. More interestingly, there is evidence of trade-offs that some of the indicators that show positive correlation with social efficiency scores are, at the same time, negatively correlated with financial efficiency scores. Finally, the relevant results from the second stage analysis are related with the lending methodology, suggesting the existence of a trade-off between financial and social efficiency for the institutions with higher percentages of their loan portfolio granted through group-based lending methodologies.

In **Chapter III** we make several contributions to the literature on gender, empowerment and entrepreneurship. Our incorporation of the family embeddedness perspective into the decision-making analysis using gender as a category represents the first empirical application that explores gender differences over decision-making in the work-family interface of

entrepreneurs. Our results suggest that female and male entrepreneurs make mostly autonomous entrepreneurial decision-making and are more likely to share decisions about household allocation resources but gender differences appear in decision-making over childbearing and child-rearing. In a more 'egalitarian' society such as Ecuador, the degree of perceived household-income contribution is highly correlated with intra-household and entrepreneurial decision-making and is more relevant than other objective factors such as the wealth of the household and education but gender differences appear in the effect of this variable depending on the decision-making. Moreover, we have shown how the analysis of entrepreneurial decision-making isolated from decision-making within the family sphere mistakenly reinforce the female underperformance hypothesis misleading policymakers towards incomplete and insufficient policies.

Finally, in **Chapter IV** we show that in the context of financial exclusion having access to a credit has a positive but modest effect of the life satisfaction of entrepreneurs but the effect is greater for male than for female entrepreneurs. Even more startling, we show that heterogeneity among female entrepreneurs mask the effects of microcredit programs. We also tested the psychometric properties of the construct of life satisfaction among entrepreneurs in Ecuador and show that male and female entrepreneurs ascribe the same meanings to scale items of the SWLS. Finally, we provide empirical evidence on how individual, household and enterprise characteristics influence the satisfaction with life of both female and male entrepreneurs. Overall, we found two common variables affecting the satisfaction with life scale of both male and female entrepreneurs: living in a wealthier household and the employment stability at the enterprise. More interesting, having employees improves the life satisfaction of male entrepreneurs while the economic sector improves the life satisfaction of female entrepreneurs.

The results presented in this thesis have several policy implications and lines of future research that should be considering when choosing developing strategies for entrepreneurship promotion in Ecuador.

This thesis outlines the presence of heterogeneity among microenterprises that requires specialized and differentiated programs and policies that better target the needs of each type of microenterprise. Hence, the design, evaluation and implementation of entrepreneurship policies should consider the high degree of heterogeneity among entrepreneurs since the results may be masked by heterogeneity, as found in the fourth chapter.

While exploring the effects of certain policies such as microcredit programs has drawn the attention of many researches, is only until a few years that researchers are considering heterogeneity among the entrepreneurial sector when estimating impact effects. Future research should explore not only whether a policy works or not, but also try to explore for whom it works. The introduction of heterogeneous profiles of entrepreneurs would allow to better estimate treatment effects of entrepreneurship and development policies.

We have also found heterogeneity among microfinance institutions. In fact, the financial sector in Ecuador includes a variety of institutions that differs on their targets and developmental goals and performance as presented in the second chapter. The presence of trade-offs and changes in regulatory framework have mainly affected the Cooperative Sector in Ecuador. Policy makers should consider the evidence of trade-off among social and financial goals since the promotion of policies that prioritize the supervision only under the sustainability approach may have pervasive effects over outreach and social outputs. Moreover, further research should expand the analysis to a wider number of institutions in the Cooperative Sector to explore the evolution of these institutions after the period of analysis used in this thesis.

The study of female entrepreneurship is still largely uncharted in the literature of entrepreneurship. Our results also suggest high degree of heterogeneity among female entrepreneurs. Further research should explore if this differences among female entrepreneurs are related with the increases the cost of providing specialized financial services.

The introduction of gender as a category using primary data has allowed providing empirical evidence of decision-making in the work-family interface (WFI) of the entrepreneurs. Although we did not provide evidence on the relationship between performance and decision-making in the WFI, the proximity of the enterprise to the household indicates that the differences between men and women could be explained by gender differences in the reproductive role and the limitations that women find when balancing their activities in the WFI. Further research should also explore the effect of microcredit over decision-making about reproductive and childbearing behavior.

We should consider that methodological challenges emerge when assessing multiple-group comparisons over decision-making index. Our first goal was to explore the effect of microcredit over decision-making for both female and male entrepreneurs at an aggregated level using Structural Equation Modeling (SEM) in the same fashion on the results presented in the fourth

chapter. However, measurement invariance between female and male entrepreneurs did not hold for any of the hypothesized SEM models and comparisons by sex would have yield biased estimators. Specifically, the measurement non-invariance was associated to decision-making items about childbearing and childrearing.

The presence of measurement non-invariance on some items of intra-household decision making, does not invalid the results presented in the third chapter that are accurate for individual analyses. Yet, it does not allow us to make comparisons about how male and female entrepreneurs balance the decision-making in the work-family interface at an aggregated level. In further research, we should explore methodologies that allow dealing with gender-related non-invariance items and social desirability bias. We should apply different methods such as Bayesian Structural Equation Models or Item Response Theory models as suggested by (Van De Schoot et al., 2015). In addition, simulation studies should explore the possibility of using the effect size cutoffs to detect non-invariance items between groups. Detecting possible measurement non-invariance items before an overall analysis would allow choosing the most appropriate methodologies in each specific case saving empirical researchers both time and effort.

Finally, there is also another question that remains unexplored and goes far beyond the scope of this thesis: the role of entrepreneurship for smoothing consumption. The use of the family embeddedness framework and evidence from the first chapter calls for the inclusion of benefits in-kind to explore heterogeneity under the logic of survivalist enterprises. This further analysis may validate the empirical framework propose in the first chapter but would also allow testing if microenterprises in the country have a hybrid role and are both production and consumption units.

Summing up, the main limitation of this thesis comes from the cross-sectional and exploratory nature of data. Besides the sample used in the second part of this thesis is restricted to a single region in the country and is not representative of the total population at the national level. We make a call to policy makers for increasing effort on collecting data on a regular basis and at the national level to better understand the workings of microenterprises in Ecuador. Indeed, this thesis is far from being a comprehensive understanding of entrepreneurship and female entrepreneurship in Ecuador but it provides a starting point for further research in the country.

RESUMEN

La literatura y evidencia sobre emprendimiento y desarrollo es extensa para países desarrollados y muestra una relación positiva del emprendimiento para el desarrollo. Por el contrario, en los países en desarrollo hay muchas interrogantes sobre si el espíritu empresarial y el emprendimiento pueden producir cambios estructurales que generen empleo, ingresos y crecimiento. Lo que se puede encontrar en la literatura en los países en desarrollo es, por un lado, una rama de la literatura que entiende el emprendimiento bajo un solo perfil homogeneizado del empresario y concluye que, en promedio, las empresas tienden a ser de tamaño pequeño, concentradas en mercados saturados, con bajos niveles de productividad y poco o ningún potencial de generación de empleo (Bloom et al., 2010; CAF, 2011; Bateman, 2013).Por otra parte, la amplia literatura que vincula el emprendimiento con la presencia de la Economía Informal, sostiene que el emprendimiento en los países en desarrollo se caracteriza por un alto grado de heterogeneidad en términos de desempeño, estatus legal, tipo de actividades, características socioeconómicas y rasgos de personalidad del propietario (International Labour Office, 1972; Rogerson & Beavon, 1980; Mead & Morrisson, 1996; Mead & Liedholm, 1998; Boston & Boston, 2007; Chen, 2012). Por lo tanto, sugieren que el perfil "promedio" del empresario puede ocultar la relación positiva entre emprendimiento y desarrollo.

El estudio de la presencia de homogeneidad o heterogeneidad en el sector empresarial es relevante para la política de emprendimiento, ya que da lugar a dos intervenciones de políticas completamente diferentes. Si sólo hay un tipo de empresario, las políticas estandarizadas podrían potenciar la promoción y el crecimiento de las empresas, mientras que, bajo la presencia de heterogeneidad, “no existe una solución única” y sería necesario investigar las características y necesidades específicas de los diferentes tipos de empresas.

Si bien la investigación del emprendimiento en los países en desarrollo es de gran importancia, los datos nacionales necesarios son difíciles de acceder o están totalmente ausentes, limitando así la comprensión y el análisis en profundidad del funcionamiento de las empresas en éstos países. Sin embargo, lo que se ha observado hasta ahora es que las empresas se concentran en ambos extremos y son o bien muy pequeñas (microempresas) o grandes corporaciones. La ausencia de pequeñas y medianas empresas en países en desarrollo fue

descrita por primera vez por Biggs & Oppenheim (1986) y es conocida como el problema del "*missing middle*" que limita el crecimiento y el potencial de creación de empleos del emprendimiento. Esta "anomalía distribucional" en términos de Farbman y Lessik (1989) puede explicarse bien por las barreras de entrada o comportamiento monopolístico de las grandes empresas o por los efectos de ciertas intervenciones políticas inadecuadas, restricciones al acceso al mercado y características específicas de los empresarios que fomentan que las pequeñas empresas siguen siendo pequeñas a pesar de su potencial de crecimiento.

En esta tesis nos centramos en el análisis de las microempresas, utilizando como ejemplo el Ecuador. Ecuador es un interesante caso de estudio para explorar el emprendimiento y la heterogeneidad entre microempresas por varias razones. La información del *Global Entrepreneurship Monitor* (GEM) acerca de más de 60 países en todo el mundo muestra que Ecuador tiene entre las tasas más altas de actividad emprendedora en las primeras etapas y propiedad de negocios ya establecidos (Kelley et al., 2016).

Por otra parte, después de treinta años sin datos oficiales, el Instituto Nacional de Estadísticas y Censos del Ecuador (INEC) publicó estadísticas completas sobre los establecimientos comerciales y las actividades en el país. En la primera fase, el Censo Económico incluyó datos a nivel nacional sobre todos los establecimientos económicos, entidades jurídicas y unidades autónomas. El Censo se desarrolló para determinar la contribución de todos los establecimientos económicos a la economía nacional, así como también, para definir el universo para el diseño de la encuesta y la implementación de cuestionarios de seguimiento en profundidad en siguientes etapas (INEC, 2010). Los resultados de la primera fase muestran que a finales de 2010 existían 511.130 empresas de las cuales las microempresas representaban el 93% de los negocios en el país.

Las microempresas son definidas por la Comunidad Andina de Naciones como todos los establecimientos económicos que emplean a menos de 10 empleados y cuentan con volúmenes de negocios y/o balance anual inferior a US $ 100.000 por año (CAN, 2009). Aunque estas empresas se caracterizan principalmente por ser empresas unipersonales con niveles de productividad relativamente bajos en comparación con otros tipos de empresas, su contribución al ingreso total y a la creación de empleo es muy significativa. De hecho, las microempresas generan alrededor del 25% del ingreso total y son la principal fuente de empleo para el 44,24% de los empleados en el país y las microempresas propiedad de mujeres representan alrededor del 54% de todas las microempresas en el país (INEC, 2010).

El objetivo principal de esta tesis es aportar evidencia empírica sobre la heterogeneidad en el emprendimiento en Ecuador. Para ello, esta tesis se estructura en cuatro capítulos empíricos agrupados en dos partes principales:

PRIMERA PARTE: proporciona una descripción general de microempresas e instituciones de microfinanzas especializadas en el Ecuador utilizando datos secundarios e incluye:

Capítulo I: "Microempresas heterogéneas en Ecuador: Prueba de una tipología a través de un análisis *model-based clustering*"

En éste capítulo se propone un marco empírico simple para explorar la heterogeneidad entre las empresas a través de un análisis de taxonomía que puede ser replicado en otros países utilizando Censo Económico o Encuestas Empresariales. Partimos de la tipología consolidada descrita por Berner et al. (2012) que reconocen la existencia de dos lógicas y racionalidades diferentes de los empresarios (supervivencia y orientadas al crecimiento) y establecen la posibilidad de múltiples tipos o subgrupos de empresas dentro de ambas lógicas. Nuestro objetivo es detectar empíricamente el número de *clusters* o tipo de empresas y probar si podemos encontrar las mismas características teorizadas en la tipología de emprendedores descrita por Berner et al. (2012). Hasta donde sabemos, esta es la primera aplicación empírica que implementa *model-based clustering* para explorar la heterogeneidad entre las empresas.

Capítulo II: "*Mission drift* o Especialización: Determinantes de la Eficiencia Financiera y Social de las Instituciones Microfinancieras en el Ecuador"

En el capítulo II se pretende analizar los factores y determinantes que influyen en el desempeño financiero y social de las instituciones microfinancieras (IMF) en Ecuador. El análisis utiliza como unidad de análisis a las instituciones miembros de Red Financiera Rural (RFR), una red nacional de IMF, para explorar la posibilidad de detectar la deriva de la misión (*mission-drift)*. La desviación de la misión ocurre cuando las instituciones de microfinanzas se ven obligadas a aumentar el tamaño de sus préstamos para aumentar los márgenes financieros, lo que significa que a largo plazo se mueven y comienzan a servir a clientes menos pobres que no pertenecen a los objetivos tradicionales de microfinanzas.

La metodología aplicada en este capítulo es un Análisis de Envoltura de Datos (DEA) en segunda etapa para medir la eficiencia en términos de sostenibilidad y alcance a través de un panel equilibrado de 34 IMF para el período 2009-2012. Este análisis difiere de los estudios previos en: (i) El papel desempeñado por la metodología de préstamo utilizada por las IMF, (ii)

la exploración de la relación entre las puntuaciones de eficiencia y los índices tradicionales de desempeño financiero y (iii) la consideración del contexto de tasas de interés legales máximas y los cambios en la regulación que han tenido lugar en los últimos años en Ecuador.

SEGUNDA PARTE: explora más profundamente el concepto multidimensional del emprendimiento y se centra en los efectos no pecuniarios del acceso al crédito utilizando datos primarios.

Creamos un conjunto de datos de una encuesta transversal realizada a 783 microempresarios de la región norte del Ecuador en 2013. La muestra incluye información sobre dos grupos diferentes: a. Miembros seleccionados al azar de una cooperativa local (Cooperativa de Ahorro y Crédito Mujeres Unidas -CACMU) que tienen un préstamo considerado como un grupo de tratamiento, y b. Microempresarios que viven en áreas geográficas cercanas al grupo de tratamiento utilizando el método de caminata aleatoria como grupo control. Para el grupo de tratamiento, utilizamos una muestra aleatoria de la lista de beneficiarios y restringimos la población de dos maneras: primero recopilamos información sobre todos los miembros que han tenido un préstamo (microcrédito) hasta el 31 de diciembre de 2012 y segundo, distinguimos entre los clientes antiguos que se convirtieron en miembros de CACMU hasta diciembre de 2011 y nuevos clientes que se convirtieron en miembros después de esa fecha. Se excluyeron nuevos clientes porque la exposición al programa en menos de un año no permite hacer inferencias de acceso al crédito. Por lo tanto, la población total estaba constituida por 908 clientes (68% mujeres y 32% hombres). El diseño de la muestra fue estratificada por sexo con reemplazo y distribuida proporcionalmente por áreas geográficas donde el CACMU tiene mayor incidencia (función al número de clientes). La muestra final incluyó a 402 empresarios, 66% mujeres empresarias.

Se definió una relación tratamiento-control de 1:1 y se entrevistó con el mismo número de empresarios mujeres y hombres en las áreas geográficas seleccionadas para el grupo de tratamiento. El grupo de control consistió en empresarios que tenían un negocio por más de un año, tenían menos de diez empleados y no tenían una cuenta en ninguna institución financiera. Elegimos dos estrategias diferentes dependiendo de si la ubicación correspondía a zonas urbanas o rurales. En las áreas urbanas se identificaron diferentes manzanas y calles dentro de las parroquias para evitar la concentración de encuestados en las áreas más dinámicas (concentración de las actividades comerciales) y se preguntó en el primer día los criterios de selección y se entrevistaron en el siguiente día solo a aquellos que pasaron dichos criterios. En

las zonas rurales, debido a las grandes distancias entre cada aldea, ésta estrategia no fue posible por lo se realizaron entrevistas los días de feria (generalmente los jueves y sábados) para aumentar la probabilidad de tener entrevistados de todas las parroquias rurales.

El trabajo de campo se realizó de febrero a junio de 2013 y los cuestionarios para el grupo de tratamiento fueron implementados principalmente por miembros del personal del CACMU, mientras que para el grupo de control trabajamos en colaboración con estudiantes de una universidad local. Logramos entrevistar sólo 390 personas para el grupo de tratamiento y 393 personas para el grupo de control, por lo tanto, el error de muestreo para la muestra total es de 3,75% (para la muestra de mujeres es de 5% y para la de hombres de 5,4%).

Aunque los siguientes dos capítulos empíricos usan el mismo conjunto de datos, éstos corresponden a dos análisis individuales e independientes e incluyen:

Capítulo III: "El papel de las percepciones sobre la toma de decisiones en la relación trabajo-familia de los microempresarios en Ecuador"

Basándonos en la perspectiva de la incorporación de la familia al emprendimiento que asume que el negocio y la familia son dos instituciones sociales interrelacionadas (Aldrich & Cliff, 2003; Dyer, 2003; Loscocco, 1997; Steier, Chua, & Chrisman, 2009), este capítulo hace dos contribuciones a la literatura sobre género y emprendimiento. En primer lugar, utilizamos el género como una categoría y proporcionamos evidencia empírica sobre las diferencias de género entre las percepciones de hombres y mujeres acerca de la toma de decisiones en la interfaz trabajo-familia. Utilizamos las microempresas como unidad de análisis y exploramos el grado de similitud/disimilitud de once preguntas sobre la toma de decisiones dentro del hogar y la empresa. Segundo, analizamos los factores y características a nivel individual, familiar, institucional y empresarial que influyen diferencialmente en la toma de decisiones entre empresarios y empresarias.

Capítulo IV: " Satisfacción de vida de los microempresarios en Ecuador: El papel de la inclusión financiera"

Este capítulo se centra en el análisis del efecto del acceso al crédito sobre la Escala de Satisfacción con la Vida (SWLS) desarrollada por (Diener et al., 1985) como proxy del bienestar. La evaluación del efecto del crédito sobre el bienestar de los microempresarios es particularmente relevante en Ecuador, donde sólo 36,7% de los adultos tenía una cuenta en una institución financiera formal (bancos, cooperativas de ahorro y crédito e instituciones de

microfinanzas) y aproximadamente 37% de los empresarios declaran que la falta de acceso a los servicios financieros es uno de los principales obstáculos para fomentar y hacer crecer sus negocios (Magill & Meyer, 2005).

El análisis empírico incluye la combinación del modelo de múltiples causas de indicadores múltiples (MIMIC) y Ponderación de Puntuación de Propensión (PSW) para evaluar los efectos del acceso al crédito sobre la satisfacción con la vida de los microempresarios. Ambas metodologías han sido ampliamente utilizadas en diseños observacionales y cuasi-experimentales, pero su uso combinado en la investigación empírica es bastante reciente. La integración de los dos análisis permite ensayar simultáneamente las relaciones hipotéticas entre las variables independientes y la variable latente (SWLS), mientras que controla el sesgo de selección sobre las variables observadas entre las diferentes condiciones de tratamiento.

Para estimar los efectos causales del microcrédito sobre el bienestar subjetivo, primero exploramos determinantes en el SWLS usando un modelo MIMIC para identificar las variables que usaremos en la segunda etapa para el análisis de puntaje de propensión. Una vez que hemos definido la fiabilidad y validez de la construcción, así como la bondad de ajuste del modelo, procedemos a estimar las puntuaciones de propensión usando las variables del análisis MIMIC. Se utilizó ponderación de puntuación de propensión (PSW) a través de *gradient boosting models* (GBM) (McCaffrey et al., 2004) para la estimación de la probabilidad de asignación al tratamiento (acceso a crédito). Finalmente, después de evaluar las propiedades de balaceo de las puntuaciones estimadas, usamos los puntajes de propensión como ponderación en un análisis multivariado sobre el tratamiento y las variables utilizando de nuevo los modelos MIMIC como lo sugieren Guo & Fraser (2014). Hasta donde sabemos, esta es una de las primeras aplicaciones empíricas que implementan la combinación de ambas metodologías al estimar el efecto del tratamiento en construcciones subjetivas en estudios observacionales.

Finalmente, presentamos un capítulo con las Conclusiones que incluye un resumen de los principales resultados y contribución de esta tesis, la implicación política de los resultados y explicamos las limitaciones y sugerencias para la investigación futura. Los principales resultados se resumen a continuación:

En el capítulo I, hacemos dos aportaciones relevantes a la literatura. En primer lugar, proporcionamos un marco empírico para explorar la heterogeneidad entre las empresas utilizando un método estadístico innovador que se puede replicar a otros países y conjuntos de datos. Hasta donde sabemos, esta es la primera aplicación empírica que utiliza *model-based*

clustering y *generalized boosted regressions* para explorar la heterogeneidad entre las empresas. En éste capítulo comprobamos empíricamente la heterogeneidad entre microempresas y confirmamos las características definidas en la tipología de emprendedores propuesta por Berner et al. (2012). Los resultados sugieren seis tipos diferentes de empresas dentro de las dos lógicas de emprendedores (supervivencia y orientadas al crecimiento) utilizando los datos de la segunda fase del Censo Económico Nacional de Ecuador recogidos durante el año 2013. Además, Las empresas se diferencian principalmente por tres características: su capacidad de generar ingresos mensuales para satisfacer las necesidades básicas de sus propietarios, el tipo de actividad económica y el porcentaje de empleados remunerados.

En el Capítulo II, nuestros resultados muestran que en un contexto de la tasa de interés máximas legal y los recientes cambios en la regulación, las Cooperativas de Crédito se han movido hacia segmentos más rentables, las organizaciones no gubernamentales son más eficientes en cuanto a alcance pero su sostenibilidad no está garantizada y los bancos a pesar de que son los principales proveedores de servicios financieros no son los más eficientes. Lo que es más interesante es que hay evidencia de *trade-off* entre algunos de los indicadores que muestran correlación positiva con los puntajes de eficiencia social y están, al mismo tiempo, correlacionados negativamente con los puntajes de eficiencia financiera. Por último, los resultados relevantes del análisis de la segunda etapa están relacionados con la metodología de préstamos, lo que sugiere la existencia de un equilibrio entre eficiencia financiera y social para las instituciones con porcentajes más altos de su cartera de préstamos otorgada a través de metodologías de préstamos asociativos y grupales.

En el capítulo III hacemos varias contribuciones a la literatura sobre género, empoderamiento y emprendimiento. Nuestra incorporación de la perspectiva de inclusión de la familia en el análisis de toma de decisiones utilizando el género como categoría representa la primera aplicación empírica que explora las diferencias de género sobre la toma de decisiones en la relación trabajo-familia de los empresarios. Nuestros resultados sugieren que los empresarios de sexo femenino y masculino toman decisiones autónomas y son más propensos a compartir decisiones sobre los recursos de asignación de hogares, pero las diferencias de género aparecen en la toma de decisiones sobre la maternidad y la crianza de los hijos. En una sociedad más "igualitaria" como la de Ecuador (entendida como la toma de decisiones conjunta dentro del hogar), el grado de percepción de la contribución del ingreso familiar está altamente

correlacionado con la toma de decisiones dentro del hogar y la emprendedora y es más relevante que otros factores objetivos como la riqueza del hogar y la educación. Además, hemos demostrado que el análisis de la toma de decisiones enfocadas únicamente en la empresa aislada de la toma de decisiones dentro de la esfera familiar puede reforzar erróneamente la hipótesis de bajo rendimiento de los emprendimientos femeninos.

Por último, en el capítulo IV hacemos varias contribuciones a la literatura del emprendimiento y de los estudios de la felicidad. Primero, se demuestra que en el contexto de la exclusión financiera el acceso a un crédito tiene efectos positivos pero modestos sobre la satisfacción de vida de los empresarios siendo el efecto mayor para los hombres que para las empresarias. Aún más sorprendente, mostramos que la heterogeneidad entre mujeres empresarias enmascara los efectos de los programas de microcrédito. Por otro lado, hemos probado las propiedades psicométricas de la construcción de la satisfacción de la vida entre empresarios en Ecuador y mostramos que los empresarios masculinos y femeninos atribuyen el mismo significado a los artículos de la escala del SWLS. Finalmente, proporcionamos evidencia empírica de cómo las características individuales, familiares y empresariales influyen en la satisfacción con la vida de empresarios tanto mujeres como hombres. En general, encontramos dos variables comunes que afectan la satisfacción con la escala de vida de empresarios tanto hombres como mujeres: vivir en un hogar más rico y la estabilidad del empleo en la empresa. Más interesante, tener empleados mejora la satisfacción de la vida de empresarios masculinos mientras que el sector económico mejora la satisfacción de la vida de mujeres empresarias.

Resumiendo, la principal limitación de esta tesis proviene de la naturaleza transversal y exploratoria de los datos. Además, la muestra utilizada en la segunda parte de esta tesis se limita a una sola región del país y no es representativa de la población total a nivel nacional. Hacemos un llamamiento a los encargados de formular políticas públicas para que aumenten los esfuerzos de recolección de datos a nivel nacional para comprender mejor el funcionamiento de las microempresas en Ecuador. De hecho, esta tesis está lejos de ser una comprensión integral del emprendimiento y el emprendimiento femenino en Ecuador, pero proporciona un punto de partida para más investigación futura en el país.

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