GEORG-AUGUST-UNIVERSITÄT
GÖTTINGEN

DOCTORAL DISSERTATION

Microenterprise Performance and Economic Development: Evidence from Mexico

Dissertation in order to

acquire the doctoral degree

from the Faculty of Economic Sciences

at the University of Goettingen

Submitted by

NEGRETE GARCÍA, Ana Karen

Born in León, Gto. Mexico

Goettingen, 2017

First academic advisor:	Apl. Prof. Dr. Jann LAY
Second academic advisor:	Prof. Dr. Sebastian VOLLMER
Third academic advisor:	Prof. Marcela IBÁÑEZ DÍAZ, Ph.D.

1 *Acknowledgements*

I would like to thank the CONACYT and the DAAD for granting me the scholarship that made possible my doctoral studies. This learning stage has been both challenging and rewarding. I sincerely hope that the findings contribute at least minimally to a better future.

I am also grateful with many talented people. First, with the professionals that guided my formation as a scientist: Apl. Prof. Dr. Jann Lay, for his skilled supervision and constant support. Prof. Dr. Marcela Ibáñez and Prof. Dr. Sebastian Vollmer for following my development throughout my studies.

I further thank: Excellent researchers with whom I was very lucky to share my work, get detailed feedback and professional guidance: Dr. Julio Leal Ordóñez, Dr. Carlos Rodríguez Castelán and Dr. Santiago Bazdresch Barquet.

My family, for their love and for being an unbelievable thinking team.

My coauthor, Hannes Greve, and interns, Dulce De Jesús Montoya and Letícia Utagawa, for a fruitful and enjoyable working time.

Wonderful friends that also shared me their time and knowledge to proofread earlier versions: Timon Bohn, Steve Olotu, Lea Strub, Sofia Trojanowska, and Tabea Lakemann.

Various friends whose presence contributed to make my doctoral stage a happy one. Especially to Simone Schotte, Dr. Jorge Garzón, Tom Konzack and Dr. Daniela García.

All the people that gave me feedback during the conferences that I attended: PEGNet, BCDE, SobreMéxico, GES, CONACYT/European Parliament, and University of Passau.

Lastly, I would like to thank people at various institutions that contributed to the completion of this thesis: GIGA, for providing great conditions to develop research ideas and scientific skills. Banco de México, for their hospitality during my stay as a summer researcher. The "laboratorio de microdatos" from INEGI, whose team granted me access to high quality data and who was always competent and helpful. OXFORD, for the support to visit their joint conference with CAF where I learned the regional overview encompassing my work.

Contents

1 *Acknowledgements* i
2 Abbreviations and Acronyms vii
3 Introduction 1
3.1 Motivation 2
3.2 International context 3
3.3 The Mexican case 7
3.4 Overview of the research project 11
3.4.1 Overview of Chapter 1 11
3.4.2 Overview of Chapter 2 14
3.4.3 Overview of Chapter 3 17
3.5 Relevant considerations and conclusion 19
3.6 References 22
4 *Chapter 1.* Structural Change from the Perspective of Microenterprises 26
4.1 Introduction 27
4.2 Structural change and firm size 27
4.3 Socioeconomic characteristics of microenterprises 31
4.4 Testing the existence of a poverty trap 41
4.4.1 Marginal returns to capital 43
4.4.2 Initial investment 50
4.5 Conclusion 52
4.6 References 54
5 *Chapter 2.* Constrained Potential: A Characterization of Mexican Microenterprises 58
5.1 Introduction 60
5.2 Scientific framework 61
5.3 An overview of firm heterogeneity 64
5.4 Determining firm segments 68
5.4.1 Binary response model 69
5.4.2 Refined classification 71
5.5 Characterization of microenterprises by segments 74
5.6 Marginal returns to capital 81
5.7 Sources of variation 87
5.8 Discussion 89
5.9 Conclusions 95
5.10 References 97

6 *Chapter 3.* Impact of Energy Price Changes on Performance 100
6.1 Introduction 101
6.2 Related literature 103
6.3 Data and descriptive overview 104
6.3.1 Data set and basic descriptive statistics 104
6.3.2 Descriptive characterization of energy use 107
6.4 First-order estimation of profit losses 109
6.5 Input-demand and output-supply elasticities 112
6.6 Conclusion 115
6.7 References 117
7 Appendix 120
8 Affidavit 145

List of Figures

1	Comparison of indexes: GDP per capita and commodity prices	4
2	Human Development Index (HDI)	6
3	Relative share of firm categories over time	28
4	Sector's overview across decades	33
5	Distribution of Start-up capital and other entry costs	51
6	Scenarios in the analysis of marginal returns to capital	64
7	Comparison of firm segments' distributions	74
8	Local polynomial smooth plots: Log capital and microenterprise age	93
9	Average expenditure structure by industry	105
10	FO impact of a one percent price increase on profits by industries	110
11	FO impact over profit percentiles for different samples	111
12	0A. GDP per capita, Headcount Ratio and Gini Coefficient	121
13	0B. Total labor force and unemployment	121
14	0C. Female labor participation and Life expectancy at birth	122
15	0D. Regional comparison of labor productivity	122
16	0E. Years of schooling and internet users	122
17	0F. Number of homicides and CO_2 emissions	123
18	1A. International comparison by firm size of exporters in the manufacturing sector	126
19	2B. Distribution of capital stock by decades	130
20	2G. Marginal returns to capital by capital percentiles	132
21	2H. Average expenditure shares of firms with and without premises	136
22	3A. Energy price increases (one year and one month)	137

List of Tables

1 Distribution of firms and employment by size 29
2 Comparison of microenterprises' characteristics across decades 35
3 Comparison of performance indicators between groups of microenterprises 38
4 Parametric estimations of marginal returns to capital 47
5 .... *Continuation* 48
6 Mean monthly marginal returns by levels of capital (percent) 49
7 Descriptive statistics 67
8 Binary response model (Probit) 72
9 Classification of each segment share across decades 73
10 Classification of each segment share across decades 73
11 Characteristics of each firm segment during the 2010s 77
12 ... *Continuation* 78
13 Characteristics of each firm segment during the 1990s 79
14 ... *Continuation* 80
15 Parametric estimation of log-log model 84
16 ... *Continuation* 85
17 Average monthly marginal returns to capital by segment and decades (percentage) 86
18 Oaxaca-Blinder decomposition of differences in mean profits between groups 90
20 Marginal returns to capital by segments and premise usage 92
21 Comparison of cost shares by profits quartiles 106
22 FO impact by premise-ownership 112
23 Input-demand and output-supply elasticities 115
24 0G. Sample of qualitative interview 124
25 0G. ... *Continuation* 125
26 1B. Description of variables 127
27 1C. Robustness Checks 128
28 ...*Continuation* 129
29 1D. Marginal returns to capital derived from robustness checks 129
30 2A. Firm characteristics by capital percentiles 131
31 2C. Description of variables 132
32 2D. Binary response model (robustness check with value added) 133
33 2E. Log-log model (robustness check with value added) 134
34 ... *Continuation* 135

35 2F. Corresponding results when considering the subsample of firms with premises 135
36 2I. Mean marginal returns to capital by location (firms without premises) 136
37 3B. Data overview of variable inputs (prices and quantities) and output prices. 139
38 3C. Firm characteristics by use of energy inputs 140
39 *... Continuation* 141
40 3D. Restricted parameter estimates of the Translog Profit Function . . 142
41 *... Continuation* 143

2 Abbreviations and Acronyms

CONACYT	National Council of Science and Technology Consejo Nacional de Ciencia y Tecnología
DAAD	German Academic Exchange Service Deutscher Akademischer Austauschdienst
EC	Economic Census
ENAMIN	National Survey of Microenterprises Encuesta Nacional de Micronegocios
ENEU - ENOE	National Survey on Employment Encuesta Nacional de Ocupación y Empleo (Urbano)
GIGA	German Institute of Global and Area Studies
HDI	Human Development Index
INEGI	National Institute of Statistics and Geography Instituto Nacional de Estadística y Geografía
LAC	Latin America and the Caribbean
NAFTA	North American Free Trade Agreement
ME	Microenterprises
MSME	Micro, Small and Medium Enterprises.

To my parents

3 Introduction

"Productivity is an elusive concept. It is used to describe a variety of characteristics that affect the relationship between inputs and outputs. (...) there is convincing evidence that total factor productivity plays a major role in accounting for the observed cross-country variation in income per worker and patterns of economic growth."

Helpman (2009). The Mystery of Economic Growth, p.19-33

3.1 Motivation

During the 1980s[1] the literature studying small scale firms experienced a boom that propagated optimism about the economic importance of small scale firms. Despite the theoretical advances, there was a lack of empirical evidence backing up the belief that these firms significantly influenced economic growth (Beck et al., 2005). Only in recent years optimism is coming back. The difference is that there are empirical hints pointing towards constrained productivity and the plausibility of relying on small scale firms as key promoters of development (Li and Rama, 2015).

My thesis compiles three empirical analyses that explore the relevance of microenterprise performance for economic development. By focusing on a single case study, I am able to provide complementary insights and thus an overview of intertwined topics. I chose Mexican microenterprises due to their high scientific relevance:

- First, Mexico provided the empirical evidence that reignited the scientific interest for small scale firms. Back in 2006, the study of McKenzie and Woodruff showed that Mexican microenterprises exhibit high marginal returns to capital, especially at very low levels of capital. Their findings enabled a pragmatic turnaround of the debate by highlighting the existence of constrained productivity. This observation has been successfully replicated in other parts of the world (Siba, 2015; Falco et al., 2011; Grimm et al., 2011a) and with experimental data (Fafchamps et al., 2011; McKenzie and Woodruff, 2008).

- Second, microenterprises have a predominant role in the Mexican economy. Despite only having up to ten workers [2], these firms are important employment providers and constitute 97 percent of the existing economic units[3]. Furthermore, they are the main income source of the population share that is vulnerable to poverty.

- Third, Mexico is a development puzzle. Despite liberalization and continuous reforms, the economy has consistently performed below expectations throughout

[1] For an overview of the debates and literature during that time see Julien and Chicha (1998)

[2] This study uses the most widespread definition of microenterprises: "Firms with at most ten employees plus the owner". There are still a few countries around the world that have not homogenized their national definition of microenterprises with the international community. In the case of Mexico, the homogenization was recently adopted, thus enabling comparability. I thus use the ten-workers threshold whenever my analysis is oriented towards the most recent years. When I use the 1990s period in my analysis then I use a five-worker threshold, in line with the Mexican definition of that time. This exercise provides inter temporal insights while keeping its relevance because Mexican microenterprises rarely have more than five workers.

[3] This computation was made by the author at the microdata department of INEGI in Mexico city. It is derived from the merging of the economic census and the ENAMIN of 2009. Therefore, it is a non biased statistic that comprises firms that are informal and/or do not have premises.

the past two decades. Although there are some successful multinationals, the majority of its private sector (microenterprises) remains poor, informal, and oriented towards the internal market.

- Fourth, given the long history of economic reforms in Mexico, the country has already compiled numerous records of successes and failures. Thus, other developing countries pursuing a similar growth plan could learn from it; especially the LAC region.

- Fifth, Mexico has one of the best firm level data specialized on microenterprises that is available for developing countries. The National Survey of Microenterprises (ENAMIN) is highly detailed. Furthermore, it includes informal firms and firms without premises, which are not captured in the economic census. This cross sectional survey is representative at a large scale and has a high quality.

- Sixth, the data encompasses the period between 1994 and 2012. Both the starting and ending years represent relevant time landmarks. On the one hand, in 1994, major liberalization measures aiming at a shift in the Mexican economic model occurred. For example, NAFTA and privatizations came into effect. On the other hand, 2012 marks the end of the so called "Social Decade", where LAC experienced the greatest advances in terms of equity of any region around the world[4]. This research is thus able to provide relevant insights from an inter temporal and regional perspective.

3.2 International context

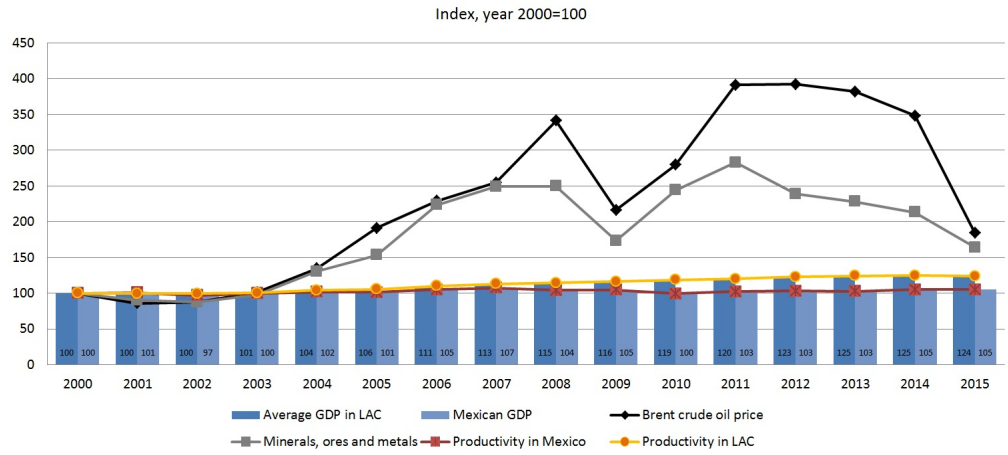
Studying microenterprises during a globalized era is relevant because these firms predominate the economic landscape across the world. The share of microenterprises, relative to the total existing firms, is usually above 90 percent in developing countries and may be as high as 98 percent. Furthermore, firm size measured by total workforce is associated with the wealth levels observed across countries. In most developing countries the average firm size is below five persons[5].

Poschke (2014) shows that there are several features of the firm size distribution that are strongly associated with income *per capita*. For example, there is a negative and significant correlation between the fraction of microenterprises and income *per capita*. Contrarily, there is a positive correlation between income *per capita* and the following labor measures: average firm size, dispersion of employment and skewness of employment. In other words, there are two major empirical observations: the richer countries are, (i) the larger the number of people that their firms usually employ, and (ii) the more common it is that their firms graduate into larger firm categories.

[4]The term "Social Decade" was used during the III Conference CAF-OXFORD in November 2016. Statistics and more details may be traced since the 7th Summit of the Americas in 2015. Current efforts and analyses are being fostered at the ECLAC, CAF and OECD.

[5]The statistics cited in this paragraph may be graphically observed in Figure 12 of Poschke (2014). It depicts an international comparison between developed and developing countries. Further data supporting these numbers are: OECD, GEM and Amadeus.

Figure 1: Comparison of indexes: GDP per capita and commodity prices



Notes: The productivity variables refer to labor productivity per hour worked.
Source: Self elaboration based on data from TCB, OECD and IEA.

Another observation is that developed countries exhibit a firm size distribution with lognormal features. Meanwhile, the firm size distribution in developing countries follows a bimodal pattern. These stylized facts have been discussed in the literature as the "Missing Middle". Tybout (2000) and Ayyagari et al. (2007) argued that developing countries appear to have a large share of microenterprises and small firms, a considerable number of large firms, but only few middle sized enterprises. Recently, Hsieh and Olken (2014) further suggested that, in fact, both medium and large enterprises may be "missing" in developing countries. Overall, Tybout (2014) summarized the debate by highlighting that the preponderance of small scale firms is an empirical observation that deserves being further studied. Specially, because the development of smaller businesses and the emergence of mid-sized firms appear to be discouraged by ongoing policies and market conditions.

As described above, the prevalence of microenterprises is relevant from both static and dynamic perspectives. In LAC, this phenomenon is related to the low growth and the prevalence of inequality throughout the region. Between 2003 and 2012, these countries benefited from the commodity boom because their exports are mainly composed of raw material. Therefore, the higher world commodity prices contributed to an overall increase of their GDP (see *Figure 1*). However, during this period LAC countries did not further diversified their exports and the productivity levels remained low. The effect was milder for countries whose exports are more diversified, such as Mexico. However, now that the commodity boom is over, economic growth is pacing down.

The equity advances made between 2003 and 2012 was the result from a mix between economic growth, improved labor markets and an expansion of public transfers. Extreme poverty was reduced by half, the middle class grew by more than 50 percent, and inequality dropped by seven percent (OECD et al., 2016). As shown in *Appendix 0A*, during that period, GDP *per capita* increased at an average rate of eleven per-

cent every five years. The regional Gini coefficient fell at a pace of 0.1 points a year since 2002 reaching a value of 0.49 in 2010 *(Gasparini et al., 2016)*. Overall, the rates of decrease in poverty and inequality were above the world average. Despite of these improvements, LAC remains the world's most unequal region. Furthermore, all these gains have decimated in recent years because the mixture of conditions that made these improvements possible do not longer exist.

Since economic growth slowed down in 2012, unemployment rates rose, the quality of jobs deteriorated, and both wage growth and formality stalled (OECD et al., 2016). Furthermore, youth and women were particularly vulnerable to these effects. Between 2014 and 2015, the number of indigent people increased by 5 million such that there was a total of 175 million poor people in the region. These numbers represent the largest increase in poverty rates since the late 1980s (ECLAC, 2016). Furthermore, economic activity contracted throughout 2015 and 2016 and only a modest recovery is expected in 2017 (OECD et al., 2016).

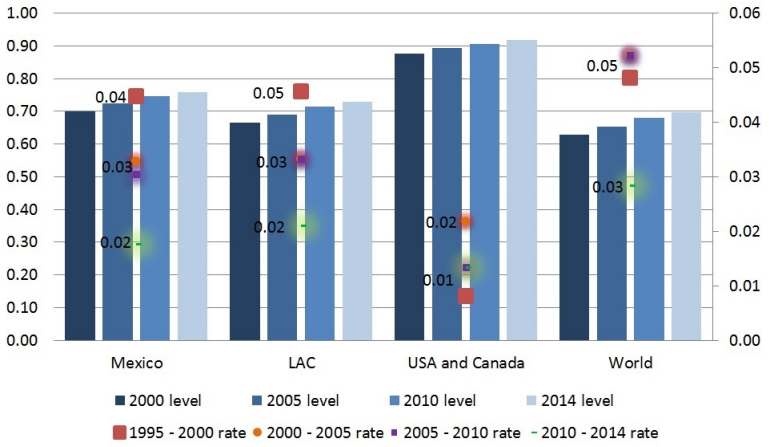
The labor market situation is even more worrisome. As observed in *Appendixes 0B* and *0C,* during the past two decades the total labor force has been steadily expanding at rates well above the world average. There are three main phenomena that explain this: the young population is entering the working age, more women are joining the labor force and life expectancy keeps rising. During the commodity boom unemployment rates were kept at bay, but the increase in labor productivity per hour worked was very low. The LAC region has historically had low levels of unemployment since workers are mainly absorbed by the informal markets. However, it might currently be trapped in a vicious cycle of poor-quality jobs (Alaimo et al., 2015). At this point, the relevance of microenterprises becomes once again apparent. These firms were, are, and will remain being (at least is the near upcoming years) important employment buffers in the labor market.

Microenterprises are also the main income source of the population in the left tail of the income distribution. According to the World Bank (2016), in the LAC region the "consolidated middle class" defined as the percentage of the population earning between ten and 50 USD a day[6] increased from 21 percent in 2001 to 35 percent in 2014. Similarly, the share of the Latin Americans living on four to ten USD a day steadily increased throughout this period, reaching a peak of 39 percent in 2014. These people are denominated the "vulnerable middle class" because although they escaped poverty, they are at risk of falling back into it.

The gains in the living standards occurred amidst the commodity boom. Therefore, the recent economic slow down will also test the robustness of the middle class that emerged over the past decade. Mazumdar (2001) argues that the existence of robust small scale firms is a factor that contributes to a more equitable distribution of income and to the alleviation of poverty. His study shows that, in Asian economies, there is a relationship between inequality and both (i) the distribution of employment size and (ii) the productivity differences between small scale firms and larger enterprises. In LAC economies, both the graduation rates of small scale firms and their productivity are lower.

[6]The World Bank provides this nominal values based on 2005 PPP.

Figure 2: Human Development Index (HDI)



Source: Self elaboration based on UNDP data.

The advances between 2003 and 2012 were not only material. The LAC region experienced socioeconomic progress as measured by the HDI (see *Figure 2).* This is why that time period has also been referred to as the "social decade". Throughout those years the conditions for women improved and the HDI increased at an average annual rate of three percent, from 0.68 to 0.72. As shown in the *Appendixes*, there was an improvement in all three main dimensions measured by the HDI: long and healthy life, a decent standard of living, and knowledge. Specifically, LAC countries managed to catch up with the world average growth rate of schooling years. In 2014, the average schooling time in LAC was 8.6 years, reducing the gap with North America to 4.5 years[7].

The case of schooling is particularly relevant for two reasons. First, the observed increase on the average years of schooling is not completely attributable to the commodity boom. Improvements in education have been consistently done throughout the past decades. For instance, between1990 and 2014, the average increase in schooling across all world regions was of 41 percent. In general, people are attending school for longer periods of time. Even if the pace slowed down recently, the positive trend remains. Second, although the LAC region experienced a further improvement in education levels during the social decade, productivity did not follow. Productivity levels and growth rates remained low.

Although external conditions are not as favorable as they were during the past years, the achievements in various socioeconomic dimensions also mean that LAC is better prepared to deal with both external shocks and internal challenges. Regaining growth momentum is important to maintain those socioeconomic gains, to prevent that the vulnerable population falls back into poverty, and to catch up with other regions in various development goals. The economic growth during the social decade was based on luck. Future well being depends on the ability of the region to make the best out

[7]In this case, Mexico is included in LAC while "North America" only refers to the USA and Canada. These two countries are taken as benchmark because their average years of schooling is the highest relative to other regions.

of the recent gains. It is possible to better shape the performance of these economies, rather than primarily depend on external conditions to determine people's livelihoods. Following this rationalization, the promotion of productivity is fundamental to achieve sustained growth.

Throughout the commodity boom labor productivity increased in LAC, although mildly. In general, productivity remains low with respect to other regions (see *Appendix 0D*). For example, the level of productivity per hour worked is three times higher in North America. Also, the productivity growth rate was higher in Asia during that decade, surpassing the productivity level of LAC back in 2010. There are several studies showing that human capital has a key role on income generation and aggregate productivity growth of countries. Recent evidence is linking productivity and equality, based on the common root causes that they share (e.g. Faggio et al., 2010; Galbraith, 2017).

In line with this emerging research, international organizations are suggesting to address low productivity and inequality in LAC via a more integrated approach. Specifically, they advocate for policies that promote higher wage equality by fostering a more equal distribution of skills within the population (OECD et al., 2016). The underlying logic is that unequal access to quality education, health technology and formal jobs might be responsible for both inequality and low productivity OECD et al. (2015).

As stated above, microenterprises are the most common production units. Also, it has been estimated that microentrepreneurs and their workers account for approximately 50 percent of the LAC labor force (Fajnzylber et al., 2009). Therefore, improving microenterprises' productivity and overall performance is a central policy concern. Research shows that the lack of productivity convergence might be the result of a combination of factors such as low savings, low financial education, weak capital accumulation, low efficiency in factor utilization and limited labor contribution to growth (Cavallo and Serebrisky, 2016; Pages, 2010; Powell, 2015). All these factors need to be better understood. The purpose of this thesis is to address them and generate micro level insights based on firm level data.

3.3 The Mexican case

During the commodity boom, the LAC region achieved, on average, various socioeconomic improvements; including lower unemployment rates, more job creation and higher wages. The forecasts of stagnation amidst a weak global macroeconomic context have increased the urgency of solving pressing problems in the labor market. Improving productivity throughout the region is fundamental to reignite economic growth. However, a one-size-fits-all approach is not feasible given the existent heterogeneity. In that sense, while LAC countries share the common development goal of improving productivity, their singularities ought be assessed.

Productivity is central to understanding economic development because it measures the efficiency with which a country, firm or worker produces goods and services. In this regard, economic growth can be considered as coming from the creation of highly productive firms (La Porta and Shleifer, 2014). Therefore, the role of productivity is also central in the study of microenterprises.

Based on the economic census, Gongora Perez (2013) estimates that the average labor productivity of microenterprises is equivalent to only 20 percent of the national average. From an international perspective, their productivity is very low. In 2013, Mexico's labor productivity was about 60 percent lower than the OECD average and 70 percent lower relative to the United States (OECD, 2015). This gap has increased over the past two decades because Mexico's productivity grew more slowly and it currently records the lowest labor productivity level among OECD countries[8]. Furthermore, the OECD also reports that productivity growth has been weaker than expected. Countries that are far away from the technology frontier often show high productivity growth due to a reallocation of labor from low to high-productivity sectors. This has not consistently occurred in Mexico.

Mexico represents a valuable development experience that might enable other countries to better understand microenterprise performance and to prevent policy mistakes. The country introduced major liberalization measures between 1984 and 1995 and has continuously undergone structural reforms ever since. This enabled it to become an important exporter and to experience high capital inflows. Throughout the past decades, Mexico introduced relevant structural adjustments. Currently agriculture represents only 3.5 percent of the GDP and the contribution of exports from goods and services to GDP increased from eleven in 1980 to 33 percent in 2012 (World Bank, 2015). Although oil and other commodities remain an important share of exports, manufactures and high technology goods are important as well. For instance, in 2014 high technology goods accounted for 22 percent of exports (ECLAC, 2015). Nevertheless, Mexico's economic growth has been sluggish and this has been mainly attributed to the low productivity growth (Canas et al., 2013).

As in the rest of LAC, Mexico benefited from the increase in world commodity prices during the past decade. However, the impact was milder in Mexico because it has one of the most diversified export compositions in the region. Furthermore, the higher temporal income mostly translated into stronger government finances rather than a vibrant performance of the economy. The development experience of this country provides at least two important insights.

First, it highlights the relevance of increasing productivity throughout LAC countries. Sustained growth is unlikely to occur in these economies if they do not improve the performance of their private sector, which is mostly composed by microenterprises. Productivity increases are necessary to take advantage of changes in the composition of the economy or liberalization measures.

Second, advances in economic development may not suffice to promote a log normal distribution of firms. Dasgupta (2016) argues that the share of middle sized firms should increase as countries develop. In his study the experience of some Asian economies was used as empirical evidence to support his dynamic model. However, this prediction cannot be generalized to the LAC region. For example, despite Mexico's development in various dimensions, its firm size distribution has not significantly changed throughout

[8]During the past two decades, Mexico's labor productivity increased at an average of 0.7 percent per year on average while this rate was 1.6 percent in OECD countries. Also, between 2000 and 2014 the total factor productivity declined in Mexico by an average of 1.4 percent per year per year whereas it increased in most other OECD countries (OECD, 2015).

the past two decades[9]. It remains uncommon that microenterprises graduate into larger firm categories. As already cited, Tybout (2014) suggests that ongoing policies and market conditions may be discouraging firm growth. In this line, Fajnzylber et al. (2009) argue that within-country differences in firm productivity arise when market and government failures limit the ability of microenterprises to reach their optimal sizes.

Most microenterprises in Mexico are informal[10] and it has been estimated that about 58 percent of the national labor force works in the informal sector[11]. The problem with informal firms is that they have been characterized as less productive and less efficient economic units (La Porta and Shleifer, 2014, 2008; Fajnzylber et al., 2011). For the case of Mexican microenterprises, the study of Baez-Morales (2015) found that formal ones are significantly more efficient than those operating informally. He explains the emergence of output differences mainly with differences in endowment characteristics and differences in efficiency with endowment returns. This evidence further supports the need of comprehensive policies that increase productivity and thus break the cycle of informality and short-lived jobs (Alaimo et al., 2015).

Informality and low productivity are multidimensional. Therefore, policies trying to assess these economic challenges require taking an integrated approach rather than introducing measures that tackle isolated problems. The literature has consistently noted that small scale firms are highly heterogeneous. Consequently, there are different target groups with the corresponding own different opportunities and needs (Liedholm, 2002).

Heterogeneity among microenterprises implies that firms with diverse characteristics exist and that their proliferation could either have a positive or negative impact on development. Liedholm (2002) argues that, on the one hand, a higher share of microenterpreneurs could mean that markets are allowing people to implement their ideas and thus to participate in the economy. On the other hand, it could contrarily mean that the markets are failing and people are thus recurring to minimal subsistence activities. Even in developing countries, both situations coexist. What matters is that the economies transit towards a situation where the market conditions enable people to either (i) consolidate their ideas and expand their firms or (ii) to find productive jobs that procures them a decent living standard. Therefore, being able to sort out these differences is fundamental when addressing poverty and growth.

My thesis studies the relationship between microenterprise performance and economic development precisely by thoroughly exploring heterogeneity. As mentioned in the beginning, it is known that Mexican microenterprises exhibit constrained productiv-

[9]Information based on INEGI's report from the economic census. Please refer to *Figure 3* for a graphic visualization of the the evolution of the firm size distribution in Mexico since 1994.

[10]There are different ways of defining an informal firm as the term is mainly associated with breaking a rule. A firm may be categorized as informal (i) when it does not provide social security to its workers, (ii) when it exhibits low productivity of employment, (iii) when working conditions are precarious, (iv) when it does not follow book keeping or (v) when it does not pay taxes. Furthermore, (vii) firm size is at times taken as a measure of informality. Under this definition, all microenterprises are regarded as informal firms. Throughout my thesis, I define informality mainly as the non provision of health insurance (social security).

[11]This statistic corresponds to an estimation for 2006 provided by Levy (2010)

ity. McKenzie and Woodruff (2006) showed that very high marginal returns to capital are to be found, especially at very low levels of capital. Given the transcendence of this finding, they further conducted an economic experiment and were thus able to present unequivocal evidence of it (McKenzie and Woodruff, 2008). However, the current puzzle is that despite generating high marginal returns to capital, many microenterprises do not grow[12]. Most microenterprises exhibit only small increases in capital or labor and show limited upward profit trajectories (BenYishay and Pearlman, 2010).

Given the international economic context and the internal challenges that the Mexican economy faces, promoting the performance of microenterprises has become a core development objective. Among the most pressing ones are, first, that the commodity prices are shrinking which adds pressure to the government finances and the funding of social programs. Second, the entrance of the new US presidential administration in 2017 introduced uncertainty about the commercial ties with its main trading partner. Third, the Drug War is increasingly harming the economy. As observed in *Appendix 0F,* the number of homicides has considerably increased in the past decade and the UN ranked Mexico among the most violent countries in the world[13]. All these phenomena are adding to the negative growth forecasts for Mexico and increasing the vulnerable population's risk of falling back into poverty.

A better understanding of microenterprise performance is fundamental to improve productivity levels and, ultimately, to achieve inclusive and sustainable development. Mexico has a pressing need of promoting higher productivity and of providing the necessary market conditions that enable small scale firms to succeed. Setting these foundations has major importance since its labor market problems are only likely to increase over time. Mexico is currently experiencing one of the highest demographic dividends across the world. The decline in mortality and fertility rates is providing the country a one-time-boost in population growth. Accordingly, it is expected that the country's population grows by 24 percent over the next 30 years and it will reach its highest proportion of working age population in 2035. Unlike Asian economies, Mexico will have more time to adjust to its eventual aging problem and should use this opportunity to gain competitive advantage over other emerging market economies (Loser et al., 2012).

Lastly, while seeking a more efficient production structure and higher income, Mexico needs to promote sustainable development. Over the past decades, the pollution levels have increased. Between 1995 and 2013, the *per capita* emissions of carbon dioxide increased by 0.4 tonnes a year (see *Appendix 0F*). Although this number is bellow the world average, the effects on the environment and human health are considerable. Also, the overall depletion of ecosystems is worrisome. The higher income that economic growth entails is only a proxy for the ultimate aim: the well being of people. Achieving a higher output while overlooking the effects on the environment goes against that very

[12]The empirical observation of no growth despite high marginal returns to capital is leading efforts to better understand microenterprises to unleash their potential and rely on them as key promoters of development.

[13]Mexico is not the only country with rising levels of violent. In fact, back in 2014 the UN classified the LAC region as the most violent around the world since it accounts for nearly one in three global homicides.

objective. Policies seeking to promote productivity and ensuring decent livelihoods should simultaneously ensure environmental sustainability.

3.4 Overview of the research project

Microenterprises dominate the economic landscape in Mexico and are the main employment and income providers of people that are vulnerable to poverty. The overreaching research question of this thesis is how microenterprise performance related to economic development in Mexico after its liberalization. It follows a cumulative structure and is organized into three self-contained research documents that are nonetheless closely related and present an integrated story.

The first chapter connects microenterprise performance during the past two decades with the structural change process that Mexico is undergoing. It shows that microenterprises are not in a poverty trap. Instead, they exhibit constrained productivity.

The second chapter explores the heterogeneity of microenterprises and characterizes them. Therefore, it assesses their growth potential. It finds that the share of microenterprises that mainly face external constraints increased during the past two decades. Therefore, cost efficient interventions are feasible and desirable. It further shows that the incentives to reinvest of some firms lacking premises might be distorted.

Finally, the third chapter explores the effect of energy price increases on microenterprise performance. It finds that, despite the long term desirability of recent energy related reforms, in the short run, microenterprise performance might be negatively affected. Therefore, there is a need of complementary measures that balance energy efficiency and welfare measured as microenterprise income.

3.4.1 Overview of Chapter 1

The structural reforms introduced in Mexico during the 1980s aimed at promoting export-led growth. Today, the country is open to trade, but the majority of its private sector is composed of microenterprises that face important constraints. In this chapter, I study the role of microenterprises during the restructuration process by pursuing a detailed analysis of their characteristics and behavior between 1994 and 2012. First, I show that, despite undergoing important socioeconomic transitions, microenterprises did not substantially improve their average performance over time. Second, there is no evidence of a poverty trap arising from an interaction between capital market imperfections and high entry costs. This implies that, even when credit constraints are relevant, they are not sufficient to explain why these firms have remained stagnant. Furthermore, microenterprises at very low levels of capital have very high marginal returns which suggests constrained productivity. Overall, the high heterogeneity of these firms and their tendency to remain small suggests that the sluggish progression of the Mexican economy may mirror inefficiencies generated by constraints of different nature such as economic, institutional or social.

Between the 1930s and the 1970s, Mexico industrialized under a scheme of import substitution and experienced high growth rates. This time period was dubbed by eco-

nomic historians as the Mexican Miracle. However, after the plummeting of oil prices, the country experienced a debt crisis. During the 1980s, Mexico started implementing a series of liberalization measures to improve the competitiveness of its industrial sector which had lagged with the protracted protectionism. The corresponding structural reforms aimed at promoting export-led growth. The underlying idea was to increase competition within the country and to integrate its private sector into international markets, in an effort to bolster long term growth. Three decades later, economic growth has been only modest and the poverty rate has remained practically unchanged.

Mexico has benefited from trade, but its private sector faces diverse challenges. Despite the existence of a few successful multinationals, microenterprises are in fact the norm. They are both the most common firm category and source of employment. However, they mainly serve the internal market, their productivity is too low and their contribution to the GDP is shrinking. For instance, microenterprises with premises contributed to 15 percent of the GDP in 2008, but this proportion shrank to 9.8 percent in 2014 (INEGI, 2017). In that sense, the structural reforms have not met the long term growth plan. The majority of the Mexican private sector is neither directly harnessing the benefits of openness to trade, nor has substantially increased its competitiveness.

The observed levels of microenterprise performance and the close relationship of these firms to informality has led some economists to state a dualistic view (Lewis, 1954; Harris and Todaro, 1970). Under this paradigm, microenterprises (informal firms) are residual economic units that provide survival income due to the lack of employment opportunities. This also implies that their workforce is constituted by people queuing for jobs in larger and more productive firms (formal jobs). However, this is not accurate. Since the 1990s, studies had already found that productive and survival activities coexist (Cunningham and Maloney, 1998; Liedholm and Mead, 1998). Furthermore, in Mexico, even well-performing wage workers constitute likely entrants into microentrepreneurship (Fajnzylber et al., 2006).

The observance of this contradictory empirical evidence led McKenzie and Woodruff (2006) to test whether Mexico was experiencing a poverty trap based on the dynamic model of Banerjee and Newman (1993). The underlying logic is that the economy stagnates when a substantial share of the population cannot get sufficient capital to enter productive activities. However, McKenzie and Woodruff falsified this and further showed that Mexican microenterprises exhibit high marginal returns, even at very low levels of capital.

In this chapter I go back to the origins of the discussion and further make intertemporal considerations. I relate the observed constrained productivity exhibited by microenterprises to the sluggish economic performance of the country and the structural change process as a whole. Specifically, I pool ENAMIN surveys into time blocks and provide insights about the changes that microenterprises underwent between the 1990s and the 2010s in urban areas.

I show that microenterprises experienced socioeconomic improvements which should have fostered their productivity and overall performance. Most notably, the share of female entrepreneurs and the schooling levels of both owners and workers increased. However, average capital stock and monthly profits changed little. I find that this

stagnation is not explained by a poverty trap[14]. Instead, it is related with an increase in constrained productivity. During the past two decades, on average, microenterprises did not significantly improve their performance nor increased their size despite the potential for doing so.

Testing the possibility of a poverty trap requires assessing two sub-questions. First, whether marginal returns to capital are low at low levels of investment. Second, whether minimum start-up costs are high relative to wealth. Correspondingly, I first do a parametric estimation of the marginal returns to capital by relying on a log-linear transformation of the profit function[15]. The dependent variable corresponds to the log of monthly profits and is controlled by capital stock, labor, and characteristics of the entrepreneur and the microenterprise. I further include ability proxies to reduce the bias arising from unobserved variables. Later, I evaluate entry costs by considering the profits and capital distributions (in logs) of young microenterprises and by assessing other entry costs such as wage expenditure or fees.

I test the poverty trap hypothesis for the whole sample and by sectors. I consider the four sectors that INEGI usually reports because this allows me to connect the statistical analyses with the introductory sections where I consider larger firm categories. For instance, I highlight that structural changes that the Mexican economy underwent are different across firm categories. According to the economic censuses, the commerce sector is being gradually superseded by manufactures and services. However, when informal firms and firms without premises are considered with the ENAMIN, then it is possible to observe that the share of trade activities actually increased from 33 percent in the 1990s to 38 percent in the 2010s. Furthermore, this is mainly explained by the expansion of petty activities rather than by firm growth: the share of the trade sector increased across decades, while the average workforce size of those microenterprises shrank from 1.7 to 1.5.

When estimating the marginal returns, I am able to provide a more sophisticated explanation of the changes in the sectorial distribution over time. The contraction by 17 percentage points of the average marginal returns to capital in the commerce sector is worrisome: microenterprises are increasingly entering into this sector despite its lower profitability and the lower chances of growing as a firm. Regarding the other sectors: manufacturing, services and construction, they experienced an increase in constrained productivity. Especially at the lower end of the capital distribution. Interestingly, construction was the only sector able to grow nonetheless; both in terms of firm size and as a total share among microenterprises.

The analysis shows that, during the past two decades, long term growth has not been fundamentally impacted by an interaction between non convex technologies and capital market imperfections. The paper thus documents the paradox of the existence of high marginal returns to capital (especially at very low levels) that is not being followed by firm growth. Despite the presence of capital market imperfections, it would be rational for microenterprises to bootstrap their way up by reinvesting their profits.

[14] At least not of the type that Banerjee and Newman (1993) modeled.

[15] I conduct various robustness checks such as (i) the exclusion of control variables, (ii) the reliance of on a fifth order polynomial rather than a log-log model, and (iii) the exchange of the profits variable from self-reported profits to sales minus costs.

Reinvestment is potentially profitable and they nonetheless stay small. Far from getting solved, this empirical observation of constrained productivity worsened over time. Furthermore, it is especially contradictory that such a tendency occurred despite socioeconomic improvements among the workforce. Although this chapter does not solve the development puzzle, it does succeed in providing evidence of the dissonance between the structural reforms and the increased hardships that the majority of the Mexican private sector faces.

Studies have suggested that the prevalence of microenterprises and informality is a self-reinforcing equilibrium. Structural reforms that unleash the observed constrained productivity are thus fundamental. Furthermore, their implementation has become pressing, given the international economic panorama and the ongoing demographic dividend. The next chapter explores the subsequent rationale: what should these measures be? The findings of *Chapter 1* provide the starting point by showing that the high heterogeneity observed among microenterprises demands that policies are at least able to distinguish between survival and entrepreneurial activities. Microenterprises have a realistic potential of becoming agents of growth.

3.4.2 Overview of Chapter 2

In the first chapter, I showed that the performance and sectorial composition of microenterprises are related to long term growth. I also showed that, despite the generation of high marginal returns to capital, these firms have remained stagnant. The lack of credit alone fails to explain this situation and the levels of firm reinvestment are low relative to their returns. During the past two decades, this constrained productivity was reflected in a sluggish performance of the Mexican economy. Setting the right market and government conditions is fundamental to enable microenterprises to grow and thus to promote a firm distribution that reflects a vibrant private sector. Unleashing firm constrained productivity is fundamental to meet the plan of trade led growth.

Microenterprises are highly heterogeneous. Therefore, there is a wide span of possible productivity interventions. This generates yet another paradox. Not only are microenterprises not growing despite their potential, but the interventions are not effective. On the one hand, the Mexican government has many programs going on and multiple departments assessing the situation[16]. Additionally, international organizations and the private sector target microenterprises. However, these efforts are not adequately coordinated and their success in promoting firm growth and microenterprise productivity has been narrow. On the other hand, in 2010 the IFC estimated that there is a finance gap of at least 2.1 trillion dollars for MSME in emerging economies. Despite the boom in microcredit efforts and the corresponding scientific literature that

[16]There are multiple government agencies that destine some efforts to this purpose. For example, CONACYT, SHCP, SE, SEGOB, ProMéxico and BANCOMEXT. For a detailed overview of the Mexican government's interventions related with small scale firms see Mittelstaedt (2007). His work also discusses the history of each program. Since then, new departments have been opened, but there is no strategy that interconnects all the ongoing efforts. Just recently, the conditional transfer program of *Prospera* included a productivity aid. Although this intervention manages to take a more integrated vision between poverty and income generation, the idea is nascent and is still being developed.

occurred about a decade ago, there was no unequivocal success[17]. In sum, the high observed heterogeneity partly explains why neither the ongoing programs nor the available credits are fully meeting microenterprises' needs.

As mentioned above, a dualistic view of microenterprises is inaccurate. In fact, subsistence-type and potentially successful firms coexist. In that sense, being able to distinguish them is fundamental to turn financing and productivity programs into effective measures that promote firm growth. Therefore, in this chapter, I profile microenterprises and investigate the constraints that they face.

To explore microenterprise heterogeneity, I rely on the empirical methodology developed by Grimm et al. (2012). Specifically, I construct an index that captures good performance in the past and the present by taking into consideration capital stock and monthly profits. Since the index takes the values of one or zero, it acts as the dependent variable in a binary response model where the predicted value is interpreted as the empirical probability of becoming a successful firm. This value allows me to classify microenterprises into three firm segments and to compare their characteristics and profitability.

The 'middle segment' is an especially relevant group because, on the one hand, the comprised firms are very similar to the 'top performers' in the socioeconomic and behavioral profile that predicts success. However, on the other hand, their levels of profits and capital are low. These two simultaneous characteristics imply that it is likely that these microenterprises are mainly facing external constraints and are thus subject to cost effective interventions.

Grouping microenterprises into upper, middle, and lower segments can also be interpreted as classifying them into successful, almost successful and not successful firms. I show that the share of middle segment firms increased between the 1990s and the 2010s. This finding is robust to the inclusion of behavioral control variables and to semiparametric estimations.

When estimating the corresponding marginal returns to capital I unexpectedly find that, despite their internal constraints, the lower segment exhibits the highest average marginal returns across decades. The marginal returns of the middle segment are more modest, though still high: about three to five times higher than the market interest rate. In that sense, even microenterprises with low profiles exhibit constrained productivity. Overall, there is capital misallocation across the Mexican economy.

Next, I do an Oaxaca-Blinder decomposition to determine the differences in profitability between two firm groups (segments). The sources of variation are traceable after controlling for their different allocation of factors. I find that the coefficients effects are significant for the middle and lower segments. Hence, the lower performance of both segments relative to the upper segment can be attributed to a lack of skills. This finding supports the view of the OECD et al. (2016) who are currently advocating for promoting skills formation throughout the LAC region. The very high marginal returns of the lower segment are mostly explained by the endowment effects, thus signaling a

[17] For example, in 2006 the Nobel Peace Prize was awarded to Yunus and his Grameen Bank for the microcredit scheme that was fostering social development. However, this Bangladeshi model could not be copied around the world because the social incentives behind the success of this framework differ across regions.

serious lack of capital.

Overall, the empirical characterization of microenterprises promotes an objective and systematic understanding of the high observed heterogeneity. It allows to distinguish among firm profiles and assesses the features that are prone to improvement in relative terms. Furthermore, the Oaxaca-Blinder decomposition provides a clearer guideline regarding the weaknesses of each group. Thereby, it sheds light on the interventions that they require. For instance, the increase in the number of middle segment firms shows that, over time, more firms remained stagnant, mainly due to external constraints.

Middle segment firms compose a group of troubled microenterprises whose situation should be "easy" to solve. The owners already have a good educational attainment and show good entrepreneurial behavior. Furthermore, by knowing their profile it becomes possible to target them. Given that these microenterprises mostly face external constraints, they should be enabled to grow in the short term once they are subject to cost effective interventions. For example, provision of credit or savings accounts. The significance of the coefficient effects provides an even finer orientation for a policy intervention because it discloses the need to complement such an intervention with skills formation.

The upper segment is constituted by the best performers among microenterprises. These firms have the most capital and earn the highest monthly profits. However, their size is also small. They need a policy that promotes the provision of more jobs with better employment features.

Lastly, unleashing the potential of the lower lower segment is more complex. First, increasing their productivity requires a long term approach that should be ideally paired with social programs because their skills are low[18]. Second, their lack of capital is substantial and they exhibit high marginal returns to capital. Despite all the odds, they are the most profitable segment among microenterprises. Third, the owners' incentives to reinvest in these microenterprises might be distorted[19]. Specifically, some of these firms might purposely not invest in their firms because that would lower their mobility, increase their visibility to authorities and overall reduce their profitability.

In sum, in this chapter, I provide specific assessments about microenterprises' needs. Unlike previous studies, the employed methodology makes it possible to establish a clear criteria for the classification of firms[20]. This characterization should enable policy makers to introduce targeted interventions and to increase the effectiveness of current programs and measures. Microenterprises have the potential to become agents that promote growth and the analysis of *Chapter 2* improved the understanding of microen-

[18]For example, they have low schooling levels and financial education. Also, they do not follow bookkeeping.

[19]I redo the whole analysis by use of premises and find that the marginal returns to capital are only significantly high for firms without premises. Afterwards, I further support this view with econometric and descriptive tests.

[20]Before Grimm et al. (2012), the scientific literature tried making sense of firm heterogeneity by relying on some features that were correlated with performance. For example, the motivation to start the firm, a narrow definition of informality, or any proxy for entrepreneurship. However, such procedures provided an incomplete and inaccurate picture. Contrarily, in this chapter I provided an empirical classification that is based on an ex post overview of the distribution of microenterprises.

terprises' constraints and profiles.

3.4.3 Overview of Chapter 3

Mexico has three important long term concerns: increasing productivity, promoting efficiency in the energy sector and lowering greenhouse emissions. However, the simultaneous implementation of actions seeking to promote them might be contradictory in the short term. First, improving productivity among firms, especially among microenterprises, is fundamental to foster economic growth. Second, the energy sector is subject to numerous inefficiencies. From the supply side, the electricity and oil companies are inefficient monopolies whose revenues remain intertwined with the government's budget. From the demand side, energy consumption is high relative to the current productivity levels in the economy. Third, there is an urge to protect the environment from pollution because of Mexico's high vulnerability to global warming effects.

There are diverse ongoing interventions from the government trying to tackle each one of these three concerns. However, they do not represent integrated efforts. For example, the reforms of 2013 in the energy sector introduced liberalization measures aiming at promoting efficiency. It is expected that energy prices will diminish over time, given the foreseen improvements in competition throughout the energy production chain. However, gasoline prices increased more than 20 percent between January 2016 and January 2017. This sudden price increase lead to a violent response of the population (LAN, 2017). Similarly, electricity prices rose. This increase was experienced gradually and was equivalent to approximately ten percent within a year.

On the one hand, the observed rise in energy prices does not match the expectations of the energy reform. On the other hand, higher energy prices have a similar effect as a carbon tax and are in line with the aim of reducing greenhouse emissions. We focus on how these changes are related to the objective of increasing firms' productivity. Overall, the achievement of all three long term objectives (higher efficiency in the energy sector, higher productivity, and lower pollution) require the understanding of short term effects to coordinate these efforts and smooth the intertemporal transition. A failure to understand the intermediate effects sets the country at risk for an even lower growth path, where the public finances worsen, the productivity of the economic units shrinks and energy consumption is shifted towards cheaper, but more pollutant energy sources.

In this chapter we estimate the short-term impact of energy price changes on microenterprise performance. Focusing on these firms is relevant not only because they are the most common economic units, but also because they are subject to the highest productivity improvements. In the previous chapters I showed that microenterprises exhibit constrained productivity and that their graduation into larger categories might be discouraged by ongoing policies and market conditions. In that sense, we now make a follow up by precisely assessing the relationship between the market effects of ongoing policies and the performance of these firms.

To explore the relationship between energy prices and microentrepreneurial activity, we estimate first order effects (FO), which are an upper bound impact that stems from the variation in the cost share. They thus correspond to the losses in profits that these

firms experience before the production function undergoes adjustments. With this approach we are also able to investigate the following effects of higher energy prices: decreases in profits, which are the most affected industries and the characteristics of vulnerable firms.

To obtain input-demand and output-supply elasticities, we afterwards estimate a seemingly unrelated regression (SUR) by using generalized least squares (GLS). Given the high heterogeneity that prevails among microenterprises, in this case we only consider a subsample and are thus able to thoroughly explore their behavior. Specifically, we provide insights about substitution and complement effects between labor, capital and energy.

We are able to contribute to the literature and to avoid aggregation biases by relying on a firm level data set instead of using time series data. Also, the consideration of informal firms and those lacking premises provides a more accurate overview about the impact that changes in energy prices may have on production units. Energy use follows different patterns across industries and place of operation. Still, results show that price increases of combustibles are expected to have larger average effects on firm performance, relative to electricity.

We also find that energy usage rates are highly correlated with performance in terms of monthly profits, capital, firm size and entrepreneurial behavior. Most importantly, we are able to distinguish vulnerable firms, which are defined as energy intensive firms with low profits. Vulnerable microenterprises in energy intensive industries are especially relevant from a structural change perspective. These firms overcame energy usage as an entry cost and decided to operate in industries that are more in line with the long term growth plan that Mexico consolidated during the nineties. Lastly, we provide sophisticated conjectures about substitution and complement effects. We consider self and cross elasticities of energy, labor, capital and output.

To the best of our knowledge, this is the first study taking a microeconomic perspective of the short run production implications of energy related reforms in Mexico. We are able to show that, despite the desirability of the recent reforms that tackle long term concerns, the impact of these measures on productivity and overall microenterprise performance is likely to be negative in the short run. These entrepreneurs and their employees are expected to have limited adaptation capacity to energy price increases. This situation contradicts the aim of enhancing productivity and diminishing informality; which is necessary to take advantage of the liberalization measures introduced more than two decades ago.

Related literature has suggested either imposing an optimal increase of energy prices that optimizes both energy efficiency and welfare (Nie and Yang, 2016) or implementing separate fiscal and social measures that spread out the benefits of eliminating energy subsidies and the corresponding price distortions (Mehrara, 2007). Our analysis also shows that welfare losses occur. Therefore, whatever complementary policy is introduced to smooth the effects of higher energy prices, the measure should consider at least all three main long term goals of energy efficiency, firm productivity and environmental preservation. Furthermore, it should encompass all economic units. In this study, we focused on microenterprises because these firms are usually overlooked. The right incentives to prevent that small scale firms are hindered from achieving gradua-

tion. As discussed at the very beginning, overcoming the "missing middle" and "missing large" phenomena is crucial to promote development.

3.5 Relevant considerations and conclusion

The analyses presented in this paper are in line with up-to-date scientific discussions and empirical methodologies. Most importantly, they assess the Mexican growth problem at its core and are highly relevant in the current policy discussions. Interestingly, the results of these firm-level analyses provide further support to international and federal discussions. For example, chapters one and two assess constrained productivity and represent a follow up on the efforts that the World Bank has been conducting during the past decade. Also, the OECD, CAF and ECLAC just issued a report about the need to improve productivity and to increase the skills of the workforce some months ago[21]. Lastly, assessing the impact of the variation in energy prices over microenterprise performance just became urgent in January 2017[22]. The effects of the energy reforms and environmental agreements on microenterprise performance represent ongoing adjustments of the economy.

A broader contribution of this thesis is thus being able to provide an interconnected overview of long term aims that Mexico has identified. In chapter one, it made a detailed assessment of the implemented structural reforms with microeconomic insights. In chapter two, it provided concise suggestions about the differentiated interventions that microenterprises need to prosper. Lastly, in chapter three, it made explicit the need of jointly considering firm productivity and other long term policies. Altogether, these insights should help policy makers to rightly assess the short term effects of interventions and to improve their overall coherence and relevance.

It should be mentioned that the analysis also has shortcomings. For instance, biases from unobserved characteristics can only be reduced, but not completely eliminated. Also, there are inherent measuring errors that even a high quality dataset such as the ENAMIN retains. Finally, the cross sectional nature of the data has its own limitations. A future analysis could reduce them by following an experimental approach.

Basing my analysis on the ENAMIN enabled me to provide representative results at the urban and national levels. Also, I was able to perform sophisticated quantitative analyses with intertemporal considerations. Still, I further engaged in short talks with microenterpreneurs during my three visits to Mexico and conducted six interviews[23] of one hour each in 2015 (the questionnaire is included in *Appendix 0G*). This small scale qualitative analysis was not included in my chapters. Instead, it was just meant to ensure that my results were consistent and to search for complementary insights. Some results worth mentioning are the following:

[21] There are multiple reports and studies, but the report of OECD et al. (2016) compiles these insights and contextualizes them in the international economic panorama.

[22] The government intended to gradually eliminate the gasoline subsidies, but the sudden price increases generated unrest in the population.

[23] I interviewed five microenterprises in León. Four of them had premises and one of them did not. Also, I interviewed one microenterprise in Mexico City that operated in the public thoroughfare near to a tianguis.

- Measurement errors might be significant both in terms of capital and profits[24].
- The rise of insecurity is an important factor. Firms seem to adapt by operating during daylight and by implementing protective measures in their businesses.
- There is a gap in knowledge between policy interventions and the perception of microenterpreneurs. For example, they mostly report not being aware of export opportunities or productivity programs.
- Microenterprises focus in serving the internal market and doing so has become increasingly difficult during the past years. In some cases, they are reducing the quality of their products or further shrinking their profits because clients expect lower prices or are reluctant to pay.
- Although high tech innovations are usually not pursued, entrepreneurs do engage in grassroots innovations such as improving their products, the way in which they make advertisements, search for clients and showcase what they sell.
- Two common reasons for which microenterpreneurs rely on family members to operate are labor costs and because they trust them better.
- Most of entrepreneurs would not give up their business for a paid job because, despite the difficulties, it gives them freedom and the possibility to spend time with their family.
- Microenterprises do not trust the government, nor are they willing to pay for taxes, since they consider that those resources would get lost in corruption or inefficient activities.

To close the introductory section, it is relevant to conceive this thesis within broader debates that are currently happening in Mexico. Throughout all the three chapters of my thesis I highlighted microenterprise heterogeneity. From a scientific perspective, the dualistic conception is subsiding. However, in policy and political debates microenterprises are still often framed as survival activities. Informality certainly plays a major role in dismissing the entrepreneurial capacity of these economic units. For instance, microenterprises are commonly overlook because their profits are low, relative to larger firms. Under such logic, even if microenterprises paid taxes, their potential contribution to the government's budget is low. However, this stand suggests a lack of understanding of the potential gains that a more inclusive and productive private sector would bring to the economy.

The OECD has suggested that activating credible forward-looking fiscal policies and investments, especially on infrastructure and skills, would contribute to the development of the LAC region. Overall, reigniting growth in Mexico is interrelated with

[24] Ongoing experimental studies additionally ask microenterpreneurs for permission to take a picture of the business and make an estimation themselves. This practice helps abating measurement errors in capital stock and could be desirable when collecting the answers of the ENAMIN survey. However, the INEGI could face important caveats in the field.

introducing structural policies that promote productivity, capital accumulation, and high quality human capital. Furthermore, without inclusiveness, advances are likely to be negligible. Enabling microenterprises to grow and develop is necessary to promote an economic environment where people can generate the necessary income to cover their basic necessities and where decent work conditions are not an exception, but the norm.

3.6 References

Alaimo, V., Bosch, M., Kaplan, D. S., Pages, C., and Ripani, L. (2015). *Jobs for Growth*. Inter-American Development Bank.

Amadeus (2017). A database of comparable financial information for public and private companies across europe. Technical report, Bureau van Dijk.

Ayyagari, M., Beck, T., and Demirguc-Kunt, A. (2007). Small and medium enterprises across the globe. *Small Business Economics*, 29(4):415–434.

Baez-Morales, A. (2015). Differences in efficiency between formal and informal micro firms in mexico. *University of Barcelona. The Research Institute of Applied Economics*, 10:1–33.

Banerjee, A. V. and Newman, A. F. (1993). Occupational choice and the process of development. *Journal of Political Economy*, pages 274–298.

Bank, W. (2015). World bank open data.

Beck, T., Demirguc-Kunt, A., and Levine, R. (2005). Small and medium enterprises, growth, and poverty: Cross-country evidence. 10(3):199–229.

BenYishay, A. and Pearlman, S. (2010). Crime, informality and microenterprise growth: Evidence from mexico. *University of New South Wales and Vassar College*, pages 1–39.

Canas, J., Coronado, R., and Orrenius, P. (2013). Will reforms pay off this time? experts assess mexicos prospects. Technical Report Q2, Southwest Economy. Federal Reserve Bank of Dallas.

Cavallo, E. and Serebrisky, T. (2016). *Saving for Development. How Latin America and the Caribbean Can Save More and Better*. Inter-American Development Bank. Palgrave Macmillan, Washington, DC.

Cunningham, W. and Maloney, W. F. (1998). Heterogeneity among mexico s microenterprises: an application of factor and cluster analysis. *World Bank Publications*, (1999).

Dasgupta, K. (2016). The missing middle in developing countries revisited. *Indian Growth and Development Review*, 9(1):32–52.

ECLAC (2015). Data and statistics - sigci plus.

ECLAC (2016). Social panorama of latin america. Technical report, Economic Commission for Latin America and the Caribbean, Santiago, Chile.

Fafchamps, M., McKenzie, D., Quinn, S., and Woodruff, C. (2011). When is capital enough to get female enterprises growing ? evidence from a randomized experiment in Ghana. *World Bank Policy Research Working Paper Series*, pages 1–44.

Faggio, G., Salvanes, K. G., and Van Reenen, J. (2010). The evolution of inequality in productivity and wages: panel data evidence. *Industrial and Corporate Change*, 19(6):1919–1951.

Fajnzylber, P., Maloney, W., and Rojas, G. M. (2006). Microenterprise dynamics in developing countries: How similar are they to those in the industrialized world? evidence from mexico. *The World Bank Economic Review*, 20(3):389–419.

Fajnzylber, P., Maloney, W. F., and Montes-Rojas, G. V. (2009). Releasing constraints to growth or pushing on a string? policies and performance of mexican micro-firms. *The Journal of Development Studies*, 45(7):1027–1047.

Fajnzylber, P., Maloney, W. F., and Montes-Rojas, G. V. (2011). Does formality improve micro-firm performance? evidence from the brazilian simples program. *Journal of Development Economics*, 94(2):262–276.

Falco, P., Kerr, A., Rankin, N., Sandefur, J., and Teal, F. (2011). The returns to formality and informality in urban Africa. *Labour Economics*, 18:S23–S31.

Galbraith, J. K. (2017). Globalization and inequality revisited. *Argumenta Oeconomica Cracoviensia*, (15):9–19.

Gasparini, L., Cruces, G., and Tornarolli, L. (2016). Chronicle of a deceleration foretold: Income inequality in latin america in the 2010s. *Revista de economÃa mundial*, 43.

GEM (2017). GEM Global Entrepreneurship Monitor. Technical report, London Business School and Babson College.

Gongora Perez, J. P. (2013). El panorama de las micro, pequenas y medianas empresas en mexico. *Comercio Exterior*, 63(6).

Grimm, M., Knorringa, P., and Lay, J. (2012). Constrained gazelles: High potentials in west africa's informal economy. *World Development*, 40(7):1352–1368.

Grimm, M., Krueger, J., and Lay, J. (2011). Barriers to entry and returns to capital in informal activities: Evidence from sub-saharan africa. *Review of Income and Wealth*, 57(s1):s27–s53.

Harris, J. R. and Todaro, M. P. (1970). Migration, unemployment and development: A two-sector analysis. *The American Economic Review*, pages 126–142.

Hsieh, C.-T. and Olken, B. A. (2014). The missing "missing middle". *Journal of Economic Perspectives*, 28(3):89–108.

INEGI (2017). Censos economicos. Technical report, Instituto Nacional de Geografia y Estadisitica.

Julien, P.-A. and Chicha, J. (1998). *The state of the art in small business and entrepreneurship*. Number Pierre-Andre. Ashgate, Aldershot, Hants, England, grepme-research group edition.

La Porta, R. and Shleifer, A. (2008). The unofficial economy and economic development. *National Bureau of Economic Research*, (14520):275–363.

La Porta, R. and Shleifer, A. (2014). Informality and development. *National Bureau of Economic Research*, (20205):1–30.

LAN (2017). Mexico and nafta. *Latin American Newsletters*, Latin American Regional Report(RM-17-01):1–12.

Levy, S. (2010). *Good Intentions, Bad Outcomes: Social Policy, Informality, and Economic Growth in Mexico*. Brookings Institution Press.

Lewis, W. A. (1954). Economic development with unlimited supplies of labour. *The Manchester School*, 22(2):139–191.

Li, Y. and Rama, M. (2015). Firm dynamics, productivity growth and job creation in Developing Countries: The role of micro-and small enterprises. *The World Bank Research Observer*, 30(1):3–38.

Liedholm, C. (2002). Small firm dynamics: evidence from africa and latin america. *Small Business Economics*, 18(1-3):225–240.

Liedholm, C. and Mead, D. C. (1998). The dynamics of micro and small enterprises in developing countries. *World Development*, 26(1):61–74.

Loser, C. M., Arnold, D., and Szyf, Y. A. (2012). *Mexico and the World - Policy Complacency After Years of Disappointing Growth*. A New Vision for Mexico 2042: Achieving Prosperity for All. Centenial Group International, Washington, DC.

Mazumdar, D. (2001). Small-medium enterprise development in equitable growth and poverty alleviation. *Asian Development Bank*, page 29.

McKenzie, D. and Woodruff, C. (2008). Experimental evidence on returns to capital and access to finance in Mexico. *The World Bank Economic Review*, 22(3):457–482.

McKenzie, D. J. and Woodruff, C. (2006). Do entry costs provide an empirical basis for poverty traps? Evidence from Mexican microenterprises. *Economic Development and Cultural Change*, 55(1):3–42.

Mehrara, M. (2007). Energy consumption and economic growth: The case of oil exporting countries. *Energy Policy*, 35(5):2939–2945.

Mittelstaedt, A. (2007). *SMEs in Mexico: Issues and Policies*. OECD Publishing, Massachusetts, USA.

Nie, P.-y. and Yang, Y.-c. (2016). Effects of energy price fluctuations on industries with energy inputs: An application to china. *Applied Energy*, 165:329–334.

OECD (2013). Entrepreneurship at a glance. Technical report, OECD Publishing, Paris.

OECD (2015). Mexico. policy priorities to upgrade skills and knowledge of mexicans for greater productivity and innovation.

OECD, CAF, and ECLAC (2015). *Latin American Economic Outlook 2015. Education, Skills and Innovation for Development*, volume 8. Organisation for Economic Cooperation and Development, Paris.

OECD, CAF, and ECLAC (2016). *Latin American Economic Outlook 2017. Youth, Skills and Entrepreneuship*. OECD Publishing, Paris.

OECD and IEA (2016). Oecd economic outlook 99 database and oil market report.

Pages, C., editor (2010). *The age of productivity: transforming economies from the bottom up*. Development in the Americas. Inter-American Development Bank ; Palgrave Macmillan, Washington, D.C., 1st ed edition. OCLC: ocn435419655.

Poschke, M. (2014). The firm size distribution across countries and skill-biased change in entrepreneurial technology. *IZA Discussion Papers Series*, (7991).

Powell, A. (2015). *The labyrinth: How can Latin America and the Caribbean navigate the global economy*. Latin American and Caribbean Macroeconomic Report. Inter-American Development Bank, Washington, DC.

Siba, E. (2015). Returns to physical capital in ethiopia: Comparative analysis of formal and informal firms. *World Development*, 68:215–229.

Stein, P., Goland, T., and Schiff, R. (2010). Two trillion and counting. assessing the credit gap for micro, small, and medium-size enterprises in the developing world. *International Finance Corporation. World Bank Group.*, (34):1–16.

TCB (2017). Total economy database. Technical report, The Conference Board, New York, USA.

Tybout, J. R. (2000). Manufacturing firms in developing countries: How well do they do, and why? *Journal of Economic literature*, pages 11–44.

Tybout, J. R. (2014). Correspondence. about the missing missing middle.

UNDP (2017). Human development data.

WB (2016). Lac equity lab. a platform for welfare analysis in latin america and the caribbean. Technical report, The World Bank and CEDLAS, Washington, DC.

4 *Chapter 1.* Structural Change from the Perspective of Microenterprises

Ana K. Negrete-García

"If you are a Mexican entrepreneur, entry barriers will play a crucial role at every stage of your career. These barriers include expensive licenses you have to obtain, red tape you have to cut through politicians and incumbents who will stand in your way, and the difficulty of getting funding from a financial sector often in cahoots with the incumbents you are trying to compete against. These barriers are either insurmountable, keeping you out of lucrative areas, or your greatest friend, keeping your competitors at bay."

Acemoglu and Robinson, 2013. Why Nations Fail, p.39

Summary

The structural reforms introduced in Mexico during the 1980s aimed at promoting export-led growth. Today, the country is open to trade, but the majority of its private sector is composed by microenterprises that face important constraints. In this chapter I study the role of microenterprises during the restructuration process by pursuing a detailed analysis about their characteristics and behaviour between 1994 and 2012. First, I show that, despite undergoing important socioeconomic transitions, microenterprises did not substantially improve their average performance over time. Second, that there is no evidence of a poverty trap arising from an interaction between capital market imperfections and high entry costs. This implies that, even when credit constraints are relevant, they are not sufficient to explain why these firms have remained stagnant. Furthermore, microenterprises at very low levels of capital have very high marginal returns which suggests constrained productivity. Overall, the high heterogeneity of these firms and their tendency to remain small suggest that the sluggish progression of the Mexican economy may mirror inefficiencies generated by constraints of different nature such as economic, institutional or social.

4.1 Introduction

The liberalization of the Mexican economy began in the 1980s and the corresponding reforms aimed at promoting export-led growth. According to this development logic, the private sector was meant to become the agent that promotes growth, and exports the means to achieve it. Consequently, in 1994 the country ratified the North American Free Trade Agreement (NAFTA) and major privatizations occurred. However, the private sector has developed unevenly across firm categories ever since. Overall, the results of this economic restructuration fell short to expectations: growth was modest and poverty rates remained high during the past two decades. The main components of the long-term growth plan are in a different stand. On the one hand, Mexico is a leading economy in terms of openness. On the other hand, its private sector is preponderantly composed of microenterprises that do not export, tend to be informal, and are concentrated in the lowest tiers of profits, capital stock, wage expenditure, and innovation activities.

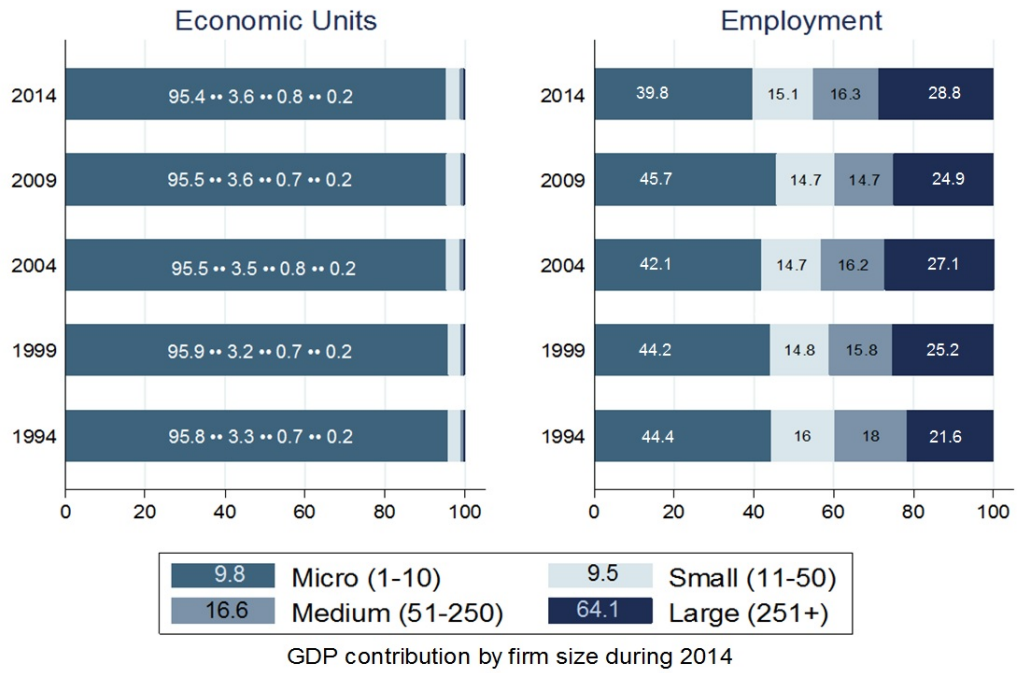
In this paper, I study how microenterprises contributed to structural change after liberalization. I do so by exploring macroeconomic dynamics from a microeconomic perspective. A detailed sectorial and intertemporal analysis thus provides insights about the relationship between economic growth and the performance of these firms. This analysis focuses on the period between 1994 and 2014 and (i) explores the characteristics of these economic units and (ii) tests whether the observed quiescence of the economy can be explained by a poverty-trap mechanism. First, I show the high heterogeneity that prevails among microenterprises and report the characteristics that are correlated with an outstanding performance. Second, in the econometric section I show that an interaction between capital-market imperfections and entry costs has not systematically prevented the emergence of profitable ventures. There is no evidence of such poverty trap. In this sense, even if credit constraints apply, they do not explain the observed censored pattern of graduation. Furthermore, the high marginal returns at very low levels of capital evidence constrained productivity. In sum, the sluggish progression of the Mexican economy may mirror inefficiencies generated by constraints of a different nature, be they economic, institutional, or social.

This is the first highly detailed study interconnecting macro and microeconomic levels of analysis to gain a comprehensive understanding about the transition of the Mexican economy in recent decades. The chapter is organized as follows: first, I explore the differences across firm size categories and their relationship with macroeconomic indicators. Second, I rely on firm level data to study the transition patterns of urban microenterprises by comparing their features during the 1990s and the 2010s. Third, I do the econometric analysis for both decades and study the corresponding patterns of marginal returns to capital and start-up costs. Fourth, I discuss the findings and conclude.

4.2 Structural change and firm size

The Mexican economy is considered to be relatively modern because the contribution of agriculture to GDP has steadily diminished from 19.4 percent in the 1940s to 4.3

Figure 3: Relative share of firm categories over time



Source: Author's computation based on the Mexican Economic Censuses (INEGI's Reports)

percent in 1994 and to 3.5 percent in 2014. Consequently, the economically active population has been transiting into the secondary and tertiary sectors. According to the economic censuses the commerce sector is gradually being superseded by manufactures and services. Although the economy experienced an initial boost right after liberalization, it faded and the restructuration pace slowed down in recent decades. For example, between 1986 and 1994, when the economy opened to trade, the share of high technology exports increased by 12.4 percentage points. This contrasts with the two subsequent decades, when it barely grew 0.4 percentage points. Despite the slowdown, the pace remains positive and the contribution of trade to GDP keeps rising[25]. Also, exports increased about 6.5 fold and imports about 5 fold between 1994 and 2014. Furthermore, the technology intensity of exports rose substantially[26].

The composition of the economy keeps changing and the country is open to trade, but the development of the private sector differs across firm sizes. According to the economic census of 2014 microenterprises represent 95.4 percent of all firms and employ 39.8 percent of the economically active population[27]. However, they only account

[25]For example, the exports arising from goods and services (as a percentage of the GDP) increased from 10.71 percent in 1980 to 32.87 percent in 2012 (World Bank, 2015).

[26]According to the ECLAC (2015) in 1986, when Mexico adhered to the GATT, the composition of exports was 45.6 percent primary goods and 9.4 percent high technology products. By 1994, when it signed the NAFTA, the share of primary goods had significantly decreased to 17.2 percent and the high technology goods increased to 21.8 percent. The increase was less dramatic in the two subsequent decades. In 2014 the corresponding shares were 14.07 and 22.24 percent.

[27]Economic censuses exclude businesses without premises (no permanent physical establishment and

Table 1: Distribution of firms and employment by size

Category	Worforce	No. Economic Units	Percentage	Employment	Percentage	Mean Size
Micro	**1**	4,831,163	68.0	4,831,163	21.8	1
	2-4	1,921,742	27.1	4,702,377	21.2	2.5
	5-7	133,332	1.9	734,192	3.3	5.5
	8-10	25,832	0.4	221,965	1.0	8.6
Small	**11-50**	149,968	2.1	3,078,665	13.9	20.5
Medium	**51-250**	30,697	0.4	3,199,650	14.4	104.2
Large	**> 250**	7,176	0.1	5,424,075	24.4	755.9
		7,099,910	100.0	22,192,087	100.0	3.1

Note: (1) The data corresponds to 2009 and stems from merging the economic census with the ENAMIN survey. The data of microenterprises was adjusted by the expansion factor assigned to each observation. (2) The statistics were computed at the IT office of INEGI and followed security protocols. (2) This table is representative at the national level.

for 9.8 percent of GDP. As observed in *Figure 3*, this has barely changed in the past twenty years. Furthermore, microenterprises rarely reach the ten workers cut-off that classifies them; a situation that contrasts with small and medium-sized firms given that the latter are closer to the upper tier of their definition (Mittelstaedt, 2007). From an international perspective, it is apparent that microenterprises have a major role in Mexico. For example, in the US, firms with up to five persons represent 61.7 percent and in the EU 86.9 percent. In Mexico they account for 88.9 percent. However, these ciphers must be further contextualized. First, they exclude firms without a permanent physical establishment (premises) and thus the majority of the existent Mexican microenterprises. Second, in the US the share of employment that microenterprises provide is a fourth of what is observed in Mexico and in the EU, about half[28]. In sum, Mexican microenterprises are relatively more numerous and smaller compared to those operating in the US and the EU.

Most microenterprises operate without premises and are informal. These two features should be considered to have an unbiased overview of their predominance. *Table 1* presents the merge between the Economic Census and the National Survey of Microenterprises (ENAMIN)[29]. It shows that self employment (one person firms) is very common and that the average size of microenterprises is 1.5 persons. This integrated overview further shows that microenterprises provide 47 percent of employment and represent 97 percent of the existent economic units in the country.

Unlike the log-normal firm distribution that is commonly observed in developed

those that can be dismantled on a daily basis). In this paper I highlight the relative importance of microenterprises by taking all of them into consideration even if they are informal or lack premises.

[28]For a detailed comparison across countries about the shares of employment and economic units please refer to the OECD reports (e.g. OECD, 2013).

[29]The expansion factor of the ENAMIN is used to obtain the total number of economic units and the population employed. The EC and ENAMIN years that were used for the merge correspond to 2009. Currently, this is the only year when both data sets were simultaneously compiled and when this merging exercise is feasible.

I thank the INEGI for the access to this data.

countries, the Mexican one exhibits a "missing middle" (Ayyagari et al., 2007; Tybout, 2000) and a "missing large" (Hsieh and Olken, 2014). In other words, there are relatively few small, middle and large sized firms. According to the stratification of the 2009 economic census the skewness and the low contribution to GDP holds across sectors. Microenterprises with premises only contribute 6.5 percent of the total production in the manufacturing sector, 37.7 percent in commerce and 25.4 percent in services. The overall contribution of these firms to the GDP is low given that these three sectors represent 98.4 percent of the economic units and 90.2 percent of employment.

The distribution's skewness also prevail in terms of international markets participation. As shown in *Appendix 1A*, when the profile of exporters in the manufacturing sector is compared across countries, it can be observed that large enterprises are always the main actors. Having few multinationals that export is certainly a common feature (Bernard et al., 2007; Dunne et al., 2009). However, in Mexico their role is stronger. As discussed above, the country has a relatively small share of large firms and thus relatively few actors in the international arena. In contrast, only 0.3 percent of the corresponding microenterprises export; they are primarily oriented to serve the internal market. Overall, developed countries generally exhibit a more inclusive interconnection between the international markets and the private sector. In other words, firms across all sizes directly harness the benefits of trade agreements and export dynamics.

Firm size categories also differ by industry composition. For instance, in the manufacturing sector, large firms tend to engage in the automotive industry and to export, while microenterprises are primarily composed of local bakeries and tortilla stores[30]. Similarly, microenterprises in the service and commerce sectors are closely intertwined with sustenance activities. Microenterprises are concentrated in industries with lower human capital intensity. Furthermore, the productivity of several of these activities has declined in the past decades[31]. Overall, the contribution that these firms make to the GDP decayed from 15 percent in 2009 to 9.8 percent in 2014. Consequently, it is worth considering the three main channels through which firms foster GDP growth: an increase in output, value added, and/or net job creation. In the first two cases, the data of the economic census shows a positive correlation between them and firm size. In the third case, microenterprises have the highest net growth rate from all categories[32]. The effect is thus mixed. In the following sections I further analyse the output behavior during the past decades.

Besides the effects that the prevailing features of the firm distribution have over

[30]According to the stratified report of the economic census by National Statistics Institute INEGI (2011), the top two activities (in relative percentage by sector) of microenterprises in terms of (i) economic units and (ii) employment are: Manufactures: bakeries and tortilla stores (29.1, 30.5), and blacksmithing (12.2, 10.1); Commerce: groceries and food retail (46.8, 42.9), accessories' retail (8.5, 7.8); Services: temporary accommodation and restaurants (28.8, 33), other services (37.5, 31).

[31]In Mexico, during the period from 1981 to 2005, productivity decreased between 2.6 and 3.1 percent a year in wholesale and retail trade, business and financial services, and restaurants and hotel services (Groningen Growth and Development Centre, 2007)

[32] According to the stratified report of INEGI (2011), the 37-months panel derived from the economic census of 2009 shows that Mexican microenterprises have a net growth of 6.3 percent in terms of economic units and 4 percent in terms of employment. The corresponding rates for medium firms are 2.4 and 2.1 percent.

the economy, the working population is also affected. Across all sectors there is a positive correlation between firm size and wages. In this paper I do not explore the immediate impact that this situation has over inequality levels. However, it should be bear in mind that people working in microenterprises are more likely to be poor, provide unpaid labor and to not receive fringe benefits. Indeed, informality is more common in microenterprises. Some studies suggest, however, that these firms contribute to the reduction of poverty and inequality precisely because they are a major source of employment (Mungaray et al., 2008). Altogether, the informal economy contributes to 24.8 percent of the GDP[33]. Even when recent interventions have decreased the costs of becoming formal, firms do not perceive their integration into the tax system as sufficiently beneficial (McKenzie and Bruhn, 2014). Consequently, the country has a relatively low tax collection rate and the contributors' base is narrow[34].

Despite liberalization, Mexican microenterprises have remained relatively overabundant and relatively small during the past two decades. Their performance is lower relative to bigger firms and this holds true regardless the sector. Moreover, their involvement in trade dynamics is negligible. Studies have found that the weak association between structural reforms and both, export and economic growth, cannot be explained with standard trade theory (Kehoe and Ruhl, 2010). Instead, this is related to a slow productivity growth (Bolio et al., 2014) and to a low domestic value added of manufacturing exports (De La Cruz et al., 2011).

4.3 Socioeconomic characteristics of microenterprises

Microenterprises are (i) important sources of employment, (ii) predominant in the economic landscape, and (iii) tend to be in the lowest tiers of the distributions of income, capital stock, and innovation activities. Understanding their characteristics is thus relevant for labor market efficiency, wealth distribution, and poverty reduction. Accordingly, in this section I explore their features and analyze how they have changed during the past two decades. I rely on the National Survey of Microenterprises (ENAMIN), which is extremely detailed and one of the best of its kind available for developing countries. Unlike the economic census, (i) it allows for a representative picture of the formal and informal sectors[35] and (ii) considers firms that lack premises. Specifically, the sampling design is three staged, probabilistic, stratified and conglomerated. This multi-layer survey stems from the national employment survey and the data can be

[33] According to INEGI, in 2013 about 75.2 percent of the GDP was produced by the formal sector. This is equivalent to 41 percent of the working population.

[34] The tax collection rate is among the lowest relative to Latin American and other OECD countries. After thirty years of continuous reforms Mexico has limited resources to replace the revenues that have recently dropped with the fall of oil prices. For instance, the budget revenue accrued from oil increased from 33.2 percent in 1995 to 35.4 percent in 2012 (CEFP, 2012). The tax collection rate has also stayed low. In 2007 it represented 20.5 percent of the GDP and the average OECD rate was 36 percent (OECD, 2009).

[35] According to INEGI´s classification, firms that belong to the informal sector rely strongly on the household´s income to operate without constituting itself as a corporation and do not follow a standard accounting system. This leads to a situation where the economic unit can be hardly audited and where its existence cannot be strictly separated from that of the household.

linked throughout stages. For instance, during the first stage, the Quarterly Survey on Employment (ENEU-ENOE[36]) collects information about individual socioeconomic characteristics and employment. In the following stages the subsample of individuals that own a microenterprise originate the ENAMIN. In that sense, there is no ex ante restriction by firm size and the consideration of these economic units is independent from their administrative behavior and location. Additionally, the periodic collection of the employment survey, which is a rotating panel, allows tracking some socioeconomic information about the owner during 15 months.

The period of the 1990s is compared with that of the 2010s by pooling together the cross-sectional surveys[37] from 1994, 1996, and 1998 on the one hand, and those of 2008, 2010, and 2012 on the other hand. The first time block corresponds to the period that followed the adherence to NAFTA and the devaluation of the Mexican Peso (MXP), while the second block corresponds to the newest available data. Comparing them allows examining the features of microenterprises during almost two decades. The data of each year is highly homogeneous relative to the surveys of the corresponding decade, and the design makes it possible to generalize the results to the population under study. However, the 1990s samples are representative for urban areas and the 2010s are representative at the national level. Also, the first time block captures firms employing up to five workers and the second one broadens its definition to up to ten workers. In the 2010s complete urban sample firms below the five-person-threshold account for 98.3 percent of the existent microenterprises at the national level. The considered sample thus represents the vast majority of the economic units in Mexico.

After considering geographic location and firm size the datasets become comparable. The final datasets thus includes microenterprises that have at most five workers and operate in cities that have been bigger than 100,000 inhabitants since the 1990s[38]. The entrepreneurs are either men or women aged at least 15 years old. It comprises 29,528 observations during the 1990s and 36,529 during the 2010s. The nominal responses correspond to 2016 MXP and are reported in USD[39]. This avoids exchange rate volatility while allowing better international comparability.

Table 2 compares relevant features of microenterprises across decades. It can be observed that they are now staying longer in the market. For instance, their average age was 7 years during the 1990s and it increased to 11 years during the 2010s. Interestingly,

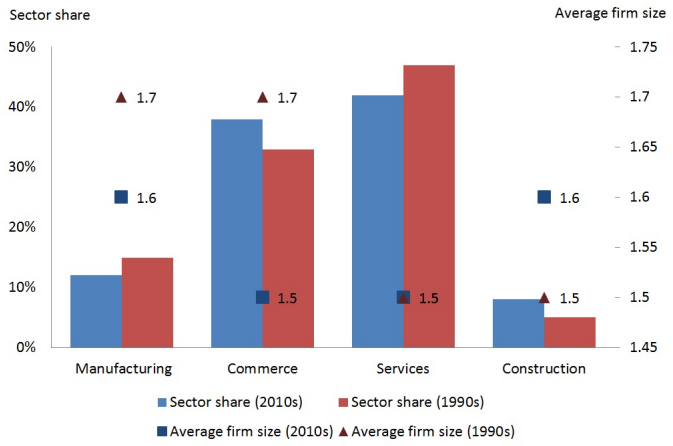
[36] In 2005 the Urban Labour Survey (ENEU) was substituted by the National Survey on Employment (ENOE) which also samples rural areas.

[37] Each year sample was also considered separately to ensure that they do behave similarly. The descriptive statistics and econometric models yielded similar results thus confirming that combining the data across years to increase the sample and compare time periods is feasible.

[38] Almost the totality of the urban areas is considered. Specifically, the cities kept in the sample are: Acapulco, Aguascalientes, Campeche, Cd. de México, Cd. Juárez, Celaya, Chihuahua, Coatzacoalcos, Colima, Cuernavaca, Culiacán, Durango, Guadalajara, Hermosillo, Irapuato, León, Manzanillo, Matamoros, Mérida, Monclova, Monterrey, Morelia, Nuevo Laredo, Oaxaca, Orizaba, Puebla, Saltillo, San Luis Potosí, Tampico, Tepic, Tijuana, Tlaxcala, Toluca, Torreón, Tuxtla Gutiérrez, Veracruz, Villahermosa, and Zacatecas.

[39] The nominal responses are first converted into 2016 MXP using the GDP deflator and are then converted into USD. The considered MXP-USD exchange rate is 18.102 which, just as the deflator, corresponds to February 2016.

Figure 4: Sector's overview across decades



the partitioning by age brackets shows that the firms older than 10 years increased their share the most. In line with this observation, workers and entrepreneurs are getting older while the latter have also gained experience. The table also shows that the average size of microenterprises shrank from 1.6 to 1.5 persons, and the number hours that they operate on average each week decreased from 66 to 60. These observations are mainly explained because the number of one person firms increased.

The use of the main input factors has not changed in qualitative terms across decades. For instance, when microenterprises hire labor this is mainly provided by family members. In fact, the share of workers with kinship ties increased by three percentage points. Interestingly, the share of workers that signed a contract decreased, but about 53 percent of them are paid. Even when the average wage expenditure decreased on average (to 227 USD), the corresponding median increased. Overall, the wage level is considerably lower relative to the USA and other OECD countries[40]. Regarding the hired capital, the average stocks increased over time. It is particularly interesting to notice that two socioeconomic transitions have occurred: (i) an increase in female participation and (ii) higher educational attainment. Specifically, women increased their participation as entrepreneurs while they still represent about half the workforce. Also both, workers and entrepreneurs, are now distributed at higher educational brackets and people without primary education represent a minority.

Figure 4 shows that the sectorial shares have had little variation during the past years. Vendors and small traders are an important feature of the economic landscape, but manufacturers and service providers are highly relevant as well. However, the trend captured by the censuses where commerce is being substituted by services and man-

[40] Wages in microenterprises are low relative to other firm sizes which sets them at a considerable disadvantage when the national level is considered for international comparison purposes. According to the Bureau of Labour Statistics (2012) the hourly compensation costs in the Mexican manufacturing sector lay at the bottom of the distribution with 6.48 USD. As comparison, Norway had the highest wages with 64.15 USD and Spain was the median country with 28.44 USD. Between 1997 and 2011 hourly wages in Mexico increased by only 15 percent.

ufactures does not hold when informal and mobile economic units are considered. In fact, the ENAMIN shows that the exact opposite may be occurring: microenterprises operating in the commerce sector increased their share the most and their average size shrank. A more detailed partitioning by industry shows that all those composing the manufacturing sector diminished their share, but the major share decrease occurred for those producing machinery and equipment. The share of services also decreased, but the firms in accommodation and food services increased by three percentage points. Contrarily, construction and commerce increased their share. In the latter case, wholesale trade is negligible and retail trade of food represents the highest share.

In sum, the current profile of the average Mexican microenterprise corresponds to a ten-year-old firm without premises that earn about 352 USD per month and that operates in the commerce sector with a capital stock equivalent to 4458 USD. The owner is a middle aged married man who is a head of household. He financed the firm with his own savings, has around 10 years of schooling and 29 years of experience. He doesn't have workers and in case of hiring someone, he would rather rely in family members to whom he would give a low wage based on a verbal agreement, for a non-specified period of time and without health insurance[41].

In what follows, I further discuss the characteristics of microenterprises and their owners to contextualize them and to better understand the changes that they underwent during the past decades. First, it should be noticed that the performance of microenterprises has not substantially changed between the 1990s and the 2010s. On the one hand, average capital stock increased from 4284 USD to 4458 USD, and the median from 617 USD to 739 USD. On the other hand, mean monthly profits decreased from 422 USD to 352 USD while the median increased from 216USD to 220 USD. The skewness of both, capital stock and profits, has decreased across decades. However, the relatively richer micro firms decreased their economic conditions while the poorest ones improved theirs. The average terms of a contract offered by a Mexican microenterprise have not changed. Overall, the contribution of microenterprises to the economy has decreased.

The level of capital stock is hughly determined by the decision of operating or not with a permanent physical establishment. The corresponding share of microenterprises that do have premises has remained at about 33 percent across decades. This share further holds across sectors; except for construction, where only about four percent of the firms have premises. The main reported reasons for lacking premises is that they are too expensive to buy it or rent. However, the share of owners stating that they do not need premises for their activity rose from 47 percent to 66 percent. Just as capital and profits, having an establishment is positively correlated with the level of education. Contrarily, education has a negative correlation with the age of the firm. Indeed, the average years that firms stay in the market decreases up to high school. However, this trend is reversed with owners that have at least an undergraduate degree[42].

[41] Across decades, about 90 percent of the firms offered verbal contracts for an undefined period of time and 15 percent of them provided health insurance. The share of firms that relied in a written contract diminished from 9 percent to 7 percent. Only 7 percent of them offer their workers a formal written contract. About 15 percent of the microenterprises offer health insurance.

[42] The firms of entrepreneurs with lower levels of education have, on average, a longer life span: less

Table 2: Comparison of microenterprises' characteristics across decades

Characteristics of Owners	**2010s**		**1990s**	
	mean	**sd**	**mean**	**sd**
Woman	0.45	0.50	0.32	0.47
Age	46	13	42	14
Head of Household	0.60	0.49	0.67	0.47
Married	0.58	0.49	0.69	0.46
Experience	29	15	27	15
Characteristics of Workers	**2010s**		**1990s**	
	mean	**sd**	**mean**	**sd**
Woman	0.46	0.46	0.45	0.46
Age	35	14	30	13
Kinship	0.68	0.44	0.65	0.45
Share of paid workers	0.53	0.48	0.47	0.48
Characteristics of Microenterprises	**2010s**		**1990s**	
	mean	**sd**	**mean**	**sd**
Financial features				
Monthly profits (USD)	352	544	422	3316
Capital stock (USD)	4,458	19,084	4,287	14,297
Wage level of paid workers (USD)	231	221	287	582
General features				
One-person microenterprises	68	0.47	65	0.48
Hours worked per week	60	52	66	51
Have a permanent physical establishment	33	0.47	33	0.47
Asked for credit to start business	7	0.26	6	0.24
Firm size by age of the microenterprise				
0-2 years	1.38	0.76	1.59	0.97
3-5 years	1.47	0.88	1.59	1.00
6-10 years	1.56	0.98	1.63	1.04
>10 years	1.63	1.05	1.58	1.01
Microenterprise distribution by education level	**Owners**		**Workers**	
	2010s	**1990s**	**2010s**	**1990s**
Less than primary school	4	30	2	20
Primary school	32	32	23	33
Secondary School	27	20	33	31
High school	16	10	21	12
At least undergraduate education	20	9	22	6
Sample size (number of firms | entrepreneurs)	36,528		29,528	
Sample size (number of workers)	18,838		20,495	

Notes: (1) The term kinship mentioned in the dot chart refers to "head of household" for owners and "family member" for workers. (2) The sample considers firms that employ up to five workers plus entrepreneurs. It is also restricted to entrepreneurs of the age between 15 to 65 years. (3) Self-employment firms are defined as those composed of either a single worker or those where only family members are employed. (4) The capital stock includes working capital and inventories. (5) The total worked hours per week accounts for the working time of the entrepreneur and both, paid and unpaid workers. (6) The tabulations of percentages may not add up to 100 due to rounding. (7) The abbreviation (m) stands for mean and (p50) for the median. (8) Nominal values are in 2016 MXP converted into USD.

Previous studies (McKenzie and Woodruff, 2006; Mittelstaedt, 2007) suggested that low human capital could be determining the low performance of Mexican microenterprises. The ENAMIN data shows that, from all socioeconomic characteristics, education is the strongest predictor of success. However, the relationship between schooling and firm performance is not straightforward. When the two time periods are compared it is observed that microenterprises' contribution to the economy has decreased despite the significant improvement of educational attainment. During the 1990s about 62 percent of the entrepreneurs had studied at most primary school. By the 2010s, the distribution of educational attainment is no longer concentrated at the lowest tier. In fact, 20 percent of the owners have at least an undergraduate degree. These observations reflect the educational transition in Mexico at large, but they also support the findings of Fajnzylber et al. (2006) about well-performing wage workers constituting likely entrants into self-employment.

As shown before, the second major transition is related with gender. During the 1990s about one third of micro entrepreneurs were women. By the 2010s this share rose to about one half. This change in the composition of labor reflects a general macroeconomic trend in Mexico. The implications for micro entrepreneurship are multifold. On the one hand, Cunningham (2000) shows that microenterprises allow women to devote time for childcare without hindering business success and suggests that programs should target types of entrepreneurs instead of gender. Indeed, the ENAMIN data shows that, across decades, men and women that entered business due to family tradition have similar characteristics in terms of age, education and experience. Furthermore, their firms are relatively similar in terms of premises' reliance, monthly profits, and capital stock.

On the other hand, being a female entrepreneur is negatively correlated with firm size, capital and profits. In fact, their most common motivation to start a business is mainly to complement family income and not entrepreneurship[43]. This contrasts with men's main motivation, which is primarily to obtain a higher income. This observation holds across decades; however, the shares have changed. During the 1990s about 62 percent of women started their businesses as income complements and this dropped to 44 percent during the 2010s. Today, their second motivation (13 percent) is to obtain a higher income. This distinction is relevant because the subsample of entrepreneurs that were driven by an income complement motivation exhibits the lowest levels of capital and earnings. Another feature of firms owned by women is that they tend to pay lower

than primary school: 13.9 years, primary school: 12.7 years, secondary school: 9.1 years, high school: 8.6 years, at least undergraduate degree: 10.3 years.

[43]Women entering self-employment to complement family income represent 44 percent while the equivalent proportion for men is only 11 percent.

wages to their workers and to rely more in family members as labor suppliers. For example, approximately 67 percent of male led firms rely exclusively in family workers and the correspondent share rises to 77 percent for females.

Recruiting workers based on kinship ties is a general feature across microenterprises. In fact, out of all employment providers, 64 percent are strictly constituted by family members, 27 percent only hire non relatives as workers, and the rest are mixed. Microenterprises are mostly family owned and family run. However, *Table 3* shows that the relationship between the share of family workers and the two main performance indicators: profits and capital is not linear. For instance, non-family firms have higher capital stock, monthly profits and average size relative to firms that strictly rely on family labor. The data also reveals that there is a negative correlation between size and the share of family labor and that, the larger the household is, the higher the number of unpaid work. However, mixed microenterprises, or those that employ people with and without kinship ties, show the highest performance. Interestingly, this firm category is also more likely to coincide with the businesses whose owner reported having started operations due to family tradition. This motivation, as analyzed before, is positively related with performance indicators.

The comparison across decades provides further insights. In relative terms, between the 1990s and 2010s, non-family microenterprises were the most affected. Their share and all their indicators decreased. Pure family firms also shrank in terms of profits and wages, but their capital stocks increased while both, their share and average size, remained constant. From all three categories, mixed firms have been the most resilient. Their level of profits is about 92 percent of what they used to be years ago and they increased their capital stock by 27 percent. Furthermore, their average wage expenditure is the highest and their exit rate the lowest[44]. These observations show evidence against studies that assume that family firms are, in general, less productive and professional (e.g. Stewart and Hitt, 2012). The non-linearity in the share of unpaid labor is compelling and it also holds with respect to premises and book keeping. For instance, 75 percent of the mixed firms have a permanent physical establishment and 74 percent of them register their accounts. From all firm categories, including one-person firms, mixed microenterprises have the highest entrepreneurial profile. Ordering firm categories by performance thus results in the following listing: (1) mixed, (2) non-family, (3) family, (4) one-person.

The study of Barcelo et al. (2011) shows that the survival rates of microenterprises that do not hire workers are lower. When one-person firms are compared with employment providers, the former are 23 percentage points more likely to be informal, about twice as likely to lack premises and two percentage points less likely to rely on credit to start their business. Historically, the average capital owned by one-person enterprises has remained at about one third of the average capital owned by larger microenterprises and the earnings at about one half. These firms are also younger and predominantly led by women[45].

[44]The estimations show that, during a period of fifteen months, one-person firms have an exit rate of 27 percent, family firms of 20.7 percent, non-family firms of 25.1 percent, and mixed firms of 19.5 percent.

[45]During the 2010s, 45 percent of women participated in the labour market as microentrepreneurs.

Table 3: Comparison of performance indicators between groups of microenterprises

	Labor composition							
	One-person firm		Family firm		Non-family firm		**Mixed firm**	
	2010s	1990s	2010s	1990s	2010s	1990s	**2010s**	**1990s**
Capital stock	2392	2165	4767	4687	9678	12571	**20566**	**16245**
Monthly profits	274	299	364	509	731	838	**911**	**991**
Wage expenditure	85	82	91	114	392	430	**687**	**1710**
Firm size	1.0	1.0	2.4	2.4	2.6	2.7	**3.9**	**4.1**
Sample share	68	65	21	21	9	10	**3**	**4**

Features highly correlated with good performance						
	Family tradition		Undergraduate studies (owner)		Start-up credit	
	2010s	1990s	2010s	1990s	2010s	1990s
Capital stock	9109	8451	9163	9495	6295	9457
Monthly profits	458	573	664	716	376	712
Wage expenditure	304	439	429	862	228	349
Firm size	1.9	1.9	1.7	1.9	1.6	2.0
Sample share	6	6	20	9	7	6

As shown before, the performance indicators have not substantially changed across decades. However, the description by labor composition gives an idea about the high degree of heterogeneity among microenterprises. *Table 3* further shows that there are four characteristics that are correlated with an outstanding performance: mixed labor composition, entrepreneurial tradition, undergraduate education, and use of credit. First, from these success predictors, being a mixed firm that hires family and non-family workers is the strongest. Second, when entrepreneurs enter the market due to family tradition their microenterprises tend to perform better regardless the gender. From all start-up motives, these owners are the best employment providers and their firms have significantly higher levels of capital stock and profits. Third, from all education levels, entrepreneurs that studied at least a bachelor degree perform better. Despite a substantial increase in the share of these firms, the marginal returns from being a professional that owns a microenterprise diminished across decades. Lastly, firms that asked for any type of credit to start their business also perform above the average. When firms that possess all these four characteristics are grouped, it can be observed that they are rare and that they do perform better than most microenterprises. For instance, their average size is five persons across decades and they currently operate with a capital stock of 2293 USD, earn 666 USD per month and have an average wage expenditure of 495 USD.

Regarding the fourth categorization variable it should be bear in mind that the interrelation between credit and performance is rather complex. In Mexico, the supply and the demand for production credit are low. On the one hand, the lending portfolio of banks is predominantly destined for consumption. On the other hand, only 1.8 percent of micro entrepreneurs asked for a productive loan in a commercial bank. In fact, only about 7 percent of GDP is assigned to loans for private businesses (Padilla-Perez and Fenton-Ontanon, 2013). In general, owners prefer other sources of start up financing and their reliance on credit remained low across decades. During the 1990s about 6 percent of the owners reported having asked for credit to start their business[46]. By the 2010s this share slightly increased to 7 percent such that the main sources of financing continue to be (i) the own savings or (ii) loans without interest provided by family members or acquaintances. Also, the main cited reasons for avoiding a loan are (i) that there is no need (66 percent) and (ii) that interests and commissions are high (17 percent). In fact, microenterprises that report access to credit as their main growth limitation dropped from 6 to 3 percent. Furthermore, when entrepreneurs have been asked for the main problems that their businesses face, they have consistently cited low sales in the first place followed by a high competition.

A detailed analysis of capital, profits and firm size by sources of finance shows that those enterprises stating not having needed complementary funding to start operations exhibit the lowest average in all three indicators. Specifically, they work with 2009 USD, earn about 291 USD per month and have an average size of 1.3 persons. The

However, this relative share is higher for one person firms (49 percent) relative to employment providers (37 percent). Married entrepreneurs have, on average, bigger firms (1.6 and 1.4 persons respectively) and are less likely to have a one-person enterprise regardless the gender (63 and 74 percent respectively).

[46]The category of firms that asked for interest credit includes those that relied in commercial banking, "caja popular", providers' credit, and private lenders.

exact opposite occurs with firms that asked for a commercial bank loan. These firms have the highest average level of capital with 9849 USD, of monthly earnings with 527 USD, and are the biggest among all with 1.8 people. This ordering by source of finance holds across decades. Overall, the data shows that businesses that relied on any source of credit to start operations are, on average, larger than those that did not. Given the need of collateral, self-selection might play a role. Indeed, according to Fajnzylber et al. (2009) credit and formality significantly increased the likelihood of firm survival because of better ex-ante and ex-post risk coping mechanisms.

Despite the existence of these relative top performers, the development of microenterprises is being slow. Their main performance indicators are, on average, sluggish thus reflecting what occurs in the economy as a whole. Furthermore, they are not graduating. When the complete ENAMIN sample of the 2010s is considered, the pronounced positive skew of the firm distribution is clearly observable[47]. Thus, at the national level, one-person firms represent 67 percent of the existent microenterprises. In contrast, those that employ five to ten workers only account for 1.5 percent. In other words, the majority of Mexican micro firms do not provide employment and when they do, they do not grow larger than five persons. This holds regardless their employment structure, sector and even when only those with premises are considered[48]. A possible explanation of this censored graduation pattern is an interaction between the nature of the working relationships and the avoidance of tax authorities. On the one hand, the strong reliance in family labor may become a natural limit if the enterprise saturates its primary source of labor supply. Indeed, microenterprises report mainly employing immediate family members[49] while the average household size in Mexico is 4.15 people. Accordingly, the slight decrease of firm size from 1.6 to 1.5 people could be related to the fact that, during the 1990s, entrepreneurs had 3.3 children and this average decreased to 2.7 children across decades.

On the other hand, the threshold may be related to operational costs and the potential penalties of being detected by the tax authority Leal-Ordonez (2014). These firms tend to be informal in terms of tax compliance and fringe benefits coverage. Indeed, most microenterprises employ unpaid labor regardless the sector, and those that happen to pay wages report not covering health insurance. This behavior supports the findings of Levy (2010) about the bundling of social security benefits as a constraint for firms' growth and an explanation to the persistence of high levels of informality. In that sense, the five-person-threshold may reflect the natural breaking point where

[47] It should be recalled that the 2010s data is representative at the national level. These statistics are thus drawn from the complete sample before dropping observations that make the time block comparable with that of the 1990s.

[48] According to the official stratified report of the economic census (2011), between 1999 and 2009 the number of firms with fixed premises that employed two to five workers (excluding the entrepreneur) more than doubled in absolute terms. The net increase of 106.3 percent contrasts remarkably with the change observed in other firm sizes. Besides the firms with six to ten workers that increased by 85.7 percent, all other firm size bins reported a positive relative growth that ranged between 15.5 percent and 57.6 percent.

[49] Firms that do have employees are composed primarily by people with immediate family ties and this holds true across decades. In the 2010s sample, the spouse represents 31 percent of the cases and children 41 percent.

the tax authority is more likely to detect firms with irregular contract schemes and tax avoidance. Lastly, the wage structure and the low entry barriers (further discussed in the next section) could be an incentive for workers to eventually start their own business instead of remaining employed in a small-scale firm.

In sum, it is true that microenterprises have remained closely related with informality and poverty since the 1990s; however, in this section I show their high heterogeneity. Previous studies (Harris and Todaro, 1970; Lewis, 1954) framed informal firms (which are mainly microenterprises) as residual units that are disconnected from the formal sector and which prevail due to a lack of employment opportunities. Some recent studies, reports, and policies still conceive them this way

(e.g. Puyana and Romero, 2012) even when the coexistence between productive and survival activities had already been exposed about two decades ago (Cunningham and Maloney, 1998; Liedholm and Mead, 1998). A dualistic view of the economy where workers employed in the informal sector queue for formal jobs is not accurate. Accordingly, in this section I further focused the attention towards the diversity of microenterprises and provided a detailed analysis about their characteristics and behavior across time.

4.4 Testing the existence of a poverty trap

The current stand after the introduction of the liberalization reforms is, on the one hand, an open economy and, on the other hand, a private sector where the majority of its economic units have had a low average performance across decades. Relatively successful microenterprises do exist, but even they tend to not graduate into bigger firm categories. Under this context, testing whether a poverty trap exists becomes relevant. Incomplete capital markets are often cited in the development literature to stress that economic constraints promote inefficiencies in production (e.g. Bigsten et al., 2003; Tybout, 1983). In 1993 Banerjee and Newman developed a dynamic model where the economy stagnates because a substantial share of the population cannot get enough resources to materialize their business ideas. According to this view, poor individuals remain poor due to an interaction between capital market imperfections and high entry costs. The main implications are: first, low entry of new firms. Second, the most talented entrepreneurs cannot obtain capital above the minimum-scale investments and production becomes inefficient. Third, the investment and saving decisions in the economy are distorted because non convexities result into low marginal returns to low levels of invested capital and poorly functioning capital markets into low marginal returns to financial savings.

Eventually, Banerjee (2001) and Banerjee and Duflo (2005) further developed this theoretical model. However, McKenzie and Woodruff (2006) empirically falsified such mechanism for the case of Mexico. Subsequent studies found similar evidence for other countries (Siba, 2015; Falco et al., 2011; Grimm et al., 2011a) and with experimental data (Fafchamps et al., 2011; De Mel et al., 2008; McKenzie and Woodruff, 2008). In this section I bring the attention back towards the Mexican case and test whether a poverty trap of this nature can indeed be discarded once a longer time span is investigated and the contextualization discussed in the previous sections is considered. Specifically, I test

whether an interaction between capital market imperfections and non convex production technologies systematically discouraged the emergence of profitable ventures during the past two decades. The methodology of McKenzie and Woodruff (2006) allows me to gain further insights about the heterogeneity of microenterprises and to have a comparison benchmark.

When the neoclassical assumption of perfect capital markets is not met, the level of marginal returns should vary upon a capital threshold. According to this view, if individuals do not have the chance to borrow their way above the minimum scale, then they have to stay in low-productivity industries. Consequently, it should be empirically observed that, below the threshold, marginal returns to capital are near to subsistence levels. Once this threshold is surpassed, marginal returns become high. This partitioned pattern occurs because capital cannot flow towards its most productive uses; therefore, marginal returns across economic activities do not equalize. Mathematically, the entrepreneur maximizes profits (π), which corresponds to the difference between sales (py) and the costs of capital and labor (rk and wl) and is subject to a borrowing constraint ($\overline{B}$). Assuming a unitary price, the optimization problem is:

$$Max.\pi = y - rk - wl$$

$$\begin{aligned} \text{s.t.} \quad & y = f(k,l) \text{ if } k > \overline{K} \\ & y = rk + wl \text{ if } k \leq \overline{K} \\ & 0 \leq y \leq f(k,l) \\ & k \leq \bar{B} \\ & l \leq \bar{L} \\ & f(0,l) = 0 \\ & f(k,0) = 0 \\ & f(0,0) = 0 \end{aligned}$$

Output y is positive only when the entrepreneur is able to raise at least $\overline{K}$ and relies in the available labor supply ($\bar{L}$). Else, input costs would exceed earnings. Therefore, the chosen capital stock is:

$$\frac{\partial f(k,l)}{\partial k} = r \quad if \quad \overline{B} > \overline{K} \tag{2}$$

Whenever it occurs that the borrowing constraint is binding ($\bar{B} \leq \bar{K}$) because the level of capital that clears the optimization conditions exceeds the initial endowment and/or the borrowable capital, it should be observed that marginal returns to an additional unit of capital lie within $k^* \epsilon \left[0, \bar{K}\right]$. Entrepreneurs maximize at this range ($\frac{\partial f(k,l)}{\partial k} = 0$) because they are indifferent across all levels of investment that lead to zero profits: $\pi(k,l) = 0$. As a result, marginal returns to capital are positive only after the emerging threshold has been surpassed. These high marginal returns fall to zero until

the optimal level of capital (k^*) is reached. Two questions (and the corresponding null and alternative hypotheses) are derived to empirically test whether this mechanism is true. Specifically:

(i) Are marginal returns to capital low at low levels of investment?
(ii) Are minimum start-up costs high relative to wealth?

4.4.1 Marginal returns to capital

Marginal returns to capital are estimated for each time spell based on the corresponding pooled cross-sectional data. Profits of microenterprise i (π_i) are modeled as a function of the production factors capital (K_i) and labor (L_i), a vector of exogenous variables (Z_i) and unobserved factors at the individual level (θ_i). An example of the latter term is entrepreneurial ability, which determines profits and capital stock simultaneously:

$$\pi_i = f\left[K_i\left(\theta_i\right),\ L_i,\ \theta_i\right] \tag{3}$$

The earnings function is modeled with a log-linear transformation where α_i corresponds to the intercept and ε_i to the error term:

$$ln\pi_i\left(K_i, L_i\right) = \alpha_i + \beta_K lnK_i + L_i^{'}\beta_L + Z_i^{'}\beta_Z + \theta_i^{'}\beta_\theta + \varepsilon_i \tag{4}$$

Profits, capital and labor are introduced in log terms. The dependent variable π_i is measured by the average monthly profits that the entrepreneur reports to earn. For the case of capital stock, the replacement cost of the owned working equipment and premises plus inventories are considered. The vector of labor includes the weekly hours that the entrepreneur and both, paid and unpaid workers, normally destine to operating the microenterprise. The vector Z_i captures firm and entrepreneur's characteristics that may affect earnings such as: age, gender and marital status of the entrepreneur, plus age of the firm. The square terms of both age variables are considered to explore the rate of the corresponding effects. Also, five schooling categories are used, where education lower than primary school serves as a reference. The vector also includes the log of the average wage at a given year, industry and state to capture the opportunity costs of (i) belonging to the wage sector and (ii) making profitable investments given short term shocks that vary across locations. Lastly, dummy variables seize year and industry effects. For a more detailed description of the control variables, please refer to the *Appendix 1A*.

The correlation between capital investment and the unobserved ability of the entrepreneur may lead to the under- or overestimation of marginal returns to capital. For instance, ability may lead to an upward bias of the estimate $\hat{\beta_K}$ because (i) entrepreneurs with better skills might generate more capital and profits or (ii) because reversed causality between capital and profits may prevail. On the contrary, a downward bias can also emerge because (i) under capital market imperfections, very high ability individuals would be more willing to start a business, even at very low levels of

capital, relative to lower ability individuals and (ii) due to the classical measurement error for profits and capital. To address concerns related with ability, the model specification takes first into consideration schooling and age; and second, introduces two ability proxies.

The vector θ_i measures the ability of the i th individual first, with a dummy for book keeping because higher ability individuals are more likely to develop an accounting system that provides them with an objective overview of their firm's performance. Second, four dummies capture the motivation of the entrepreneur to start the business: (i) complementing family income and having more flexible hours, (ii) family tradition or obtaining a higher income, (iii) not finding a job or being laid off, and (iv) another motivation. Where the first category serves as reference. The intuition behind is that more capable individuals will be eager to enter self-employment and more likely to put a profitable idea into action.

It should be noted that *Equation 4* assumes that the unobserved ability can be modeled in an additive manner. The inclusion of ability measures leads to unbiased estimations provided that they are uncorrelated with optimal capital stock; thus implying that ability increases profits without increasing marginal returns. The cross-sectional nature of the data makes it difficult to deal with ability biases and the considered proxies are imperfect. However, they are available for the whole sample and are good predictors of firm performance. In that sense, a third mechanism to further consider bias concerns is introduced. Specifically, the sample is partitioned into different levels of capital and three subsamples are considered: (i) very low levels of capital, which comprises firms that operate with an equivalent of up to 250 USD in capital stock, (ii) low capital, ranging between 250 and 1250 USD, and (iii) intermediate levels of capital, ranging between 1250 and 6200 USD. These thresholds were chosen based on two criteria. First, the sample distribution is considered to derive subsamples with a similar number of observations. Second, to generate subsets that are roughly comparable with those chosen byMcKenzie and Woodruff (2006) once they are adjusted by base year and exchange rate.

The log-log model and marginal returns are estimated separately for the complete sample and for each partitioning by levels of capital. To reduce boundary effects in the parametric estimations, about 20 percent of the subsequent observations are added to each capital partitioning. The marginal returns are next estimated over the relevant capital ranges thus diminishing results' sensitivity. The regression analysis disregards influential outliers from each subsample by ascertaining them with the DFITS-statistic. In that sense, the cut-off threshold is $|DFITS|_i = 2\sqrt{\frac{k}{N}}$ where k stands for the degrees of freedom plus one and N for the number of observations (Belsley et al., 1980).

The regression results are shown in *Table 4*. As expected, both input factors (capital and labor) have a positive economic effect over earnings. At very low levels of capital the labor elasticity is higher than the elasticity of capital, thus suggesting that profits are mostly determined by the number of hours that the entrepreneur destines to his/her business. The gap between factor elasticities narrows as capital stocks increase such that, at intermediate levels of capital, the effect reverses and profits are mostly determined by capital. These observations hold across decades. When the elasticities of the

three sources of labor are compared, it can be observed that those from the owner's working hours are the highest, followed by paid workers and then by unpaid workers. It is noticeable that the contribution that unpaid workers make to profits is substantially lower relative to paid workers and to the owner's labor. Furthermore, it decreases as capital stocks increase. Across decades, microenterprises became less dependent on the owner's labor and increased their reliance on capital to generate profits. Regarding paid labor, its elasticity increased across all capital levels and over time.

The sign of the control variables is also aligned with expectations and is consistent across decades. For instance, both, age of the entrepreneur and of the firm, support the existence of a learning effect that is positive at a decreasing rate. When very low capital businesses are compared across decades, it can be observed that it still takes them about 55 years of operation to reach their maximum contribution to profits. The turning point being so high regardless the level of capital stock suggests that firms do increase their earning the longer they stay in the market. This coincides with the observation of firms staying, on average, three years longer in business than what they used to during the 1990s. Regarding other socioeconomic characteristics, there is a negative and significant gender effect over profits which decreases as capital levels increase and over time. Nonetheless, *ceteris paribus*, the sole fact of being a woman translates into 36 to 43 percent lower profits relative to entrepreneurs that are men.

Education has positive and nonlinear effect over profits. Having an undergraduate degree is highly significant in statistical and economic terms. However, the positive influence of education has decreased across decades regardless the capital level and schooling category. This suggests that, despite the increase in educational attainment that the economy has experienced, the accumulation of human capital is generating lower marginal returns in terms of earnings. Even highly educated individuals are finding increasing difficulties in making their business prosper. With respect to marriage, the positive effect is only significant at intermediate levels of capital.

The opportunity cost captured by the hourly average wage in the industry and state is positive and it has increased across decades regardless the level of capital. Regarding the variables used as ability proxies, the signs and significance levels coincide with expectations. Specifically, the effects of (i) following a book keeping method and (ii) having entered the business due to family tradition or to increase income are positive, highly significant and large in economic terms. The fact that the remaining motivation categories have a positive effect with respect to "complementing family income and having more flexible hours" shows that the latter survivalist approach to entrepreneurship poses an important limitation for the development of the firm. In other words, seeing the microenterprise as a milking source rather than as a growth opportunity, strays entrepreneurial possibilities. Despite the imperfection of the discussed dummies as ability proxies, their association with higher earnings does support the idea that they provide some measure of ability.

In what follows, I estimate the marginal returns to capital and analyse their behaviour to answer the empirical question: "(i) Are marginal returns to capital low at low levels of investment? " It should be bear in mind that logging the dependent and control variables implies assuming a constant capital elasticity of profits. Also, the marginal returns are the product of the output elasticity of capital $\left(\hat{\beta_K}\right)$ and capital profitability $\left(\frac{\pi_i}{K_i}\right)$:

$$\frac{\delta(ln\pi)}{\delta K} = \frac{\delta(\alpha_K lnK)}{\delta \alpha_K} \tag{5}$$

Table 4: Parametric estimations of marginal returns to capital

	All levels of capital		*Very low*		*Low*		*Intermediate*	
	R_+		*(0,250]*		*(250,1250]*		*(1250,6200]*	
Control variable	**log monthly profits**		**log monthly profits**		**log monthly profits**		**log monthly profits**	
	2010s	**1990s**	**2010s**	**1990s**	**2010s**	**1990s**	**2010s**	**1990s**
	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)
Log of capital	0.163***	0.122***	0.143***	0.091***	0.188***	0.143***	0.161***	0.183***
	(0.004)	(0.004)	(0.011)	(0.004)	(0.010)	(0.006)	(0.008)	(0.007)
Log of entrepreneur's s total labor hours	0.138***	0.345***	0.176***	0.410***	0.097***	0.281***	0.061**	0.155***
	(0.011)	(0.015)	(0.010)	(0.016)	(0.011)	(0.016)	(0.012)	(0.011)
Log of paid workers' total labor hours	0.036***	0.036***	0.033***	0.024***	0.035***	0.037***	0.040***	0.039***
	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Log of unpaid workers' total labor hours	0.007***	0.006***	0.017***	0.012***	0.006*	0.011**	-0.002	0.001
	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)
Age of entrepreneur	0.017***	0.015***	0.009***	0.015***	0.017***	0.017***	0.022***	0.010*
	(0.001)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.004)	(0.004)
Age squared of entrepreneur	-2.67e-4***	-2.53e-4***	-1.96e-4***	-2.70e-4***	-2.44e-4***	-2.75e-4***	-3.03e-4***	-1.76e-4**
	(1.77e-5)	(1.56e-5)	(2.42e-5)	(1.93e-5)	(2.73e-5)	(2.04e-5)	(4.10e-5)	(4.06e-5)
Female entrepreneur	-0.447***	-0.397***	-0.514***	-0.429***	-0.363***	-0.378***	-0.359***	-0.287***
	(0.023)	(0.018)	(0.023)	(0.020)	(0.016)	(0.018)	(0.027)	(0.030)
Married	0.003	0.038	-0.010	0.016	-0.010	0.043*	0.027*	0.103***
	(0.009)	(0.018)	(0.012)	(0.020)	(0.015)	(0.018)	(0.011)	(0.016)
Primary school (entrepreneur)	-0.017	0.063***	-0.038	0.037**	0.058	0.063**	0.051	0.126**
	(0.027)	(0.010)	(0.026)	(0.008)	(0.041)	(0.017)	(0.059)	(0.028)
Secondary school (entrepreneur)	0.046	0.118***	0.003	0.075**	0.121*	0.115***	0.144*	0.216***
	(0.021)	(0.016)	(0.038)	(0.018)	(0.048)	(0.018)	(0.054)	(0.032)
High school (entrepreneur)	0.094*	0.247***	0.066	0.180**	0.159*	0.216***	0.190**	0.328***
	(0.028)	(0.023)	(0.045)	(0.034)	(0.050)	(0.036)	(0.050)	(0.024)
At least undergraduate studies (entrepreneur)	0.260***	0.492***	0.187**	0.415***	0.327***	0.418***	0.370***	0.520***
	(0.030)	(0.032)	(0.041)	(0.034)	(0.058)	(0.030)	(0.055)	(0.029)

Table 5: .... *Continuation*

	All levels of capital		*Very low*		*Low*		*Intermediate*	
	R_+		*(0,250]*		*(250,1250]*		*(1250,6200]*	
Control variable	**log monthly profits**		**log monthly profits**		**log monthly profits**		**log monthly profits**	
	2010s	**1990s**	**2010s**	**1990s**	**2010s**	**1990s**	**2010s**	**1990s**
	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)
Age of firm	0.015***	0.015***	0.016***	0.015***	0.011***	0.013**	0.016***	0.015**
	(0.002)	(0.003)	(0.003)	(0.003)	(0.001)	(0.004)	(0.003)	(0.003)
Age of firm squared	-2.72e-4***	-2.74e-4**	-2.56e-4**	-2.52e-4**	-1.74e-4***	-2.17e-4	-2.76e-4**	-2.87e-4**
	(4.49e-5)	(6.50e-5)	(7.23e-5)	(6.94e-05)	(3.10e-5)	(9.83e-5)	(6.43e-5)	(6.83e-5)
Log of average hourly wage in the industry and state	0.308***	0.252**	0.302***	0.286**	0.303***	0.245*	0.310***	0.236*
	(0.045)	(0.071)	(0.050)	(0.062)	(0.047)	(0.082)	(0.031)	(0.083)
Entered business due to family tradition or to increase income	0.162***	0.232***	0.134**	0.223***	0.185***	0.235***	0.160***	0.237***
	(0.021)	(0.012)	(0.034)	(0.024)	(0.028)	(0.020)	(0.021)	(0.026)
Entered business because could not find a job or was laid off	0.066**	0.005	0.054*	0.001	0.084	0.003	0.047	0.032
	(0.018)	(0.021)	(0.022)	(0.021)	(0.041)	(0.033)	(0.034)	(0.045)
Entered business due to another reason	0.117***	0.091**	0.079**	0.076*	0.125***	0.091*	0.120***	0.113**
	(0.015)	(0.024)	(0.021)	(0.030)	(0.022)	(0.027)	(0.016)	(0.026)
Book keeping	0.167***	0.130**	0.226***	0.141**	0.150***	0.135**	0.117***	0.087
	(0.014)	(0.031)	(0.019)	(0.028)	(0.014)	(0.030)	(0.017)	(0.044)
Intercept	3.058***	2.371***	3.300***	2.188***	2.929***	2.481***	3.152***	2.637***
	(0.0907)	(0.230)	(0.107)	(0.193)	(0.141)	(0.321)	(0.134)	(0.245)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	13,787	16,860	6,939	9,244	6,963	7,315	5,584	6,828
Robust R-squared	0.534	0.585	0.452	0.536	0.358	0.424	0.378	0.399

*** p<0.001, ** p<0.01, * p<0.05

Note: (1) Estimations of the double-log model are parametric. (2) For estimation purposes, only positive capital and profits are considered and influential outliers are ascertained with the DFITS-statistic. (3) The grouping of firms by level of capital classifies them into very low (0, 250], low (250, 1250], and intermediate (1250, 6200]. At each range of capital an additional 20 percent of the observations are considered to diminish boundary effects. (4) Robust standard errors are corrected for clustering. (5) Nominal values are reported in 2016 MXP converted into USD. (6) Reference categories are: sector (manufactures), motivation (complementing family income and having more flexible hours), education (less than primary school), men, years (1994 and 2008).

Table 6: Mean monthly marginal returns by levels of capital (percent)

Sector	Very low (0,250]		Low (250,1250]		Intermediate (1250,6200]	
	1990s	2010s	1990s	2010s	1990s	2010s
Manufactures	44	62	6	10	3	2
Commerce	62	45	7	9	3	3
Services	48	56	7	9	3	3
Construction	49	55	6	8	4	4
All sectors (m)	57	59	8	10	3	3
All sectors (p50)	18	24	5	8	2	2

Note: The reported values by sector correspond to the mean.

$$\frac{\delta\pi}{\pi} = \alpha_K \frac{\delta K}{K} \tag{6}$$

$$MRK = \frac{\delta\pi}{\delta K} = \alpha_K \frac{\pi}{K} \tag{7}$$

The marginal returns are computed at the average profitability ($\frac{\bar{\pi}}{K}$) because the estimated elasticity is an average effect; however, the medians are also reported to show skewness and heterogeneity. In *Table 6* a detailed and stratified summary of the monthly marginal returns to capital across decades is reported. It shows that the marginal returns are almost 60 percent at very low capital levels[50]. The very high marginal returns hold true across decades. It can also be observed that marginal returns to capital follow a decreasing pattern over capital until they reach an average of about three percent, which roughly corresponds to the market interest rate. It is also noticeable that there is a wider gap between mean and median marginal returns the lower capital is, thus evidencing higher heterogeneity across these microenterprises.

To check whether sector aggregation yields to different patterns of capital marginal returns, I run the econometric analysis for each sector as an independent subsample. The reported marginal returns are thus estimated with the $\hat{\beta_K}$ that captures specific sectorial effects. The overall decreasing pattern of MRK is in line with the findings of previous studies. Specifically, across all years and sectors, marginal returns are not initially low as the described model of poverty trap would predict. There is no censored pattern for marginal returns and no capital threshold is observable. It is not true that firms with low levels of capital only have access to low-productivity industries. In fact, poorly capitalized firms are highly profitable.

[50]The study of (Grimm et al., 2011a; McKenzie and Woodruff, 2006) reported an approximate of 15 percent for monthly average marginal returns in the Mexican case. However, their sample excludes women and they report median marginal returns. The capital ranges are roughly comparable, but the partitioning is still different and more detailed in this case. Also, the log-log model facilitates the interpretation of the capital coefficient as elasticity.

A direct comparison of marginal returns across sectors might be inaccurate given their differences in capital intensity. However, the intertemporal comparison is relevant. First, it should be noticed that marginal returns at very low and low capital levels have increased in the past decades while those at intermediate levels remained unchanged. The marginal returns in commerce, which is the sector that increased its share the most during the past years, exhibits a decrease in marginal returns at very low levels of capital. In other words, vendors became more numerous and the profitability of their businesses decreased. All other sectors increased their marginal returns in the same capital range.

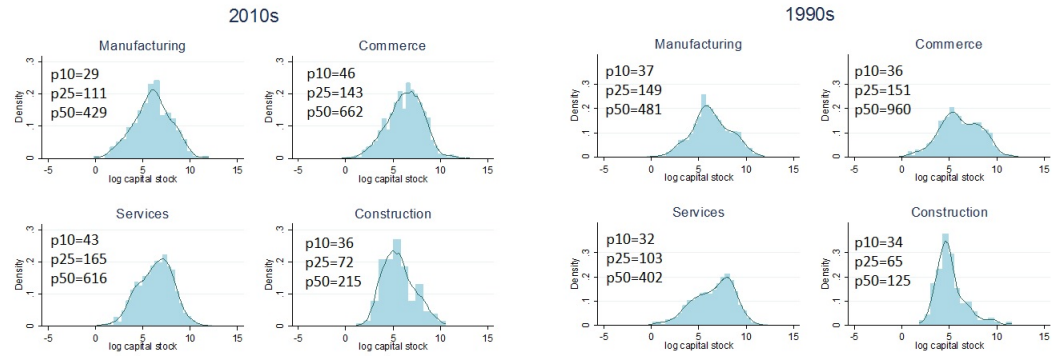
When the marginal returns are scrutinized based on diverse characteristics of the owner and the firm, the heterogeneity of microenterprises is apparent once again. With respect to socioeconomic characteristics, it can be observed that marginal returns are positively correlated with the owner's education. Also, the marginal returns' gap of firms owned by male and women decreased from nine to four percentage points. Regarding the relationship between labor and marginal returns to capital, it is interesting to notice that marginal returns are negatively correlated with the size of the firm. However, the difference between the marginal returns of one person firms and those that provide employment narrowed across decades. Lastly, marginal returns from firms without premises are substantially higher than those with premises at very low levels of capital. Such discrepancy decreases as capital stock increases and, at intermediate levels of capital, the average marginal returns are at similar levels regardless the ownership of an establishment.

In *Appendix 1B* I include robustness checks and the corresponding estimations of marginal returns to capital. In both cases, the decreasing pattern of marginal returns over capital stock levels holds. Specifically, model one (RC1) excludes all ability measures. The results show that the introduced proxies make a downwards correction to the unobservable ability bias. The second model (RC2) replaces the profits measure by the difference between benefits and costs. The pattern holds, but self-reported profits provide a more accurate measure (De Mel et al., 2009).

4.4.2 Initial investment

In this section I address the second testable hypothesis: Are minimum start-up costs high relative to wealth? To account for initial investment I only consider those microenterprises aged at most two years. This corresponds to a subsample with 11533 observations during the 1990s and to 9128 during the 2010s. The histograms of *Figure 5* shows that there are no substantial ridges that could support the existence of a threshold. Furthermore, the slight ones vanished across time. In general, initial capital requirements may be quite low regardless the year and sector. Microenterprises at the lowest decile enter the market with less than 50 USD. Capital requirements remain low up to the median in the case of manufacturing, commerce and services. After the 50th percentile they all increase their levels of capital in a relatively similar way. Except for the case of manufactures, when initial investment levels are compared across decades, it can be observed that firms operating in the lowest half of the distribution have increased it. Meanwhile, relatively richer microenterprises have decreased their start-up

Figure 5: Distribution of Start-up capital and other entry costs



All sectors 2010s (percentage)

(i) No wage expenditure:	87
(ii) No formal premises:	71
(iii) No inventories:	51
(iv) No government registration:	83
(v) No trade association:	99

All sectors 1990s (percentage)

(i) No wage expenditure:	85
(ii) No formal premises:	67
(iii) No inventories:	59
(iv) No government registration:	82
(v) No trade association:	94

Note. (1) Start-up capital is proxied with capital stock owned by recent entrants that started operating two years ago or less. (2). The reported percentiles (p10, p25, p50) represent initial capital stock in absolute terms expressed in 2016 USD. (3) (a) Percentage of firms that: (a.1) do not employ paid workers, (a.2) do not have permanent physical establishment, (a.3) do not have inventories in stock, (a.4) are not registered at the Municipality, nor at the Ministry of Health, nor at the Ministry of Economy. (a5) Are not registered at any kind of trade association, including associations of tenants and small traders, carriers and taxi drivers, chambers of commerce or industry, and professional associations.

capital; especially those operating in the upper 90th percentile. In that sense, the poorest firms are relatively improving their performance. By contrast, initial investment in the manufacturing sector has decreased along the whole distribution.

Commerce exhibits the highest initial capital requirements and construction the lowest. The latter sector is particularly interesting because initial investment remains low for a higher share of firms. This situation is intelligible because construction firms rarely have premises or inventories. For example, masons tend to secure short term contracts and the constructor provides the building material. Despite representing the lowest share of economic activity, construction offers the less expensive conditions to start a business since capital may be primarily financed from profits while additional fixed costs are the lowest among all sectors.

It is relevant to analyze entry costs in relative terms by taking into consideration firm profits. During the 1990s, if an entrepreneur with average profits had monthly saved ten percent, it would have taken him/her about seven months to accumulate the equivalent to start a business as a firm in the 25th percentile of capital. During the 2010s the required saving time increased to ten months. If an entrepreneur at the lowest decile of profits did the same, the number of months increased from 31 to 37. Overall, start-up costs became relatively more expensive. However, opening businesses and reinvesting in them remains feasible. Across decades, new entrants increased their reliance in credit from six to nine percent. Nonetheless, most microenterprises keep

relying on their own means to start operations. From a sectorial perspective, only two percent of firms in construction rely on credit, which is consistent with the fact that this is the cheapest sector to start operations. By contrast, the share increases to seven percent in manufactures and services, and to eleven percent in commerce.

Besides initial capital investment, there are other fixed costs that may arise when starting a business. The above table also shows that most firms tend to skip them and thus do not represent a major obstacle for them to enter the market. From all sectors, construction has the lowest *de facto* additional entry costs and services the highest ones. In general, the high share of non-compliance with regulations, either complementary affiliations or wage expenditure shows the informal modality under which microenterprises tend to operate. In fact, the share of informal entrants increased over time and formalization does not substantially increase with firms' age. It is also observed that, on average, more young microenterprises are choosing not to pay wages. This is especially true for the case of commerce. Regarding other start-up costs, most firms report not having premises nor inventories, as well as not being registered in government or trade associations. From all these additional costs, the latter is the one that most firms tend to skip. Conversely, having inventories is more common, but it varies by sector.

4.5 Conclusion

Growth has been modest in Mexico despite liberalization and more than two decades of continuous reforms. The performance of the economy can be better understood at the microeconomic level. For instance, microenterprises represent the largest share of the private sector and their performance indicators have not substantially changed across decades.

On the one hand, microenterprises have undergone important socioeconomic transitions such as an increase in schooling levels of its workforce and the share of female entrepreneurs. On the other hand, their average profits decreased across decades. Therefore, it is reasonable to hypothesize the existence of a poverty trap. Capital market imperfections are often cited as a major impediment for the development of these firms and thus of the economy as a whole. However, this study shows that an interaction between capital market imperfections and high entry costs did not systematically discouraged the emergence of profitable ventures between the 1990s and the 2010s. Although limited access to credit is a prevailing constraint, it is not the main impediment of firm graduation in Mexico.

This chapter also finds that the decreasing pattern of marginal returns along capital holds across decades. This shows constrained productivity and a misallocation of capital in the economy. It is puzzling that, despite the high marginal returns, microenterprises are not substantially improving their profits neither growing (size). Moll (2014) shows that the self-financing strategy reverts inefficiencies only when idiosyncratic productivity shocks are relatively persistent. In other words, high productivity episodes should be sufficiently prolonged as to accumulate enough funds to capitalize the desired investments. In Mexico, high marginal returns at very low levels of capital have prevailed across decades and the poorest microenterprises seem to be improving

their conditions. However, those with relatively higher capital levels are decreasing their share and performance indicators.

Overall, the censored pattern of graduation and the high heterogeneity of microenterprises may reflect inefficiencies at the macroeconomic level; for example, economic, institutional or social constraints (Grimm et al., 2011b). The prevailing policies and market conditions may be discouraging the emergence of medium sized firms and their graduation (Tybout, 2014). Lastly, policy makers should take into consideration that microenterprises are highly heterogeneous. Firms with growth potential do exist and it is relevant to promote conditions that enable them becoming agents of growth (Li and Rama, 2015).

4.6 References

Meghana Ayyagari, Thorsten Beck, and Asli Demirguc-Kunt. Small and medium enterprises across the globe. *Small Business Economics*, 29(4):415–434, 2007.

Abhijit V. Banerjee. Contracting constraints, credit markets and economic development. In *Advances in Economics and Econometrics: Theory and Applications*, volume III. Cambridge University Press, 2001.

Abhijit V. Banerjee and Esther Duflo. Growth theory through the lens of development economics. *Handbook of Economic Growth*, pages 473–552, 2005.

Abhijit V. Banerjee and Andrew F. Newman. Occupational choice and the process of development. *Journal of Political Economy*, pages 274–298, 1993.

World Bank. World bank open data, 2015. URL `http://data.worldbank.org`.

Jose G. Aguilar Barcelo, Natanael Ramirez Angulo, and Carlos Hernandez Campos. Microenterprise market entry and its relationship with the life expectancy of informal microenterprises in mexico. *Revista Internacional Administracion y Finanzas*, 4(4): 1–14, June 2011. ISSN 1933608X.

David A. Belsley, Edwin Kuh, and Roy E. Welsch. *Regression Diagnostics*. John Wiley and Sons, New York, 1980.

Andrew B. Bernard, J. Bradford Jensen, Stephen J. Redding, and Peter K. Schott. Firms in international trade. *Journal of Economic Perspectives*, 21(3):105–130, 2007.

Arne Bigsten, Paul Collier, Stefan Dercon, Marcel Fafchamps, Bernard Gauthier, Jan Willem Gunning, Abena Oduro, Remco Oostendorp, Cathy Patillo, Soderbom, et al. Credit constraints in manufacturing enterprises in africa. *Journal of African Economies*, 12(1):104–125, 2003.

BLS. International comparisons of hourly compensation costs in manufacturing, 2011. Technical Report USDL-12-2460, Bureau of Labor Statistics. U.S. Department of Labor., 2012. URL `www.bls.gov/ilc`.

Eduardo Bolio, Jaana Remes, Tomas Lajous, James Manyika, Morten Rosse, and Eugenia Ramirez. A tale of two mexicos: Growth and prosperity in a two-speed economy. Technical report, McKinsey Global Institute, 2014.

CEFP. Dependencia petrolera de las finanzas publicas de mexico. Technical Report notacefp / 046 / 2012, Centro de Estudios de las Finanzas Publicas. LXI Legislatura. Camara de Diputados., July 2012.

Wendy Cunningham. Mexican female small firm ownership: Motivations, returns, and gender. *The World Bank*, 2000.

Wendy Cunningham and William F. Maloney. Heterogeneity among mexico s microenterprises: an application of factor and cluster analysis. *World Bank Publications*, (1999), 1998.

Justino De La Cruz, Robert B. Koopman, Zhi Wang, and Shang-Jin Wei. Estimating foreign value-added in mexico s manufacturing exports. *US International Trade Commission Working Paper*, (2011-04A), 2011.

Suresh De Mel, David McKenzie, and Christopher Woodruff. Returns to capital in microenterprises: Evidence from a field experiment. *The Quarterly Journal of Economics*, 123(4):1329–1372, 2008.

Suresh De Mel, David J. McKenzie, and Christopher Woodruff. Measuring microenterprise profits: Must we ask how the sausage is made? *Journal of Development Economics*, 88(1):19–31, 2009.

Timothy Dunne, J. Bradford Jensen, and Mark J. Roberts. Producer dynamics: New evidence from micro data. *University of Chicago Press*, 2009.

ECLAC. Data and statistics - sigci plus, 2015. URL `www.eclac.cl`.

Marcel Fafchamps, David McKenzie, Simon Quinn, and Christopher Woodruff. When is capital enough to get female enterprises growing ? evidence from a randomized experiment in ghana. *World Bank Policy Research Working Paper Series*, pages 1–44, 2011.

Pablo Fajnzylber, William Maloney, and Gabriel Monies Rojas. Microenterprise dynamics in developing countries: How similar are they to those in the industrialized world? evidence from mexico. *The World Bank Economic Review*, 20(3):389–419, January 2006. ISSN 0258-6770.

Pablo Fajnzylber, William F. Maloney, and Gabriel V. Montes-Rojas. Releasing constraints to growth or pushing on a string? policies and performance of mexican micro-firms. *The Journal of Development Studies*, 45(7):1027–1047, 2009.

Paolo Falco, Andrew Kerr, Neil Rankin, Justin Sandefur, and Francis Teal. The returns to formality and informality in urban africa. *Labour Economics*, 18:S23–S31, 2011.

Michael Grimm, Jens Krueger, and Jann Lay. Barriers to entry and returns to capital in informal activities: Evidence from sub-saharan africa. *Review of Income and Wealth*, 57(s1):s27–s53, 2011a.

Michael Grimm, Rolph Van der Hoeven, and Jann Lay. Unlocking potential: Tackling economic, institutional and social constraints of informal entrepreneurship in subsaharan africa. main findings and policy conclusions. *World Bank Policy Research Working Paper Series*, 2011b.

Groningen Growth and Development Centre. Ggdc 10- sector database, 2007. URL `www.rug.nl`.

John R. Harris and Michael P. Todaro. Migration, unemployment and development: A two-sector analysis. *The American Economic Review*, pages 126–142, 1970.

Chang-Tai Hsieh and Benjamin A. Olken. The missing "missing middle". *Journal of Economic Perspectives*, 28(3):89–108, 2014. doi: http://dx.doi.org/10.1257/jep.28.3.89.

INEGI. Micro, pequena, mediana y gran empresa. estratificacion de los establecimientos. censos economicos 2009. Technical report, Instituto Nacional de Estadistica y Geografia, 2011.

Timothy J. Kehoe and Kim J. Ruhl. Why have economic reforms in mexico not generated growth? *Journal of Economic Literature*, 48(4):1005–1027, 2010.

Julio Cesar Leal-Ordonez. Tax collection, the informal sector, and productivity. *Review of Economic Dynamics*, 17(2):262–286, 2014.

Santiago Levy. *Good Intentions, Bad Outcomes: Social Policy, Informality, and Economic Growth in Mexico*. Brookings Institution Press, 2010.

W. Arthur Lewis. Economic development with unlimited supplies of labour. *The Manchester School*, 22(2):139–191, 1954.

Yue Li and Martin Rama. Firm dynamics, productivity growth and job creation in developing countries: The role of micro-and small enterprises. *The World Bank Research Observer*, 30(1):3–38, 2015.

Carl Liedholm and Donald C. Mead. The dynamics of micro and small enterprises in developing countries. *World Development*, 26(1):61–74, 1998.

David McKenzie and Miriam Bruhn. Entry regulation and the formalization of microenterprises in developing countries. *Oxford University Press*, 29:186–201, 2014. doi: 10.1093/wbro/lku002.

David McKenzie and Christopher Woodruff. Experimental evidence on returns to capital and access to finance in mexico. *The World Bank Economic Review*, 22(3): 457–482, 2008.

David J. McKenzie and Christopher Woodruff. Do entry costs provide an empirical basis for poverty traps? evidence from mexican microenterprises. *Economic Development and Cultural Change*, 55(1):3–42, 2006.

Axel Mittelstaedt. *SMEs in Mexico: Issues and Policies*. OECD Publishing, Massachusetts, USA, 2007.

Benjamin Moll. Productivity losses from financial frictions: Can self-financing undo capital misallocation? *The American Economic Review*, 104(10):3186–3221, 2014.

Alejandro Mungaray, M. Ramirez, Michelle Texis, David Ledezma, and Natanael Ramirez. Learning economics by servicing: a mexican experience of service learning in microenterprises. *International Review of Economics Education*, 7(2):19–38, 2008.

OECD. Oecd review of budgeting in mexico. OECD Journal on Budgeting Suppl. 1, Organisation for Economic Cooperation and Development, Paris, 2009.

OECD. Entrepreneurship at a glance 2013. Technical report, OECD Publishing, Paris, 2013.

Ramon Padilla-Perez and Rodrigo Fenton-Ontanon. Commercial bank financing for micro-enterprises and smes in mexico. *ECLAC Review*, page 15, 2013.

Alicia Puyana and Jose Romero. Informalidad y dualismo en la economia mexicana. *Estudios Demograficos y Urbanos*, 27(2 (80)):449–489, 2012. ISSN 0186-7210.

Eyerusalem Siba. Returns to physical capital in ethiopia: Comparative analysis of formal and informal firms. *World Development*, 68:215–229, 2015.

Alex Stewart and Michael A. Hitt. Why can t a family business be more like a nonfamily business? modes of professionalization in family firms. *Family Business Review*, 25 (1):58–86, 2012.

James R. Tybout. Credit rationing and investment behavior in a developing country. *Review of Economics and Statistics*, 65:598–607, 1983.

James R. Tybout. Manufacturing firms in developing countries: How well do they do, and why? *Journal of Economic literature*, pages 11–44, 2000.

James R. Tybout. Correspondence. about the missing missing middle, 2014.

5 *Chapter 2.* Constrained Potential: A Characterization of Mexican Microenterprises

Ana K. Negrete-García

"The national competitiveness policy may be conceived as a strategy to integrate into international markets, formalize the economy and generate productive employment. (...) There are various interdependent factors that determine the success of entrepreneurial ventures. For example, level of schooling, capital stock, social networks, culture, family support, income, experience, skills and abilities. Therefore, a public policy will prove itself effective and fruitful to the extent that it manages to provide an array of differentiated frameworks that foster the productivity of each one of the diverse groups of entrepreneurs that exists, while enabling the achievement of specific projects. This is only possible when the identified regional and national development goals are aligned with the international economic context. Furthermore, there are two social groups that should be identified: first, entrepreneurs with the most potential to contribute to the corresponding development goals; second, those entrepreneurs that are in need of support in order to be able to participate in the process."[51]

Gomez, 2006. El Reto de la informalidad y la pobreza moderada. p.84

[51]The original citation is in Spanish. The author compiled the above translation based on the underlying meaning of each expression to ensure the comprehension of the corresponding ideas. This is the original text: *"La política nacional de competitividad como estrategia de inserción internacional, formalización de la economía y generación de empleo productivo (...) Las diferencias en niveles de escolaridad, capital, redes sociales, culura, apoyo familiar, ingresos, experiencia, habilidades y capacidades contribuyen a determinar el éxito del emprendimiento. Por lo cual, una política sobre este aspecto es útil y fructífera en la medida que brinde condiciones diferenciadas para aumentar la productividad de diversos grupos de emprendedores, y para realizar proyectos específicos. Esto sólo es posible cuando se identifican previamente las áreas de interés para el desarrollo a nivel regional y nacional, de acuerdo con el proceso económico internacional, e identificando los grupos sociales que más pueden aportar y los que necesitan más apoyos para participar en tal proceso."*

Summary

This chapter studies the apparent stagnation of microenterprises between 1994 and 2012 by exploring the nature of the constraints that they face. It relies on a micro level firm database (ENAMIN) to construct an index of performance based on size (capital) and profitability. It uses the index to estimate the empirical probability of being a successful firm subject to observable characteristics. Microenterprises are then classified into three categories according to their predicted success probability: upper, middle and lower segments. The middle segment is constituted by firms with the same average empirical probability of being a top performer (upper segment) but that, nonetheless, are not as successful. Thdese firms face substantial external constraints and their share increased from 16 percent during the 1990s to 22 percent during the 2010s. Also, their average returns to capital remained high at around 15 percent; thus suggesting constrained productivity. Interestingly, microenterprises that belong to the lower segment have average marginal returns of 30 percent, compared to one percent of the upper segment. The decomposition analysis shows that the lower segment has a significant shortage of endowments. Furthermore, the most profitable firms are those lacking premises. Overall, the document shows that capital misallocation may be in place and provides insights on the constraints that each segment faces.

5.1 Introduction

Microenterprises are the most common firm category in the Mexican economic landscape and represent a significant source of employment. Despite their predominance, their contribution to the GDP is low[52]. Furthermore, they do not export, tend to be informal and are concentrated on the lowest segments of profits, capital stock, wage expenditure and innovation activities. Despite liberalization and the implementation of structural reforms both, microenterprises and the economy as a whole, have had a sluggish performance. Altogether, understanding why these firms appear to be stagnant is relevant to achieve economic development.

The goal of this document is to investigate (i) whether microenterprises face constraints that impede their growth, (ii) what is the nature of those constraints and (iii) how have those constraints changed during the past two decades. Specifically, it distinguishes microenterprise segments based on their empirical probability of success. The profile of each segment is then characterized and the nature of the constraints that they face are discussed. The analysis relies in a micro level firm survey and pools data of the 1990s and the 2010s to compare the performance of microenterprises across decades.

The paper distinguishes three firm segments: upper, middle and lower segments and it is determined that the nature of their constraints differ. By definition, the upper segment are those microenterprises that are top performers. I find that their average marginal returns to capital are close to the market interest rate, just as economic theory would predict. In the case of middle segment firms, whose observable characteristics are similar to the upper segment but are less successful, it is observed that their marginal returns to capital are relatively high. Furthermore, they have increased across decades. Together, the high levels of profitability and the features exhibited, suggest that this segment mainly faces external constraints (which increased over time) and is subject to cost-efficient policies. Lastly, the profile of the lowest segment suggests that the main growth limitation of these firms is of internal nature. Nonetheless, it was surprising to find that lower-segment-micrenterprises that lack premises have very high marginal returns. This suggests that, despite their internal limitations such as low schooling, they do have growth potential and are in need of investment. Overall, the study shows that capital misallocation in the economy might be in place and highlights that policies should contemplate the differentiated needs of firm segments.

The remainder of this chapter is structured as follows. Section two introduces the theoretical framework and the literature review. Section three explains the data structure and provides the main descriptive statistics. Section four presents the methodology and the determination of three distinct firm segments. Section five characterizes each resulting group and provides their main features. Section six estimates the marginal returns to capital of each group and thus provides a notion of the nature of the constraints that each one of them might be facing. Section six explores the sources of profits variation with a decomposition method. The last two sections discuss the results and conclude.

[52]According to the economic census of 2014, microenterprises contribute to 9.8 percent of GDP, small firms with 9.5 percent, medium with 16.6 and large ones with 64.1 percent.

5.2 Scientific framework

Microenterprises provide 47 percent of employment and represent 97 percent of the existent economic units *(*see *Table 1*). This contrasts with what is observed in developed countries[53]. For example, microenterprises only account for 15 percent of employment in the US and 31 percent in the EU. In terms of number of firms, they represent 70 and 92 percent respectively. Furthermore, Mexican microenterprises are small relative to the definition of their category because only about 1.4 percent of them have a total workforce of more than five persons. This observation holds in both urban and rural areas[54]. Overall, the country exhibits a 'missing middle' (Ayyagari et al., 2007; Tybout, 2000) and a 'missing large' Hsieh and Olken (2014); meaning that there are relatively few small, middle and large sized firms. Such distribution has barely changed since the liberalization of the economy about two decades ago [55].

Microenterprises are the most common firm category. Yet, their levels of performance are lower relative to bigger firms in virtually any indicator. Including profits, capital stock and wage expenditure. These predominantly informal firms were originally conceptualized with a dichotomic framework (Hart, 1972; Harris and Todaro, 1970; Lewis, 1954). According to this view, they were residual economic units whose prevalence in the market was explained by the lack of employment opportunities. Therefore, people employed in microenterprises were involuntarily queuing for a paid job in larger firms that offered better labor conditions such as the provision of social security. However, as research advanced, it was found that microenterprises are highly heterogeneous (Mead and Morrisson, 1996). Not all of these persons are awaiting a paid job. In fact ,there is evidence about well-performing wage workers that choose micro entrepreneurship Fajnzylber et al. (2006). Furthermore, there are strong linkages between the formal and informal sectors (Boehme and Thiele, 2014). Overall, there are multiple studies that have shown that productive and survival activities coexist (Cunningham and Maloney, 1998; Liedholm and Mead, 1998). However, the behavior and characteristics of these firms shows heterogeneity which goes beyond a dualistic conceptualization.

Eventually, some theoretical models suggested that a poverty trap could be preventing microenterprises from graduation and keeping them in lower productive ventures (Banerjee, 2001; Banerjee and Duflo, 2005; Banerjee and Newman, 1993). In such case, poor firms remained poor due to an interaction between capital market imperfections and high minimum-scale investments. When talented entrepreneurs cannot get sufficient resources to enter profitable activities, then (1) few new firms enter the mar-

[53]The information for the US corresponds to 2008 and was obtained from the SBA and the BLS. For Europe, it is an average of the period 2008 - 2013 that was published by the ECB. The statistics that were provided include one-person firms (self-employment).

[54]According to the ENAMIN of 2009, only 1.7 percent of microenterprises in urban areas have a total workforce of more than five persons. The corresponding statistic for rural areas is one percent.

[55]The matching exercise presented in the above table unfortunately cannot be done for all years. However, the trends of the corresponding proportions are indeed known. On the one hand, the economic censuses show that microenterprises represent about 95 percent of the total economic units and 40 percent of employment since 1994. On the other hand, the ENAMIN also considers mobile and informal microenterprises and it shows that approximately two of each two firms lack premises since 1994.

ket, (2) production becomes inefficient, and (3) both, investment and saving decisions, get distorted. However, this mechanism of economic stagnation has been proven false with survey data (Siba, 2015; Falco et al., 2011; Grimm et al., 2011a; McKenzie and Woodruff, 2006) and with experimental data (Fafchamps et al., 2011; De Mel et al., 2008; McKenzie and Woodruff, 2008). The high marginal returns to capital that these studies have found, even at very low levels of capital, suggest the existence of constrained productivity. Furthermore, Grimm et al. (2011b) argues that constraints may as well be of different nature, such as economic, institutional or social.

At present, some authors insist in a dualistic view (Puyana and Romero, 2012) while others consider that microenterprises may become key promoters of development (Li and Rama, 2015). Overall, the mass of microenterprises is large and their diversity considerable, such that either generalizing or classifying them may become a questionable endeavor. For instance, classifications might substantially vary depending on the thematic interest, disciplinary background, or might be context specific. To assess this problem, the study of Grimm et al. (2012) first proposed a clear classification procedure where, in line with Nichter and Goldmark (2009), segments are defined as relatively homogeneous groups of entrepreneurs sharing similar characteristics that differentiate them from other groups.

The present study contributes to the literature in various ways. First, it deepens the debate about the heterogeneity in profitability and success potential among microenterprises. Second, it calls the attention back towards Mexico because the empirical debate started when this country was used as a case study (McKenzie and Woodruff, 2006). Furthermore, it applies the recently developed methodology of segment classification (Grimm et al., 2012) to derive highly detailed insights. Third, it is the first study doing an intertemporal comparison of microenterprise performance, characteristics and behavior. Because of its design and magniture, the ENAMIN is one of the best surveys of this kind that are available for developing countries. The datasets are pooled together into two time spells that encompass the two decades following liberalization.

In what follows, the neoclassical framework of the current analysis is briefly discussed. Specifically, I show the intuition behind the empirical finding of heterogeneous marginal returns to capital. Regardless of the microenterprise i formality status, when the corresponding owner who has an ability z_i decides to rely in technology $f(z_i,k,l)$ and employs capital k and labor l as production factors, then y_i is produced (Lucas Jr, 1978).

$$y_i = f(z_i, k, l) \tag{8}$$

By considering a unitary price vector p_i, each firm resolves the following optimization problem where r is the cost of capital and w the cost of labor :

$$Max\left\{f(z_i, k, l) - rk - wl\right\} \tag{9}$$

$$\text{s.t. } l \geq 0 \text{ and } k \geq 0$$

The resulting first order conditions are:

$$z_i \frac{\delta f(k,l)}{\delta k} = r \tag{10}$$

$$z_i \frac{\delta f(k,l)}{\delta l} = w \tag{11}$$

The rearrangement of terms leads to two main observations. First, the marginal returns of each production factor corresponds to the profitability of the factor adjusted by its return to scale. Consequently, the factor cost equalizes each share and the marginal returns to capital.

$$MRK = z_i \frac{\delta f(k,l)}{\delta k} = r \tag{12}$$

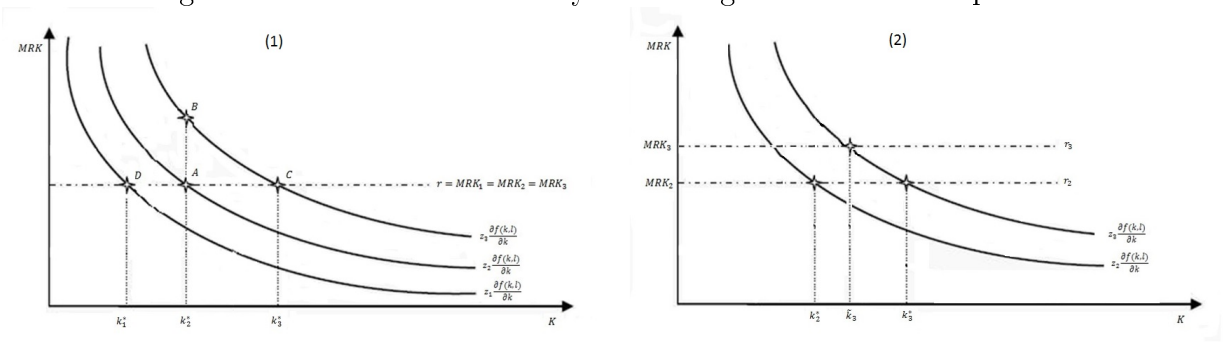
$$MRL = z_i \frac{\delta f(k,l)}{\delta l} = w \tag{13}$$

Second, the ratio between δk and δl should remain relatively constant. Intuitively, an increase of a production factor should lead to an increase of the complementary factor.

$$\frac{\delta k}{\delta l} = \frac{w}{r} \tag{14}$$

The following figures show a graphic representation of the analysis. In *Figure 6.1* it can be observed that firms with higher productivity should have higher K, but same MRK and face the same cost of capital r. For example, even when microenterprise three is more productive relative to microenterprise two, both firms should have the same MRK provided that they face the cost r. Indeed, employing k_2 is only optimal for firm two (point A) because firm three can produce more with that same level of capital. Because firm three exhibits higher marginal returns relative to its costs (point B), it would be convenient for the entrepreneur to hire an additional unit of capital until such condition is saturated (point C). The opposite occurs when firm two is compared with a relatively less productive firm one (point D). Consequently, the marginal returns equalize across firms and the only observable difference should be the level of capital that each one of them decides to hire.

Figure 6: Scenarios in the analysis of marginal returns to capital



Notes: Scenario (1) depicts the equalization of marginal returns to capital across firms with heterogeneous levels of productivity. Scenario (2) shows a situation where one of the firms is capital-constrained.

Figure 6.2 compares firms, say firm one and firm two, which display different levels of productivity (z_2 and z_3) and also different capital costs (r_2 and r_3). In such case, even when firm three is more productive than firm two, it exhibits a relatively low level of capital and high marginal return. That is, the hired $\tilde{k_3}$ is lower relative to the optimal level of capital k_3^*. It is thus said that constrained firms exhibit low capital levels$k$ and high marginal returns to capital MRK.

Empirically, Mexican microenterprises do not follow the two above implications of the neoclassical model. On the one hand, as discussed above, there is empirical evidence of high marginal returns to capital even at low levels of capital. On the other hand, labor and capital do not increase simultaneously. It is seldom that microenterprises employ more than five persons even if they belong to the upper capital percentiles.

5.3 An overview of firm heterogeneity

The ENAMIN is a three stage survey that stems from the National Survey on Employment (ENEU-ENOE[56]). During the first stage, the employment survey collects information about individual socioeconomic characteristics and employment. In the following stages, the subsample of individuals that own a microenterprise originate the ENAMIN and complementary information is collected. In that sense, there is no *ex ante* restriction by firm size and the determination of these economic units is independent from their administrative behavior and location. Also, the ENAMIN's sampling design is probabilistic, stratified and conglomerated.

The dataset employed for the analysis matches the ENAMIN and the National Survey on Employment. Therefore, it is extremely detailed and representative at a large scale. Furthermore, unlike the economic census, it takes into consideration (i) the formal and informal sectors[57] and (ii) firms that lack premises. The period of

[56]In 2005 the Urban Labor Survey (ENEU) was substituted by the National Survey on Employment (ENOE) which also samples rural areas.

[57]According to INEGI´s classification, firms that belong to the informal sector rely strongly on the household´s income to operate without constituting itself as a corporation and do not follow a standard

the 1990s is compared with that of the 2010s by pooling together the cross-sectional surveys[58] from 1994, 1996, and 1998 on the one hand, and those of 2008, 2010, and 2012 on the other hand. The first time block corresponds to the immediate period that followed the introduction of structural reforms, the adherence to NAFTA and the devaluation of the Mexican Peso (MXP), while the second block corresponds to the newest available data. The data of each year is highly homogeneous relative to the surveys of the corresponding decade, and the sampling design makes it possible to generalize the results to the population under study. However, the 1990s samples are representative for urban areas and the 2010s are representative at the national level. Also, the first time block captures firms employing up to five workers and the second one broadens its definition to up to ten workers.

Both data sets become comparable once geographic location and firm size are taken into consideration. The final dataset thus includes microenterprises that have at most five workers and operate in cities that have been bigger than 100,000 inhabitants since the 1990s. Such restrictions led to the following observational losses: first, dropping firms with a total workforce of more than six persons (including the entrepreneur) from the 2010s sample allowed keeping the majority of the observations because these firms only represented 0.9 percent of urban microenterprises. Second, 38 cities were considered for the analysis [59] because the 2010s data is representative at the national level and the 1990s is representative for urban areas. This city readjustment allowed keeping 51.3 percent of the urban sample of 2010s. Lastly, the analysis considers entrepreneurs that are either men or women aged at least 15 years old. Overall, the final samples comprise 29,528 observations during the 1990s and 36,528 during the 2010s. The nominal responses correspond to 2016 MXP and are reported in USD. They were first deflated and then adjusted by currency to avoid exchange rate volatility [60].

The profile of the average Mexican microenterprise during the 2010s corresponds to a ten-year-old firm without premises that earns about 352 USD per month and which operates with a capital stock equivalent to 4,458 USD. The owner is a middle aged married man who is a head of household. He financed the firm with his own savings, has around 10 years of schooling and 29 years of experience. He does not have workers and, in case of hiring someone, he would rather rely in family members to whom he would give a low wage based on a verbal agreement, for a non-specified

accounting system. This leads to a situation where the economic unit can be hardly audited and where its existence cannot be strictly separated from that of the household.

[58] Each year sample was also considered separately to ensure that they do behave similarly. The descriptive statistics and econometric models yielded similar results thus confirming that combining the data across years to increase the sample and compare time periods is feasible.

[59] Almost the totality of the urban areas is considered. Specifically, the cities kept in the sample are: Acapulco, Aguascalientes, Campeche, Cd. de Mexico, Cd. Juárez, Celaya, Chihuahua, Coatzacoalcos, Colima, Cuernavaca, Culiacán, Durango, Guadalajara, Hermosillo, Irapuato, León, Manzanillo, Matamoros, Mérida, Monclova, Monterrey, Morelia, Nuevo Laredo, Oaxaca, Orizaba, Puebla, Saltillo, San Luis Potosí, Tampico, Tepic, Tijuana, Tlaxcala, Toluca, Torreón, Tuxtla Gutiérrez, Veracruz, Villahermosa, and Zacatecas.

[60] The nominal responses are first converted into 2016 MXP using the GDP deflator and are then converted into USD. The considered MXP-USD exchange rate is 18.102 which, just as the deflator, corresponds to February 2016.

period of time and without health insurance. This first overview thus portrays firms with low earnings and capital stock relative to larger firm categories, and reveals some fundamental challenges that characterize microenterprises such as the lack of premises and low labor conditions.

The intertemporal comparisons provide further relevant insights. For instance, *Table 7* shows that there have been positive transitions during the past two decades in terms of gender, schooling and experience. First, more women have joined the labor force as microentrepreneurs. Indeed, about one third of the owners were female during the 1990s and the share increased to about one half by the 2010s. Second, the levels of education rose substantially for both, firm owners and workers. Specifically, the share of microentrepreneurs without primary education diminished from 30 to four percent, while the people that hold at least a bachelor degree doubled. Third, firms are staying for longer periods of time in the market and the owners are gaining experience. For instance, the average age of firms rose from seven to 11 years. Interestingly, the partitioning by age brackets shows that firms older than 10 years increased their share the most. In line with this observation, workers and entrepreneurs are getting older while the latter have also gained experience. Overall, these three changes reflect a general macroeconomic trends in Mexico.

Despite the qualitative advances, *Table 7* also shows that the performance of microenterprises seems to be stagnant. Neither capital stock nor monthly profits have substantially changed across decades. Furthermore, the share of one-person firms increased and the average number of hours that are worked per week decreased. This average performance contrasts that of large firms. The latter have followed the opposite trend during the past two decades by increasing their contribution to the GDP and to exports.

Microenterprises have, on the one hand, increased their average capital stock from 4284 USD to 4458 USD and, on the other hand, decreased their mean monthly profits from 422 USD to 352 USD. Even when the skewness of both, capital stock and profits, has slightly faded over time these indicators show that the performance of microenterprises is below expectations. This occurred despite the introduction of structural reforms that liberalized the economy and aimed at improving the conditions of the private sector. In fact, studies have pointed out that a major reason for which Mexico has not substantially grown during the past three decades is related to a low productivity growth (Cepeda and Ramos, 2015; Hanson, 2010; Chiquiar and Ramos-Francia, 2009).

The distribution of capital stock provides further insights about the performance of microenterprises. For instance, firms at the lowest half of the capital distribution increased their capital stocks over timer while those above the median decreased it (*Appendix 2A*). It is thus the relatively poorer firms the ones that have accumulated the most capital over time, which is in line with the empirical observation that Mexican microenterprises exhibit high marginal returns at low levels of capital (McKenzie and Woodruff, 2006, 2008). Despite the partial increase of capital, profits decreased across all levels of capital. Also, the number of weekly worked hours decreased even when the average size of firms below the 25th percentile of capital increased. This is interesting because the share of one-person firms primarily increased at higher capital levels.

The remainder of the table further depicts the heterogeneity of microenterprises by

Table 7: Descriptive statistics

Positive transitions	**Mean**		**sd**	
	2010s	**1990s**	**2010s**	**1990s**
Microenterprises owned by women	45%	32%	50	47
Education				
Less than primary school	4%	30%	-	-
Primary school	32%	32%	-	-
Secondary school	27%	20%	-	-
High school	16%	10%	-	-
At least undergraduate education	20%	9%	-	-
Mean firm age	11 yrs.	7 yrs.	10	9
Mean years of experience	29 yrs.	27 yrs.	15	15

Apparent stagnation		**Mean**		**sd**	
		2010s	**1990s**	**2010s**	**1990s**
One person microenterprises		68%	65%	47	48
Mean working hours per week		60 hrs.	66 hrs.	52	51
Monthly profits	**(m)**	352 USD	422 USD	544	3316
	(p50)	220 USD	216 USD		
Capital stock	**(m)**	4,458 USD	4,287 USD	19,084	14,297
	(p50)	739 USD	619 USD		

Notes: (1) The sample considers firms that employ up to five workers plus entrepreneurs. It is also restricted to entrepreneurs of the age between 15 to 65 years. (2) Self-employment firms are defined as those composed of either a single worker or those where only family members are employed. (3) The capital stock includes working capital and inventories. (4) The total worked hours per week accounts for the working time of the entrepreneur and both, paid and unpaid workers. (5) The tabulations of percentages may not add up to 100 due to rounding. (6) Regarding abbreviations, (m) stands for mean and (p50) for the median. (7) Nominal values are in 2016 MXP converted into USD.

showing some basic features across capital percentiles and time. It can be observed that the age of the entrepreneur does not substantially vary across capital stock. This is also true for age of the firm, though the 2010s microenterprises stayed for longer periods in the market relative to previous years. Only firms in the upper capital decile exhibit a recognizable differentiated behavior by having four years more of experience than the rest. On the contrary, gender and the use of premises do have a strong correlation with capital stock. For instance, it is surprising to notice that despite the higher participation of women in micro entrepreneurship, they have mainly entered at the lowest levels of capital. Indeed, female firms at the lowest capital decile increased their share by 14 percentage points while the upper capital decile only did by six percentage points. Female participation thus ranges from representing approximately one out of every two firms at very low levels of capital, until about one out of five at very high levels of capital. Similarly, the distribution of premises is unequal. The average share of firms with a permanent physical establishment remained at 33 percent over time; however, only five percent of the poorest firms (in terms of capital) have premises while this proportion increases to 74 percent for the richest decile.

Lastly, most industries have a similar capital distribution. Nonetheless, a differentiated behavior at the upper quartiles does occur in four industries. Specifically, firms above the 75th capital percentile become rare in construction and restaurants/hotels. On the contrary, they increase their participation in trade and transportation services. Overall, there is no evidence of barriers to entry in any sector. This also holds true when only initial investment is taken into account[61] and when considering the profits that each capital decile makes. In other words, it is not true that microentrprises only participate in low productivity activities. Empirically, they do participate in all industries even when their capital levels are very low.

5.4 Determining firm segments

This section further explores the seemingly contradictory stand of microenterprises regarding their improvements in socioeconomic features during the past two decades while staying apparently stagnant in terms of capital and profits. Accordingly, I rely on the methodology of Grimm et al. (2012) to explore the nature of the constraints that these firms face. Three segments are identified: (i) the 'upper segment' is composed of the top performers, (ii) the 'middle segment' are microenterprises with a high empirical probability of becoming a top-performer given their observable characteristics, and (iii) the 'lower segment' are firms with features of survivalists. The identification strategy that allows differentiating among all three groups follows these steps: first, a subgroup of enterprises is defined as the upper segment based on their capital stocks and monthly profits. Second, among a list of socioeconomic features some owner and firm characteristics are distinguished based on their correlation with the performance measures (capital and profits). Third, these variables are used as controls to predict the empirical probability of being a successful firm according to the performance criterion set in the first step. Fourth, each microenterprise is classified into one of the three firm seg-

[61] As measured by the subsample of firms that have been in the market for two years or less.

ments according to its predicted probability of success. Finally, the differences among the characteristics and behavior of all three segments are discussed. These features are contextualized over time and the changing shares analyzed from the perspective of the structural change process.

Accordingly, the upper segment (or set A) is defined as the top 10 percent of the most successful microenterprises. To classify each one of the observations in the data sets the index $I_i^{Up}$is used. This index takes the value one when the economic unit complies with two criteria: size and profitability. Else, I_i^{Up} is zero. Specifically, the firm is considered as part of the upper segment when it belongs to the highest 15th percentile of capital stock and, additionally, exhibits high levels of profits. This is equivalent to the firms with the upper 66 percentile of the profits provided that they have at least 6,400 USD in capital stock (*Appendix 2B*). The two classification criteria thus allows taking into consideration past and current performance.

$$I_i^{Up} = \begin{cases} 1 & if\ a \in A \\ 0 & otherwise \end{cases} \tag{15}$$

It should be noted that employment is not considered as indicator of top performance because firm size has little variation across the distribution of capital, it might change over the course of a year, and because microenterprises strongly rely on family labor. Both performance considerations are measured as follows: capital stock corresponds to the replacement cost of the owned working equipment, premises and inventories. The average monthly profits correspond to those reported by the entrepreneur when answering the following question: "How much do you normally obtain as earnings after deducting expenses?". This measure of profits is used by taking into consideration that it comprises a lower measurement error relative to the computation of income minus costs De Mel et al. (2009). Furthermore, value added is used to perform robustness checks to each analysis and it is measured as turnover minus the costs for intermediate inputs. This variable is also considered because it includes paid wages and the implied income of both, the owner and unpaid workers[62]. However, it is not used as the main profitability measure because the 2010s data would only provide few observations.

5.4.1 Binary response model

The empirical classification is done with a binary response model where I_i^{Up} is regressed on the list of control variables of the vector X_i. The corresponding probit estimation is made two times, therefore X_i changes. In this section I first present the base model where only socioeconomic variables are included. The advantage of using this simplified version is that it provides an initial partition whose controls are correlated with the measures of performance while being subject to little scrutiny. The variables used thus correspond to inherent features that were largely already determined by the time

[62]The 2012 ENAMIN data shows that, on average, 49 percent of the workers do not receive a wage. Also, 93 percent of microentrepreneurs do not assign themselves a regular wage that is clearly separated from the firm's earnings.

when the firm started to operate. Specifically, the employed variables are: age of the owner, gender, education, marital status, and age of the firm. The econometric model also controls for year and industry fixed effects. There are nine industry dummies: construction, manufacturing, miscellaneous services, personal services, professional services, repair services, restaurants and hotels, retail and wholesale trade, and transportation services. A more detailed description of the variables can be found in *Appendix 2C*.

Equation (16) presents the probit equation where the response probability $Pr(I_i^{Up}=1)$ is modeled in terms of the vector variables X, the vector of coefficients β, and a random error term ω. The function Φ corresponds to the standard normal cumulative distribution function and it takes on values strictly between zero and one: $0 < \Phi(z) < 1$, for all real numbers z. Therefore, the estimated probabilities of firm success strictly lye between zero and one.

$$Pr(I_i^{up} = 1) = \Phi(\beta_0 + X_i^{'}\beta_1 + \omega_i) \tag{16}$$

Columns one and four of *Table 8* present the maximum likelihood estimations of the above equation for each decade[63]. The estimates for "age of the entrepreneur" and "age of the firm" show that time has a significant effect that is positive at decreasing rates. The education of the entrepreneur has positive and significant effects over the empirical probability of high performance. This is especially true for those firms whose owner studied at least a bachelor degree. The effect of being married is positive and significant, though it has decreased over time. Lastly, the gender effect is highly significant and negative.

I then consider the estimators of the probit ($\hat{\beta}_0$ and $\hat{\beta}_1$) to predict the probability of being a top performer for every observation in the sample. Therefore, $\hat{Pr}(I_i^{Up} = 1)$ refers to the empirical probability of belonging to the upper segment given the observable characteristics of the firm.

$$\hat{Pr}(I_i^{Up} = 1) = \Phi(\hat{\beta}_0 + X_i^{'}\widehat{\beta}_1) \tag{17}$$

The shares of the two other segments are determined by choosing a cut-off point for $\hat{Pr}(I_i^{Up} = 1)$. The middle segment is thus isolated where the average predicted probability of being part of the upper segment equalizes the average predicted probability of the subsequent predicted probabilities once they are sorted:

$$E\left[\hat{Pr}(I_i^{Up}) \mid I_i^{Up} = 1\right] = E\left[\hat{Pr}(I_i^{Up}) \mid I_i^{Up} = 0\right] \tag{18}$$

It should be noted that there are different ways in which the threshold can be defined. The definition that I rely on provides a clear cut-off criteria where the the

[63]The remainder columns correspond to the extended probit, which will be explained in the following section.

upper and middle segments should be equally likely to be successful. This implies that the distribution of the observable variables X is the same in both groups.

The empirical strategy leads to the determination of three firm segments: upper, middle and lower. Where the upper segment is composed of those firms who are actually top performers. The middle segment includes microenterprises with a high empirical probability of being a top-performer given their observable characteristics and that, nonetheless, are not as successful. The lower segment comprises the remainder of the firms. Accordingly, *Table 9* shows some features of each firm segment:

Overall, the empirical classification matches expectations in qualitative terms. For instance, the upper segment has high levels of capital stock and outstanding profiles in terms characteristics and behavior. On the contrary, the lower segment has low levels of capital and the profiling of the firms is low. Finally, the middle segment is similar to the upper segment in terms of observable characteristics while also being similar to the lower segment in terms of capital. It should also be noted that the share of middle-segment firms increased across time. This suggests those firms mainly facing external constraints have become more numerous.

5.4.2 Refined classification

The above described empirical strategy enables a clearer distinction of features that are highly correlated with the probability of being a successful firm. These are the main distinguishable characteristics: (i) starting the business due to family tradition or to have higher earnings, (ii) following book keeping, (iii) having premises, and having contact (iv) with governmental institutions or (v) with trade associations. It is also relevant whether they (vi) provide employment, and (vii) the proportion of workers that receive a wage. All these variables are included in the vector of control variables X_i to estimate a second version of *Equation (16).*

The new probit estimation thus includes characteristics and behaviors that proxy unobserved characteristics such as ability. This procedure aims at modeling non observable terms that could be systematically included in the error term ω_i. In this case it is assumed that the behavioral measures enter the model in an additive way. The characterization could have certain degree of endogenity if the employed proxies depended on a third variable. Overall, the iteration of the probit estimation with the above considerations results in a more refined partitioning that enables a more detailed profiling of each firm segment.

Columns two and five of *Table 8* present the estimates of the extended version of the binary response model. Then, columns three and six report the marginal effects of each control variable. It can be observed that the signs hold when the estimates of both, the simplified and refined models are compared. Also, the sign of each one of the considered variables is as expected. The results reported in the columns of the marginal effects (three and six) show that the contribution of time to success is minimum. Only about two percentage points for the case of both, age of the entrepreneur and age of the firm. The effect of education becomes economically significant only if the entrepreneur visited at least high school. If the owner owns at least a bachelor degree, then the probability of having a successful business increases by eleven percent. Similarly, the

Table 8: Binary response model (Probit)

Control variable	I_i^{Up}			I_i^{Up}		
	2010s			**1990s**		
	(1)	(2)	(3)	(4)	(5)	(6)
Age of entrepreneur	0.024**	0.029**	0.002**	0.042***	0.036***	0.003***
	(0.008)	(0.011)	(0.001)	(0.005)	(0.006)	(0.000)
Age squared of entrepreneur	-3.0e-4***	-3.4e-4**	-2.9e-5***	-4.3e-4***	-3.6e-4***	-2.7e-5***
	(8.7e-5)	(1.1e-4)	(7.5e-6)	(5.5e-5)	(6.3e-5)	(2.8e-6)
Female entrepreneur	-0.604***	-0.543***	-0.042***	-0.424***	-0.327***	-0.021***
	(0.053)	(0.065)	(0.006)	(0.056)	(0.078)	(0.005)
Married	0.214***	0.157***	0.013**	0.325***	0.237***	0.016***
	(0.044)	(0.043)	(0.004)	(0.042)	(0.059)	(0.004)
Primary school	0.241	0.073	0.006	0.255***	0.175**	0.014**
	(0.151)	(0.169)	(0.015)	(0.045)	(0.060)	(0.005)
Secondary school	0.498**	0.266	0.025	0.637***	0.429***	0.041***
	(0.162)	(0.191)	(0.021)	(0.055)	(0.065)	(0.009)
High school	0.845***	0.504**	0.056	0.948***	0.596***	0.069***
	(0.169)	(0.195)	(0.030)	(0.066)	(0.069)	(0.013)
At least undergraduate studies	1.311***	0.832***	0.110**	1.252***	0.798***	0.106***
	(0.159)	(0.180)	(0.037)	(0.087)	(0.089)	(0.020)
Age of firm	0.039***	0.028***	0.002***	0.026***	0.021***	0.002***
	(0.005)	(0.007)	(0.001)	(0.004)	(0.004)	(0.000)
Age of firm squared	-6.8e-4***	-6.0e-4**	-5.1e-5**	-5.3e-4***	-5.0e-4***	-3.5e-5***
	(1.6e-4)	(1.9e-4)	(2.0e-5)	(1.2e-4)	(1.1e-4)	(9.2e-6)
Family tradition or increase income		0.147**	0.013**		0.294***	0.023***
		(0.049)	(0.005)		(0.038)	(0.003)
Book keeping		0.478***	0.045***		0.600***	0.050***
		(0.052)	(0.003)		(0.100)	(0.009)
Firm has premises		0.470***	0.045***		0.512***	0.046***
		(0.048)	(0.008)		(0.042)	(0.007)
One person firm		-0.054	-0.004		-0.207**	-0.016**
		(0.036)	(0.003)		(0.065)	(0.005)
Share of paid workers		0.667***	0.057***		0.505***	0.037***
		(0.046)	(0.005)		(0.038)	(0.003)
Contact with government		0.116*	0.011*		0.157***	0.013***
		(0.050)	(0.005)		(0.042)	(0.004)
Contact with trade associations		0.115*	0.011*		0.227***	0.019***
		(0.055)	(0.005)		(0.032)	(0.004)
Constant	-2.644***	-3.225***		-2.538***	-3.228***	
	(0.237)	(0.311)		(0.157)	(0.177)	
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	14,772	14,655	14,655	18,478	18,386	18,386
Pseudo R-squared	0.1730	0.2953	0.2947	0.1838	0.3423	0.3423

*** p<0.001, ** p<0.01, * p<0.05

Table 9: Classification of each segment share across decades

Decade	Segments		$\hat{Pr}(I_i^{Up})$	Share	Capital	Profits	Labor	Size
2010s	Upper	mean	0.22	10	25,422	1,076	112	2.4
		sd	0.14	-	46,932	1,093	74	1.4
	Middle	mean	0.22	31	3,251	392	65	1.6
		sd	0.10	-	14,536	375	49	1.0
	Lower	mean	0.04	59	1,315	261	58	1.5
		sd	0.04	-	4,226	286	47	0.9
1990s	Upper	mean	0.24	10	23,136	1,136	114	2.4
		sd	0.16	-	33,402	3,567	68	1.4
	Middle	mean	0.24	25	3,430	439	68	1.5
		sd	0.11	-	7,900	1,485	46	0.9
	Lower	mean	0.04	65	1,262	326	59	1.5
		sd	0.03	-	3,405	4,282	42	0.8

Note: The sample partitioning into firm segments corresponds to the simplified version of the probit model.

Table 10: Classification of each segment share across decades

Segments	2010s	1990s
Upper	10	10
Middle	22	16
Lower	67	74

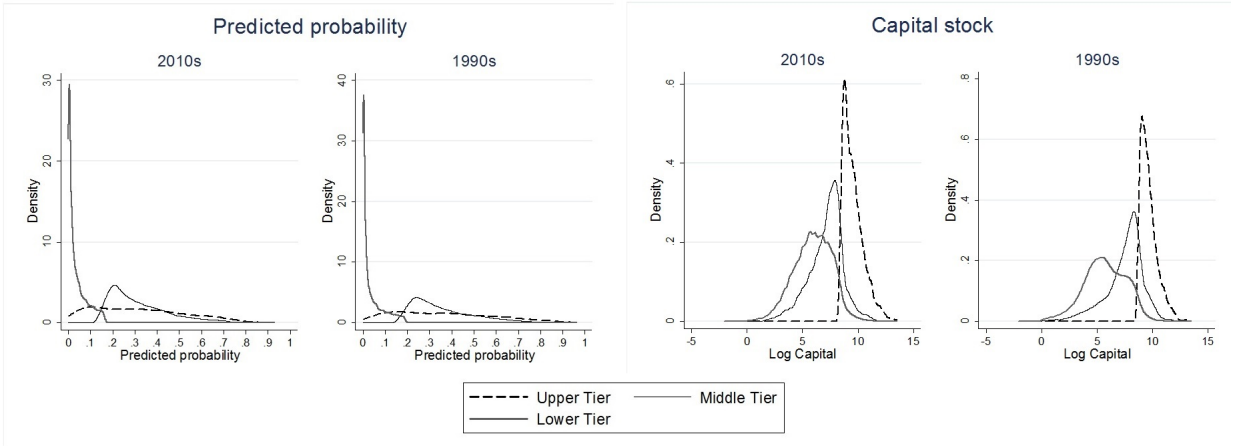
motive to start the business and having contact with the government or with trade associations increase the probability of success by about one percentage point.

The negative effect of being a female entrepreneur is significant and has slightly increased over time. For instance, during the 2010s the sole fact of being a woman diminished the probability of success by four percentage points. The behavioral variables show that the three features that contribute the most to good performance of the firm are the following: book keeping, operating with premises, and paying a wage to workers. Each factor contributes by about 5 percentage points to the probability of firm success. Lastly, firms that do not hire workers are less likely to be successful.

By following the same procedure as previously described, the empirical probability of success is predicted for each firm and used to determine the cut-off point among segments. *Table 10* thus presents the resulting share of each firm segment across decades. If it is compared with *Table 9* it can be observed that the modification of the econometric model lead to a more refined classification of segments. Furthermore, the observation about the share of the middle segment increasing over time holds. This is a relevant inference because it shows that the number of firms, whose main constraints are of external nature rather than internal limitations, has increased over time. *Appendix 2D* shows that the results are robust to considering value added as profitability measure.

In *Figure 7.1* the distributions of the predicted probability of each firm segment are

Figure 7: Comparison of firm segments' distributions



shown. As a complement, *Figure 7.2* displays the distribution of capital stock of all three firm segments.

The distribution of capital shows that, despite similarities in observable characteristics between the upper and middle segments, the later segment has lower levels of capital stock. Also, from all segments, the firms of the lower segment have increased their levels of capital the most over time. Despite having very low levels of capital in absolute terms, the positive skew has been fading.

5.5 Characterization of microenterprises by segments

The tables of this section show a detailed characterization of each firm segment. The descriptive statistics do follow the expected intuitive pattern. First, the upper segment outperforms the other two groups from a financial and behavioral perspective. Second, the lower segment follows the exact opposite trend. Third, the middle segment is similar to the upper one in terms of business characteristics and behavior; however, they resemble the lower segment in terms of capital and profits. It should be noticed that this is an *ex post* characterization because the observed features were not used as a criterion in the initial classification. They are the result of an methodological specification that allows an empirical classification and avoids rigid or arbitrary definitions.

Table 11 to *14* comprise information about each firm segment during the 2010s and the 1990s respectively. Therefore, it is possible to derive inter temporal insights. The tables show how and by how much was the performance of each segment affected. The negative trend shows that, in the midst of liberalization measures and constant reforms, microenterprises have not been able to develop as expected. Additionally, both tables report a t-Test for each variable. This allows comparing whether the differences across segments are significant. In what follows, the commonalities among all three segments are first presented. Then, the differentiated characteristics of each firm segment are described. Lastly, relevant contrasts across groups are discussed.

Since the 1990s and across all segments, the average profile of the owner corresponds to a middle aged man that is married and is the head of household. He has almost three decades of experience and has been a worker that regularly receives a wage at least once in his life. To start his business he did not use credit and reports not having needed external financing. It is further relevant to notice that, across all firm segments, the correlation between profits and firm age is positive, but for profits and owner's age it is negative. There is thus a premium for staying in the business. However, there is a simultaneous effect of diminishing returns when the owner ages. This pattern is also true for firm size, but not for capital.

The comparative tables also show that there are certain behavioral commonalities. For example, all firm segments tend to rely on their family to run the business and, as they increase their income and capital stock, they start hiring non family members. Nonetheless, microenterprises tend to stay small and most of them are not bigger than three people. Despite the positive correlation between firm size and and the probability of success, the upper segment is, on average, only one worker bigger than the lower segment.

It is seldom that microenterprises rely on credit and they normally use own savings or non interest financing from their support network. However, the reason that they give for this behavior is that they do not need financing. Furthermore, when asked about the main problem that they face, only four percent of microenterprises mentions credit. Instead, all segments report "low sales" as their main problem followed by "facing high competition". This pattern is observed since the 1990s.

There is a positive correlation between the probability of success and the affiliation with institutions. However, it is rare that microenterprises relate to them. This holds true for governmental institutions or trade associations. Lastly, there is a positive correlation between use of premises and probability of success. However, there is a commonality across all firm segments when only firms that lack premises are taken into consideration: home based businesses. Across all segments, firms that do not have premises are operating directly at their home or visiting their clients' home. This characterization is particularly relevant because it shows that the majority of microenterprises, in fact, do not operate on the public thoroughfare nor on informal open air agglomerations.

The industrial composition is particularly interesting because microenterprises strongly conglomerate in retail and wholesale trade. Approximately one third of the firms that conform each segment realize trade activities. Furthermore, the share of firms occupied in this industry has increased over time in every segment. This tendency contrasts the reported in national censuses where only firms with premises are considered. Transiting towards trade and not towards services opposes development expectations. It should also be noticed that there are only four industries that follow a distinguishable pattern. For instance, the upper and middle segments encompass most of the firms that are engaged in "personal services" and "transportation". Contrarily, the industries of "construction" and "restaurants and hotels" are dominated by the lower segment. Nonetheless, it is interesting to notice that all industries encompass microenterprises from all three segments. Furthermore, the distribution of firms by industry is rather

similar across all segments. This is also true when only recent entrants[64] are considered, thus confirming that entry barriers across industries do not play a significant role (McKenzie and Woodruff, 2006). Therefore, in principle, microenterprises have the potential to become successful in virtually any sector.

The inter temporal insights provided by these tables are relevant to deepen the understanding of *Table 7*. First, the gender and educational transitions have occurred unevenly. On the one hand, more women entered the labor market as micro entrepreneurs over time; however, their entrance rate was highest at the middle segment[65]. This provides evidence on gender constraints. On the other hand, across all firm segments illiteracy dropped and the share of entrepreneurs with a bachelor degree increased. As expected, there is a positive correlation between years of schooling and probability of success. However, monthly profits did not increase at the same rate as schooling.

Second, contrary to the expectations that liberalization measures raised, profits decreased over time across all segments. Capital stock followed the same negative trend; except for the lower segment, which exhibited a modest increase. It is noticeable that the middle segment experimented the strongest shrinkage in terms of capital stock, monthly profits, and weekly hours worked. Simultaneously, it was the only segment that increased its average firm size across decades. These empirical observations complement *Table 10* by showing that, on the one hand, the share of middle segment firms increased by six percentage points over time and, on the other hand, the hardships that they faced accentuated. The intuition behind is that, despite the improvements on microenterprises' socioeconomic and behavioral profiles, their economic performance decreased. Therefore, the empirical observations match the concept of "middle segment": firms whose observable characteristics and behaviors are similar to those of successful firms and which, most likely, are subject to external constraints rather than internal limitations.

There are other inter temporal insights that deserve being mentioned. Microenterprises stayed longer in business across all segments. However, they pulled away from governmental and trade institutions. Also, the usage and ownership of premises decreased. Lastly, the share of paid and family workers increased. In other words, despite allocating more resources for wages, they became more reluctant of including non-family members in their business activities.

The particularities of each segment are now discussed. The upper segment has about 6.5 times more capital than the middle segment and 2.5 times as much profit. These firms stay the longest average time in the market (13 years) and follow book keeping. Also, the owners of upper segment microenterprises have a bachelor degree and started their business to increase their income. These firms tend to operate steadily by relying

[64] This is defined as microenterprises that have been operating for two years or less.

[65] Women do not predominate in any segment. However, they are remarkably scarce among the upper segment. For every 25 entrepreneurs, there are 4 women in the US, 8 in the MS and 11 in the LS. Furthermore, even when women most commonly belong to the lower segment (44 percent), they almost doubled their participation at the middle segment over time (women represented 16 percent of the MS during the 1990s and their share increased to 30 percent during the 2010s).

Table 11: Characteristics of each firm segment during the 2010s

Concept	**Upper**	**Middle**	**Lower**	**Pr(|T| > |t|)**	**Pr(|T| > |t|)**
Average values	**(US)**	**(MS)**	**(LS)**	**(US) vs**	**(MS) vs**
	2010s	**2010s**	**2010s**	**(MS)**	**(LS)**
Main performance indicators					
Predicted probability ($\hat{Pr}(I_i^{UP})$)	0.31	0.31	0.03	0.983	0.000
Capital stock	25,422	3,894	1,390	0.000	0.000
Monthly profits	1,076	418	272	0.000	0.000
Labor (weekly hours)	112	79	55	0.000	0.000
Firm size (total workforce)	2.4	1.9	1.4	0.000	0.000
Characteristics of entrepreneurs					
Woman	0.16	0.30	0.44	0.000	0.000
Head of household	0.78	0.67	0.59	0.000	0.000
Married	0.73	0.67	0.56	0.000	0.000
Age	44	45	45	0.292	0.222
Experience	28	29	29	0.532	0.031
Used to a be wage worker	0.68	0.62	0.56	0.000	0.000
Education of entrepreneur					
Less than primary school	0.01	0.01	0.05	0.295	0.000
Primary school	0.12	0.13	0.38	0.436	0.000
Secondary school	0.18	0.18	0.30	0.947	0.000
High school	0.23	0.24	0.16	0.373	0.000
At least undergraduate education	0.46	0.43	0.11	0.153	0.000
Firm characteristics					
Age	13	12	10	0.000	0.000
Share of paid workers	0.77	0.68	0.39	0.000	0.000
Offers contract to workers	0.12	0.04	0.01	0.000	0.000
Follows book keeping	0.81	0.70	0.28	0.000	0.000
Used credit to start business	0.11	0.08	0.07	0.002	0.039
Reports not having needed financing	0.04	0.07	0.11	0.000	0.000
Expects to continue operations next year	0.98	0.97	0.96	0.007	0.119
Labor composition					
Share of one person firms	0.34	0.47	0.71	0.000	0.000
Family firm	0.38	0.52	0.79	0.000	0.000
Mixed firm	0.23	0.11	0.05	0.000	0.000
Non-family firm	0.38	0.38	0.17	0.696	0.000
Main motive to become entrepreneur					
Family tradition	0.11	0.10	0.05	0.369	0.000
Complement family income	0.09	0.17	0.27	0.000	0.000
Obtain a higher income	0.26	0.22	0.19	0.009	0.000
Could not find a job or was laid off	0.05	0.07	0.08	0.009	0.012
Flexible hours	0.01	0.02	0.02	0.011	0.166
Other	0.35	0.33	0.32	0.131	0.127

Table 12: ... *Continuation*

Concept	**Upper**	**Middle**	**Lower**	**Pr(|T| > |t|)**	**Pr(|T| > |t|)**
Average values	**(US)**	**(MS)**	**(LS)**	**(US) vs**	**(MS) vs**
	2010s	**2010s**	**2010s**	**(MS)**	**(LS)**
Relationship with institutions					
Healthcare registration (IMSS)	0.32	0.16	0.07	0.000	0.000
Registration at the Ministry of Economy	0.07	0.05	0.01	0.000	0.000
Registration at Municipality	0.47	0.41	0.18	0.000	0.000
Registration at any trade association	0.28	0.21	0.08	0.000	0.000
Premises					
Firm has premises	0.70	0.60	0.26	0.000	0.000
Premises are owned by the entrepreneur	0.53	0.46	0.55	0.000	0.000
Operates in public thoroughfare	0.02	0.03	0.07	0.134	0.000
Operates at an open-air market (tianguis)	0.05	0.07	0.09	0.320	0.004
Operates in a vehicle	0.41	0.27	0.08	0.000	0.000
Operates at the client's home	0.22	0.23	0.29	0.709	0.000
Operates in the own home	0.10	0.21	0.27	0.000	0.000
Operates as an ambulant firm	0.01	0.03	0.05	0.102	0.000
Main reported problem					
Low sales	0.22	0.26	0.28	0.001	0.017
High competition	0.21	0.19	0.18	0.057	0.515
Low profits	0.01	0.01	0.01	0.133	0.449
Lack of credit or resources	0.04	0.03	0.03	0.113	0.751
Conflict with workers	0.00	0.00	0.00	0.139	0.000
Debts from clients	0.04	0.03	0.02	0.161	0.068
Problems with the authority	0.00	0.01	0.01	0.836	0.708
Other	0.33	0.31	0.24	0.366	0.000
No problem	0.15	0.16	0.22	0.580	0.000
Industry					
Construction	0.04	0.04	0.12	0.528	0.000
Manufacturing	0.18	0.16	0.15	0.0756	0.219
Miscellaneaous services	0.13	0.17	0.18	0.000	0.446
Personal services	0.07	0.05	0.02	0.011	0.000
Professional services	0.05	0.05	0.03	0.323	0.000
Repair services	0.01	0.02	0.03	0.654	0.000
Restaurants and hotels	0.05	0.08	0.15	0.001	0.000
Retail and wholesale trade	0.34	0.33	0.31	0.392	0.035
Transportation services	0.12	0.10	0.02	0.030	0.000

Table 13: Characteristics of each firm segment during the 1990s

Concept	Upper	Middle	Lower	Pr(|T| > |t|)	Pr(|T| > |t|)
Average values	**(US)**	**(MS)**	**(LS)**	**(US) vs**	**(MS) vs**
	1990s	**1990s**	**1990s**	**(MS)**	**(LS)**
Main performance indicators					
Predicted probability ($\hat{Pr}(I_i^{UP})$)	0.36	0.36	0.03	0.987	0.000
Capital stock	23,136	4,897	1,283	0.000	0.000
Monthly profits	1,136	538	323	0.000	0.006
Labor (weekly hours)	114	88	56	0.000	0.000
Firm size (total workforce)	2.4	2.0	1.4	0.000	0.000
Characteristics of entrepreneurs					
Woman	0.12	0.16	0.32	0.000	0.000
Head of household	0.84	0.74	0.67	0.000	0.000
Married	0.86	0.83	0.66	0.008	0.000
Age	43	43	43	0.983	0.062
Experience	26	27	28	0.657	0.000
Used to be a wage worker	0.68	0.71	0.63	0.061	0.000
Education of entrepreneur					
Less than primary school	0.19	0.19	0.36	0.910	0.001
Primary school	0.20	0.21	0.36	0.653	0.000
Secondary school	0.22	0.22	0.18	0.837	0.000
High school	0.20	0.19	0.06	0.225	0.000
At least undergraduate education	0.19	0.20	0.05	0.665	0.000
Firm characteristics					
Age	8	8	8	0.359	0.000
Share of paid workers	0.73	0.64	0.32	0.000	0.000
Offers contract to workers	0.11	0.07	0.01	0.000	0.000
Follows book keeping	0.86	0.78	0.28	0.000	0.000
Used credit to start a business	0.12	0.08	0.04	0.000	0.000
Reports not needing financing	0.07	0.09	0.17	0.135	0.000
Expects to continue operations next year	0.96	0.93	0.91	0.000	0.000
Labor composition					
Share of one person firms	0.32	0.41	0.74	0.000	0.000
Family firm	0.35	0.48	0.77	0.000	0.000
Non-family firm	0.18	0.09	0.05	0.000	0.000
Mixed firm	0.47	0.42	0.18	0.006	0.000
Main motive to become entrepreneur					
Family tradition	0.10	0.08	0.05	0.062	0.000
Complement family income	0.16	0.19	0.34	0.002	0.000
Obtain a higher income	0.53	0.50	0.31	0.030	0.000
Could not find a job or was laid off	0.07	0.09	0.17	0.001	0.000
Flexible hours	0.03	0.03	0.04	0.108	0.048
Other	0.12	0.10	0.09	0.021	0.086

Table 14: ... *Continuation*

Concept	**Upper**	**Middle**	**Lower**	**Pr(|T| > |t|)**	**Pr(|T| > |t|)**
Average values	**(US)**	**(MS)**	**(LS)**	**(US) vs**	**(MS) vs**
	1990s	**1990s**	**1990s**	**(MS)**	**(LS)**
Relationship with institutions					
Healthcare registration (IMSS)	0.34	0.20	0.02	0.000	0.000
Registration at the Ministry of Economy	0.03	0.03	0.01	0.153	0.000
Registration at Municipality	0.32	0.31	0.11	0.788	0.000
Registration at any trade association	0.37	0.32	0.11	0.000	0.000
Premises					
Firm has premises	0.67	0.62	0.20	0.002	0.000
Premises are owned by the entrepreneur	0.65	0.35	0.50	0.000	0.000
Operates in public thoroughfare	0.02	0.05	0.09	0.000	0.000
Operates at an open-air market (tianguis)	0.04	0.06	0.06	0.150	0.883
Operates in a vehicle	0.59	0.49	0.08	0.000	0.000
Operates at the client's home	0.23	0.20	0.41	0.159	0.000
Operates in the own home	0.09	0.13	0.27	0.009	0.000
Operates as an ambulant firm	0.02	0.05	0.07	0.002	0.008
Main reported problem					
Low sales	0.24	0.33	0.36	0.000	0.006
High competition	0.23	0.23	0.18	0.668	0.000
Low profits	0.11	0.11	0.13	0.863	0.002
Lack of credit or resources	0.08	0.07	0.06	0.109	0.230
Conflict with workers	0.01	0.00	0.00	0.165	0.000
Debts of clients	0.09	0.06	0.04	0.001	0.000
Problems with the authority	0.03	0.02	0.02	0.126	0.002
Other	0.05	0.04	0.03	0.006	0.423
No problem	0.16	0.14	0.18	0.013	0.000
Industry					
Construction	0.02	0.02	0.09	0.679	0.000
Manufacturing	0.20	0.19	0.16	0.254	0.000
Miscellaneaous services	0.16	0.17	0.31	0.153	0.000
Personal services	0.01	0.01	0.01	0.964	0.523
Professional services	0.11	0.10	0.03	0.381	0.000
Repair services	0.00	0.00	0.00	0.391	0.023
Restaurants and hotels	0.03	0.05	0.12	0.008	0.000
Retail and wholesale trade	0.29	0.30	0.27	0.500	0.003
Transportation services	0.19	0.17	0.02	0.072	0.000

on premises (70 percent) or on a vehicle (12 percent). They are mostly employment providers and usually pay their workers. However, their employees do not receive a contract (only 12 percent do) and are mostly family members.

The middle segment stays in the market an average of 12 years and rely on both premises and vehicles. These firms are very similar to the upper segment in terms of socioeconomic and behavioral characteristics. Other resemblances are educational attainment and the disposition to follow book keeping. Their motivations to start their business were mixed. The majority of them reported the motivations that are most highly correlated with the probability of success: obtain higher income and family tradition. Nonetheless, an important share (17 percent) started operating out of need: complementing family income. Also, despite being mostly employment providers, the middle segment is less prone to subscribe workers to the national health system and to offer them a contract. Furthermore, these microenterprises only have 2.8 times more capital than the lower segment and generate 1.5 times more profits each month. This suggests severe capital constraints.

Lastly, the lower segment is mostly composed of entrepreneurs that have solely employed themselves for about ten years. These firms conform the lowest tiers of capital and profits distributions. Other relevant features are that they only attended primary school, do not follow book keeping and lack premises. Also, they started their business to complement family income. In accordance with these survivalist characteristics, if lower segment firms happen to have workers, those persons are mostly family members that do not have a contract nor receive a regular wage.

5.6 Marginal returns to capital

This section explores the capital constraints that each firm segment faces. Accordingly, consider again the production function discussed in section two. Profits of microenterprise i (π_i) are modeled as a function of the production factors capital (k) and labor (l) and the individual ability level (z_i).

$$\pi_i(z_i, k, l) = py_i(z_i, k, l) \tag{19}$$

Assuming unitary prices $p = 1$

$$\pi_i(z_i, k, l) = f(z_i, k, l) = z_i k^{\theta_k} l^{\theta_l} \tag{20}$$

In logarithmic terms:

$$ln\pi_i(z_i, k, l) = ln(z_i) + \theta_k ln(k) + \theta_l ln(l) \tag{21}$$

The above function is thus estimated as follows: the log of capital lnK_i and a vector with the log of the three labor categories (L_i) are introduced together with a

vector of exogenous variables (X_i) and unobserved factors at the individual level (Z_i). Industry and year fixed effects (D_i) are also considered. An example of the latter term is entrepreneurial ability, which determines profits and capital stock simultaneously: The earnings function is modeled with a log-linear transformation where α_i corresponds to the intercept and ε_i to the error term. The marginal returns to capital are estimated for each time block based on the corresponding pooled cross-sectional data.

$$ln\pi_i(K_i, L_i, Z_i, X_i, D_i) = \alpha_0 + \alpha_K lnK_i + L_i'\alpha_L + Z_i'\alpha_Z + X_i'\alpha_X + D_i'\alpha_D + \varepsilon_i \qquad (22)$$

Profits, capital and labor are introduced in log terms. The vector of labor includes the weekly hours that the entrepreneur and both, paid and unpaid workers, normally destine to operating the microenterprise. The vector $Z_i$captures firm and entrepreneur's characteristics that may affect earnings such as: age, gender and marital status of the entrepreneur, plus age of the firm. The square terms of both age variables are considered to explore the rate of the corresponding effects. Also, five schooling categories are used, where education lower than primary school serves as a reference. The vector also includes the log of the average wage at a given year, industry and state to capture the opportunity costs of (i) belonging to the wage sector and (ii) making profitable investments given short term shocks that vary across locations. Lastly, dummy variables seize year and industry effects.

The correlation between capital investment and the unobserved ability of the entrepreneur may lead to the under- or overestimation of marginal returns to capital. For instance, ability may lead to an upward bias of estimated $\hat{\alpha}_K$because (i) entrepreneurs with better skills might generate more capital and profits or (ii) because reversed causality between capital and profits may prevail. On the contrary, a downward bias can also emerge because (i) under capital market imperfections, very high ability individuals would be more willing to start a business, even at very low levels of capital, relative to lower ability individuals and (ii) due to the classical measurement error for profits and capital. To address concerns related with ability, the model specification takes first into consideration schooling and age; and second, introduces two ability proxies.

The vector Z_i measures the ability of the ith individual first, with a dummy for book keeping because higher ability individuals are more likely to develop an accounting system that provides them with an objective overview of their firm's performance. Second, four dummies capture the motivation of the entrepreneur to start the business: (i) having started their business due to family tradition or to have higher earnings, or (ii) complement family income or not finding a job. Where all other motives serve as reference. The intuition behind is that more capable individuals will be eager to enter self-employment and more likely to put a profitable idea into action. It should be noted that *Equation (22)* assumes that the unobserved ability can be modeled in an additive manner. The inclusion of ability measures leads to unbiased estimations provided that they are uncorrelated with optimal capital stock; thus implying that ability increases profits without increasing marginal returns. The cross-sectional nature of the data makes it difficult to deal with ability biases and the considered proxies are

imperfect. However, they are available for the whole sample and are good predictors of firm performance.

The log-log model and marginal returns are estimated separately for the complete sample and for each partitioning by levels of capital. To reduce boundary effects in the parametric estimations, about 20 percent of the subsequent observations are added to each capital partitioning. The marginal returns are next estimated over the relevant capital ranges thus diminishing results' sensitivity. The regression analysis disregards influential outliers from each subsample by ascertaining them with the DFITS-statistic. In that sense, the cut-off threshold is $|DFITS|_i = 2\sqrt{k/N}$where k stands for the degrees of freedom plus one and N for the number of observations (Belsley et al. 1980).

Table 15 shows the estimated parameters. Their sign is aligned with expectations and is consistent across decades. It is found that both input factors *(K, L)* have a positive economic effect over earnings. Nonetheless, labor elasticity is higher relative to capital. The owner's labor has the largest economic effect over profits relative to that accrued from workers. Across decades, the profit elasticity of capital increased. On the contrary, the profit elasticity of entrepreneur's labor decreased. The positive effects of relying on paid work are larger relative to unpaid work and increased across decades and capital levels.

The estimates for age of the entrepreneur and age of the firm support the existence of a learning effect that is positive at a decreasing rate. This coincides with the observation of firms staying, on average, three years longer in business than what they used to during the 1990s. Regarding other socioeconomic characteristics, the negative gender effect over profits stayed highly significant across decades. Despite the entrance of more women into the labor market, it became more difficult for them to be successful entrepreneurs. *Ceteris paribus,* the sole fact of being a woman decreased profits by 47 percent.

Education has positive and nonlinear effect over profits. During the 1990s, completing primary school had a positive and significant impact over monthly profits. In the 2010s, microenterpreneurs required at least a high school degree to significantly increase their earnings. Overall, returns to education decreased across decades regardless the level of schooling. Despite the increase in educational attainment that the economy has experienced, the accumulation of human capital is generating lower returns in terms of earnings. Even highly educated individuals are finding increasing difficulties in making their business prosper.

The hourly average wage in the industry and state is positive and it has increased across decades. In other words, the trade off for not being a wage worker increased. This observation is coherent with reports from INEGI showing that small scale firms decreased their overall contribution to GDP while larger firm size categories improved their performance across decades. Regarding the variables used as ability proxies, the effect of use of premises and relationship with the government are unclear. All other signs coincide with expectations. For example, the effects of (i) following a book keeping method and (ii) having entered the business due to family tradition or to increase income are positive, highly significant and large in economic terms. Despite the imperfection of the discussed dummies as ability proxies, their association with higher earnings does support the idea that they provide some measure of ability.

Table 15: Parametric estimation of log-log model

Control variable	**log monthly profits**		**log monthly profits**	
	2010s		**1990s**	
	(1)	(2)	(3)	(4)
Log of capital	0.182***	0.164***	0.143***	0.128***
	(0.004)	(0.003)	(0.003)	(0.004)
Log of entrepreneur's s total labor hours	0.150***	0.138***	0.367***	0.354***
	(0.010)	(0.010)	(0.012)	(0.016)
Log of paid workers' total labor hours	0.040***	0.026*	0.042***	0.018
	(0.002)	(0.009)	(0.002)	(0.008)
Log of unpaid workers' total labor hours	0.008**	0.020***	0.006*	0.029*
	(0.002)	(0.003)	(0.002)	(0.010)
Age of entrepreneur	0.016***	0.015***	0.014***	0.015***
	(0.002)	(0.001)	(0.001)	(0.002)
Age squared of entrepreneur	-2.7e-4***	-2.4e-4***	-2.5e-4***	-2.5e-4***
	(2.7e-5)	(1.7e-5)	(1.2e-5)	(1.5e-5)
Female entrepreneur	-0.478***	-0.474***	-0.455***	-0.401***
	(0.020)	(0.023)	(0.016)	(0.018)
Married	-0.006	0.002	0.031	0.033
	(0.011)	(0.008)	(0.016)	(0.019)
Primary school	-0.010	-0.018	0.075***	0.067***
	(0.024)	(0.030)	(0.011)	(0.011)
Secondary school	0.054*	0.043	0.137***	0.116***
	(0.017)	(0.023)	(0.016)	(0.017)
High school	0.113**	0.088*	0.272***	0.252***
	(0.025)	(0.031)	(0.028)	(0.022)
At least undergraduate studies	0.291***	0.257***	0.510***	0.493***
	(0.034)	(0.030)	(0.032)	(0.030)
Age of firm	0.018***	0.016***	0.017***	0.015***
	(0.002)	(0.002)	(0.002)	(0.002)
Age of firm squared	-2.9e-4***	-2.9e-4***	-0.000**	-2.5e-4**
	(4.5e-5)	(4.7e-5)	(0.000)	(6.1e-5)
Log of average hourly wage per industry and state	0.317***	0.311***	0.253*	0.239*
	(0.047)	(0.046)	(0.077)	(0.069)

Table 16: ... *Continuation*

Control variable	**log monthly profits**		**log monthly profits**	
	2010s		**1990s**	
	(1)	(2)	(3)	(4)
Family tradition or increase income		0.087***		0.211***
		(0.016)		(0.010)
Book keeping		0.167***		0.146**
		(0.015)		(0.031)
Firm has premises		0.022		-0.096***
		(0.017)		(0.016)
One person firm		0.111**		0.174*
		(0.027)		(0.070)
Share of paid workers		0.198		0.339*
		(0.099)		(0.130)
Contact with government		-0.006		-0.006
		(0.013)		(0.013)
Contact with trade associations		0.074**		0.074***
		(0.021)		(0.020)
Constant	3.055***	3.066***	2.376***	2.216***
	(0.098)	(0.130)	(0.251)	(0.237)
Year effects	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes
Observations	13,762	13,809	16,858	16,748
Robust R-squared	0.525	0.533	0.571	0.587

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Influential outliers are ascertained with the DFITS-statistic. (2) Robust standard errors are corrected for clustering. (3) Nominal values are reported in 2016 MXP converted into USD. (4) Reference categories are: sector (manufactures), motivation (all other categories), education (less than primary school), men, years (1994 and 2008).

Table 17: Average monthly marginal returns to capital by segment and decades (percentage)

Segments	Mean		Median		sd	
	2010s	1990s	2010s	1990s	2010s	1990s
Upper	1	1	1	1	0.02	0.03
Middle	14	15	4	2	0.93	0.84
Lower	30	43	7	7	1.09	4.15

In what follows, I estimate the marginal returns to capital and analyze their behavior to explore whether each segment exhibits capital constraints. It should be bear in mind that logging the dependent and control variables implies assuming a constant capital elasticity of profits. Also, that the marginal returns are the product of the output elasticity of capital ($\hat{\alpha}_K$) and capital profitability ($\frac{\pi_i}{K_i}$):

$$\frac{\delta(ln\pi)}{\delta K} = \frac{\delta(\alpha_K lnK)}{\delta \alpha_K} \tag{23}$$

$$\frac{\delta\pi}{\pi} = \alpha_K \frac{\delta K}{K} \tag{24}$$

$$MRK = \frac{\delta\pi}{\delta K} = \alpha_K \frac{\pi}{K} \tag{25}$$

The marginal returns are computed at the average profitability ($\frac{\bar{\pi}}{K}$) because the estimated elasticity is an average effect. In *Table 17* a detailed and stratified summary of the monthly marginal returns to capital across decades is reported.

The estimations show that microenterprises of the middle and lower segments seem to be constrained. As explained in *Figure 6*, it is said that firms are constrained when (i) the *MRK* that they exhibit are higher relative to the capital cost r that prevails in the market, and (ii) when they have too little capital given their production function. These conditions imply that such firms have not saturated yet their production potential. If production is inefficient for a substantial share of microenterprises, then the economy as a whole is producing inefficiently. In other words, we observe that microenterprises produce little relative to larger firm categories; however, this might be because they have capital constraints.

The above results are further tested. For instance, *Appendix 2E* shows the robustness checks that were performed by replacing profits with value added as profitability measure. The results hold. The alternative estimations of marginal returns are naturally higher because value added is larger than the measure of self reported profits. However, the estimated marginal returns are similar to those presented in *Table 17* and follow the same pattern. Furthermore, the qualitative observation of high marginal returns for the middle and lower segments is robust to a semiparametric estimation.

The high marginal returns of the middle segment are in line with the classification procedure. Given their observable profile, these entrepreneurs show a clear potential to become successful. In other words, it is likely that these firms are mainly constrained by their business environment. For example, due to. external constraints such as the lack of access to capital, insurance and productive infrastructure. On the contrary, the high *MRK* exhibited by the lower segment are rather unexpected because these microenterprises face serious external constraints and internal limitations. In other words, they might also need policy interventions that improve their education and skills. Interventions with long-term targets that are likely to be much more costly. This empirical finding will be further discussed.

5.7 Sources of variation

This section decomposes the differences in monthly profits among firm segments to analyze the origins of such variations. Based on the Oaxaca-Blinder method (Oaxaca, 1973; Blinder, 1973), it is explored whether the differences across the profits of each firm segment arises due to the level of factors that each grouping has or due to the effectiveness with which they use those factors. In other words, the endowments and coefficient effects are estimated.

Specifically, given two firm segments $S1$ and $S2$, an outcome variable $ln\pi$, and a set of predictors C, it is explored how much of the mean outcome difference (R) is accounted by group differences in the predictors. The differences in (log) profits are thus expressed in terms of expected values.

$$R = E(ln\pi_{S1}) - E(ln\pi_{S2}) \tag{26}$$

From *Equation (22)* it is known that profits are modeled in terms of variables K, L, Z, X and D and an error ε.

$$ln\pi(K, L, Z, X, D) = \alpha_0 + \alpha_K lnK + L^{'}\alpha_L + Z^{'}\alpha_Z + Z^{'}\alpha_X + D^{'}\alpha_D + \varepsilon \tag{27}$$

The control variables can be renamed and grouped in matrix C for simplification and α contains the slope parameters and the intercept.

$$ln\pi(C) = C^{'}\alpha + \varepsilon \tag{28}$$

The linear model from equation (28) can thus be expressed by segment with the purpose of comparing their means: $ln\pi_{Sl} = C^{'}_{Sl}\alpha_{Sl} + \varepsilon_{Sl}$where $l \in \{1, 2\}$ and it is assumed that $E(\varepsilon_{Sl}) = 0$. Therefore, the mean outcome difference (R) can be noted as follows:

$$E(ln\pi_{S1}) - E(ln\pi_{S2}) = E(C^{'}_{S1}\alpha_{S1} + \varepsilon_{S1}) - E(C^{'}_{S1}\alpha_{S2} + \varepsilon_{S2}) \tag{29}$$

$$E(ln\pi_{S1}) - E(ln\pi_{S2}) = E(C_{S1})^{'}\alpha_{S1} + E(\varepsilon_{S1}) - E(C_{S2})^{'}\alpha_{S2} - E(\varepsilon_{S1}) \tag{30}$$

$$E(ln\pi_{S1}) - E(ln\pi_{S2}) = E(C_{S1})^{'}\alpha_{S1} - E(C_{S2})^{'}\alpha_{S2} \tag{31}$$

The contribution of group differences in predictors to the overall outcome difference can be determined in *Equation (31)* is rearranged by adding and subtracting terms:

$$E(ln\pi_{S1}) - E(ln\pi_{S2}) = \left[E(C_{S1}) - E(C_{S2})\right]' \alpha_{S2} + E(C_{S2})'(\alpha_{S1} - \alpha_{S2})$$

$$- \left[E(C_{S1}) - E(C_{S2})\right]' (\alpha_{S1} - \alpha_{S2}) \tag{32}$$

The above decomposition allows determining three summands where each one of them captures different effects. Specifically, the first summand or "endowment effect" $E = \left[E(C_{S1}) - E(C_{S2})\right]' \alpha_{S2}$ measures the expected change in the mean outcome of firm segment$S2$ if it had the predictor levels of segment $S1$. The second summand $C = E(C_{S2})'(\alpha_{S1} - \alpha_{S2})$ captures the "coefficient effect", which measures the expected change in segment $S2$ mean outcome, if $S2$ had the coefficients of segment $S1$. Lastly, the "interaction effects" $I = \left[E(C_{S1}) - E(C_{S2})\right]' (\alpha_{S1} - \alpha_{S2})$ accounts for the fact that differences in endowments and coefficients may exist simultaneously..

The mean outcome difference may thus be rewritten as $R = E + C + I$ to observe each effect in a simplified version or it may be reconverted into its extended form to include all regressors in detail:

$$\begin{aligned} E\left[ln\pi_{S1}\right] - E\left[ln\pi_{S2}\right] = &\left\{E\left[ln\pi_{S1}(K, L, Z, X, D)\right] - E\left[ln\pi_{S2}(K, L, Z, X, D)\right]\right\}(\alpha_{S2}) \\ &+ E\left[ln\pi_{S2}(K, L, Z, X, D)\right](\alpha_{S1} - \alpha_{S2}) \\ &+ \left\{E\left[ln\pi_{S1}(K, L, Z, X, D)\right] - E\left[ln\pi_{S2}(K, L, Z, X, D)\right]\right\}(\alpha_{S1} - \alpha_{S2}) \end{aligned} \tag{33}$$

In this case, *Equations (32 and 33)* are written from the perspective of segment$S2$ because its coefficients weight the differences in the predictors. In the Stata specification the categorical variables are normalized. *Table 18* presents the results of the group comparisons by decades. Columns one and two compare the upper and the middle segments. The endowment effect shows that the middle segment does lack capital. However, the coefficient effect shows that the upper segment firms are more productive. For example, during the 2010s, if the middle segment had the characteristics of the upper segment, then their log profits would increase by 0.08. Similarly, if the middle tier had the coefficients α of the upper segment, then their log profits would increase by 0.53. This implies that the profits gap of 0.74 is mainly explained by the coefficient effects. This suggest that, despite the similarities between the upper and middle segments in terms of observable characteristics and behaviors, there might be other abilities that the top performers display while doing business.

Columns three and four compare the upper and lower segments. It is found that the endowments effect is almost twice as large as the coefficients effect. Regarding the endowments effects, during the 2010s, the estimations show that the log profits of the lower segments would be 1.13 higher if these firms had the same observable features as the upper segment. The detailed decomposition shows that the lower-segment firms lack endowments in every characteristic. The coefficients effect shows that, if the lower segment had the same estimates as the upper segment, then their log profits would increase by 0.79. In this case, the differences mainly arise from how does the upper tier employs capital and labor. The latter factor is particularly problematic. Given that

lower-segment firms mainly rely in unpaid family labor, if they started paying wages and kept operating the way they do, then their profits would be reduced by about one fourth.The gender and managerial features are also significant. Overall, the results show that the main problem of the lower-segment microenterprises is that they are severely constrained in terms of capital.

The Oaxaca-Blinder analysis provides other complementary insights. First, the upper segment is better at managing capital stock when compared with the middle segment, and better in managing both capital and labor relative to the lower segment. Second, the upper and lower segments significantly differ in all effects: endowments, coefficients and interactions. Third, during the 1990s the upper and middle segments used to be more similar. Despite the affinity of their empirical profiles, the differences on the effects of features, gender and capital broadened.

Even when specific hypothesis would have to be tested in the field, the results of Oaxaca-Blinder decomposition suggest that the middle and lower segments would need different approaches to alleviate their capital constraints. On the one hand, a policy that targets the middle segment should consider that the provision of credit or saving devices would have to be complemented with an improvement of their managerial skills and financial literacy. On the other hand, financing the lower segment might be an appropriate measure. For example, the recent intervention of *Prospera* that aims at promoting entrepreneurial activities among the poorest households could become particularly relevant for poverty alleviation.

5.8 Discussion

Section 6 shows that, on average, microenterprises from the middle and lower segments have high marginal returns to capital. Then, *Section 7* shows that the endowment effects of those two segments are significant when they each one of them is compared with the upper segment. In sum, both sections show that microenterprises can be highly profitable and that they do lack capital. Interestingly, despite their lower socioeconomic profile, this is especially true for firms at the lower segment. Furthermore, as explained in *Section 2*, finding different levels of marginal returns to capital shows that there is a large share of capital-constrained firms and thus that capital is misallocated in the Mexican economy.

The literature considers capital markets imperfections as an economic constraint that promotes inefficiencies in production (e.g.Tybout 1983; Bigsten et al. 2003). However, even in a context of capital market imperfections and capital misallocation, a rational behavior of firms with high marginal returns would be to bootstrap their way up by reinvesting their profits (McKenzie and Woodruff, 2006). The accumulation of internal funds to overcome financial constraints is a transition dynamic that is often overseen in analyses Moll (2014).

Capital accumulation is central to economic growth. If a reinvestment channel is plausible and the high marginal returns to capital have been present for at least two decades, then we should observe that microenterprises increased their capital stock and therefore their profits. However, as shown in *Sections 3* and *5*, the means and medians suggest mixed evidence.

Table 18: Oaxaca-Blinder decomposition of differences in mean profits between groups

	Upper segment = S1 = 1		**Upper segment = S1 = 1**	
	Middle segment = S2 = 0		**Lower segment = S2 = 0**	
	2010s	**1990s**	**2010s**	**1990s**
	(1)	**(2)**	**(3)**	**(4)**
Segment 1	6.729***	6.661***	6.728***	6.631***
	(0.014)	(0.013)	(0.014)	(0.013)
Segment 2	5.993***	5.904***	5.258***	5.113***
	(0.015)	(0.015)	(0.009)	(0.008)
Difference	0.736***	0.758***	1.471***	1.519***
	(0.020)	(0.020)	(0.016)	(0.015)
Endowments				
Total	0.079**	0.005	1.131***	1.105***
	(0.027)	(0.025)	(0.023)	(0.021)
Capital	0.048*	-0.035	0.531***	0.423***
Labor	0.026*	0.002	0.068	0.229***
Woman	-0.007*	-0.002	0.152***	0.080***
Education	-0.003	-0.006	0.102***	0.096***
Features	0.021***	0.007	0.081***	0.070***
Management	-0.010	0.028	0.233***	0.117*
Institutions	-0.000	-0.000	0.016*	0.037***
Industry	0.004	0.002	-0.051***	-0.021**
Coefficients				
Total	0.527***	0.426***	0.787***	0.503***
	(0.035)	(0.036)	(0.057)	(0.066)
Capital	0.540***	1.613***	-0.284**	0.397***
Labor	-0.122	-0.242	-0.386***	-0.822***
Woman	0.021**	0.006	0.156***	0.084***
Education	0.026	-0.001	0.003	0.011
Features	-1.128***	-0.069	-0.308	-0.339
Management	-0.315	-0.572*	-0.305*	-0.300*
Institutions	0.028	-0.009	0.005	-0.007
Industry	0.041	0.090	0.020	0.064**
Interaction				
Total	0.131***	0.327***	-0.448***	-0.089
	(0.039)	(0.039)	(0.058)	(0.067)
Year effects	Yes	Yes	Yes	Yes
Observations	3,300	3,897	11,920	14,686

Standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05

In what follows, the possibility of a bootstrapping behavior during the past years is further analyzed. First, it should be recalled that *Appendix 2A* shows that firms at the lowest tiers of capital are precisely the ones that increased their capital levels the most over time [66]. This is in line with expectations because those are the firms that exhibit the highest marginal returns. However, such capital stock increase was modest and did not matched the very high marginal returns. Furthermore, despite capital accumulation, monthly profits decreased over time.

The second approach that I follow to provide evidence on the bootstrapping mechanism is to rely on a local polynomial smooth plot. Given that the ENAMIN is cross sectional data, it is not possible to track the same economic units over time. However, it is possible to capture their intertemporal behavior to a certain extent by comparing the levels of capital stock over age of the firms. I thus run a regression with the natural logarithm of capital stock as dependent variable and nine industry dummies as controls. The OLS is run separately for each decade. Then, the evolution of the residuals with respect to firm age is plotted. Accordingly, *Figure 8* depicts the behavior of capital during the 1990s and the 2010s while accounting for industry effects. It can be observed that microenterprises have increased their capital stocks over time, especially older firms. The difference becomes economically significant for firms with more than six years of existence. In other words, when both decades are compared, the data shows that firms were similarly capitalized at the moment of starting operations. Once they overcame the initial business stage, they increased their investment levels as they aged. For example, there is a difference of approximately 0.3 log units between 20-year-old firms across decades. This is equivalent to a capital increase of about 30 percent.

[66] This is further observable in *Appendix 2A*, where the distribution of capital and profits can be observed by percentiles.

Table 20: Marginal returns to capital by segments and premise usage

2010s				1990s			
Segments		**Premises**	**No premises**	**Segments**		**Premises**	**No premises**
Upper	**mean**	1	1	**Upper**	**mean**	1	1
	sd	2	2		**sd**	3	1
Middle	**mean**	10	20	**Middle**	**mean**	7	32
	sd	110	199		**sd**	32	129
Lower	**mean**	10	38	**Lower**	**mean**	27	54
	sd	232	378		**sd**	782	252

I do the same exercise by firm segments and find that, in all three cases, the pace at which microenterprises accumulate capital used to be higher during the 1990s. It is also possible to observe, that during the 2010s, firms that have been operating for less than 35 years have a positive though smooth accumulation of capital. "Old firms" have the most capital. This is especially the case for the upper segments, which have higher levels of capital and a higher accumulation rate for a more prolongues time span. Lastly, it is interesting to notice that, despite the high MRK that the lower segment exhibits, their capital accumulation is low in absolute and relative terms.

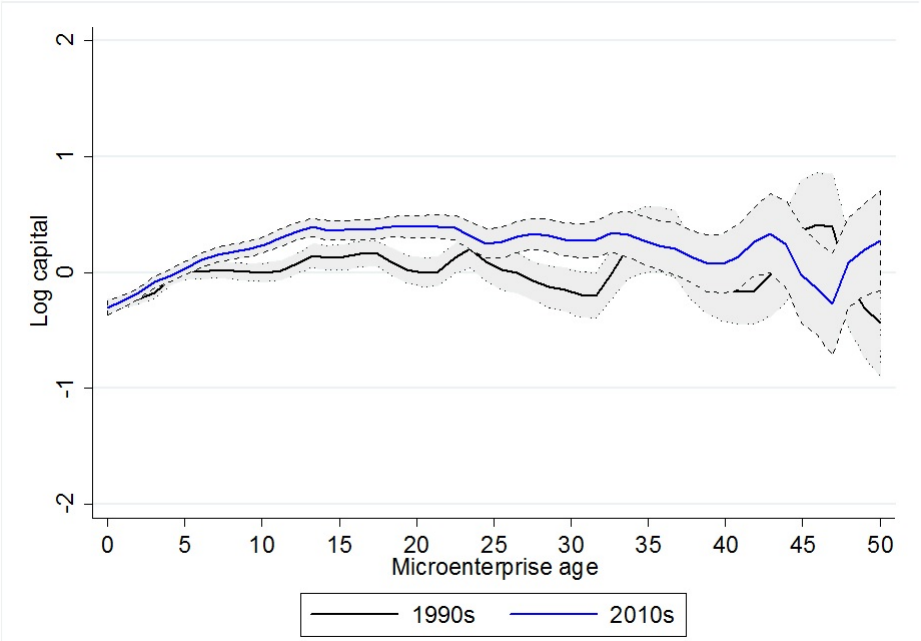
The third mechanism to explore reinvestment patterns that I consider is horizontal growth. Specifically, I rely on the 2010s ENOE surveys to explore whether entrepreneurs use their profits to start a new business instead of reinvesting in the firm that originated that income. This is a sensible behavior because it could depict risk diversification. However, I find that only 0.4 percent of firm owners grow horizontally and this holds true across sectors. When making the partitioning by levels of capital I find that horizontal growth is more common in firms with very low capital levels (0.6 percent). This, again, is consistent with the finding of significantly high levels of marginal returns in the lowest segments of capital.

Overall, microenterprises seem to be reinvesting. However, the pace is very low and inconsistent with the observed high marginal returns to capital. This low reinvestment behavior might partly explain why profits did not increased over time. Future studies should rigorously test this inconsistent behavior. In what follows, I provide some initial insights. First, *Table 20* characterizes the marginal returns to capital according to their use or lack of premises. It is found that the very high marginal returns that microenterprises exhibit at the middle and lower segments only holds for those that lack a permanent establishment to operate. This holds across decades.

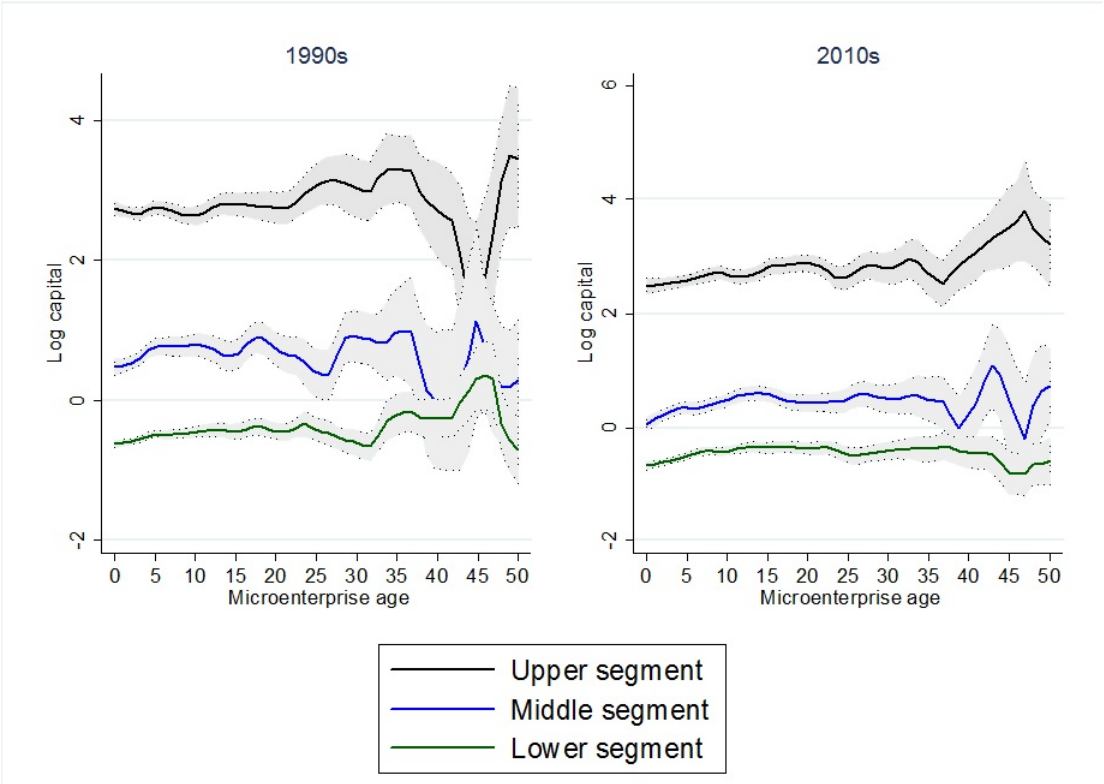
To verify that microenterprises without premises have higher marginal returns I perform two robustness checks. First, I rerun the whole analysis on a sub sample that excludes firms lacking premises (*Appendix 2F*). The qualitative results are the same: the share of middle segment firms increased over time and firms at the lower segment have the highest marginal returns from all three groups. However, when only firms with premises are considered, it can be observed that the average marginal returns are lower across all segments. Also, the levels are rather moderate. Lower segment firms have the highest average of marginal returns with six percent during the 2010s. Second, I

Figure 8: Local polynomial smooth plots: Log capital and microenterprise age

Comparison across decades



Comparison across segments per decade



Note: 95% CI. Kernel epan2.

compare the marginal returns by capital percentiles and find that firms without premises do have substantially higher marginal returns at the lowest tiers (*Appendix 2G*).

To explain the differences of marginal returns across firms with and without premises I first consider the costs structure of these firms. As shown in *Appendix 2H*, microenterprises present a similar cost structure across all expenditures, except for (i) transport, (ii) fuels and (iii) rent. The cost share difference for each expenditure is around 10 percentage points. For example, firms without premises spend, on average, less in rent (12 percent *versus* 2 percent), but have to pay more for combustibles (12 percent *versus* 22 percent) and for transportation (3 percent *versus* 14 percent). Therefore, the costs structure is not enough to explain the high profitability of microenterprises without premises. In other words, these firms might spare themselves the cost of rent; however, such advantage fades out because they need to pay more for transportation and fuels in order to operate.

Another explanation could be that lacking premises increases entrepreneurs' mobility and thus enables them to reach their clients more easily. In this case, if microenterprises operate without premises, then the features of the chosen place may provide them with an environment that enables them to generate very high marginal returns. The data shows that this might be the case because the marginal returns to capital do vary depending on the features of the place where they operate (*Appendix 2I*). For example, the dis-aggregation shows that the most profitable microenterprises are those that (i) operate as ambulant firms, (ii) have an improvised structure or (iii) visit clients at their homes. The case of ambulant firms is particularly notorious because their average marginal return is 85 percent.

Mobility seems to explain the apparent contradictory observation of "high marginal returns without substantial reinvestment". Entrepreneurs that operate without premises and are oriented towards mobility might be able to capture more business opportunities. For example, by exposing their product to more potential clients. Furthermore, they might be able to adjust their supply based on temporal and geographical considerations by offering their products whenever and wherever people happen to agglomerate. Under this logic of operation, reinvesting in capital would diminish their mobility and therefore their profitability. There is indeed a negative correlation between capital stock and the profitability of firms without premises (*Appendix 2G*). It is also observable that entrepreneurs whose overall profile makes them less likely to be successful (lower segment) are precisely the ones that would most likely operate their firm as a mobile economic unit (*Appendix 2I*). For example, there is indeed a negative correlation between educational attainment and running a mobile firm.

The idea of mobility as enabler of high profitability levels is further supported when the main problems that these entrepreneurs report are taken into consideration. A lower share of "mobile" entrepreneurs reports sales and high competition as the main problem that their business face. For example, the share of lower segment firms with sales problems decreases by about 10 percentage points when they do not rely on premises (26 percent *versus* 35 percent).

One last possibility that should be considered is that microenterprises do not reinvest to avoid being detected by the authorities. The study of Leal-Ordonez (2014) finds that the capital-labor ratios for microenterprises are heterogeneous instead of constant (as

it would be expected on a typical model of heterogeneous firms without distortions). Furthermore, he finds that there is a capital level that informal establishments do not exceed. This supports the notion that, despite their high marginal returns, reinvesting in their firms may turn them more visible and therefore put them at risk of being detected as informal economic units. This is further supported by the data because the share of firms that report having a problem with the authorities is low and appears to stay constant across all firm segments. Given that there is a positive correlation between the probability of success and the interaction with governmental institutions, it may be the case that the level of capital that microenterprises display is optimal according to their informality levels.

5.9 Conclusions

Despite the liberalization reforms that were introduced about three decades ago, the performance of most Mexican economic units remained below expectations. The levels of capital stock and profits have not substantially changed among microenterprises; nor has their average size. This is especially surprising when it is further considered that schooling levels, business experience and the share of female entrepreneurs rose between the 1990s and the 2010s.

Microenterprises are highly heterogeneous and this paper classifies them into three segments according to their empirical probability of becoming successful: upper, middle and lower. The grouping of firms into segments is based on their empirical characteristics and provides a clear cutoff that enables an objective comparison of groups. The analysis shows that there are some behavioral features that significantly predict entrepreneurial success: use of premises, book keeping, start the business due to family tradition or to increase income, provide employment and pay a wage to workers, and interaction with institutions.

The study also shows that the share of middle segment firms increased over time and that their marginal returns to capital remained relatively high at around 15 percent. This observation provides evidence of an increase in profitable firms whose constraints are mostly external. These microenterprises exhibit constrained productivity and a plausible potential of growing. The middle segment is particularly relevant because cost-effective policies such as provision of credit and savings accounts may be applicable. Such targeted interventions are more likely to be effective in the short run because the profile of middle segment firms is already very similar to the profile of top performers (upper segment).

The lower segment has different features. The entrepreneurs have a low profile and, surprisingly, their firms exhibit very high marginal returns. The Oaxaca-Blinder decomposition further shows that the main difference between their performance and that of the upper segment can be explained by a lack of endowments, especially capital. When the marginal returns to capital are further stratified, it is found that firms that operate without premises are precisely the ones that bring the average up. This finding provides some insights about the puzzle of "high marginal returns without substantial reinvestment" and introduces a new perspective about the relevance of the business environment.

Overall, this paper shows evidence about the existence of capital misallocation in the economy throughout the past decades. Entrepreneurs need to invest in their businesses; however, they face different types of constraints. The insights provided throughout the chapter are numerous and highly detailed. For example, the main growth impediments for some firms are external constraints. However, some others need to improve their socioeconomic and behavioral profiles. Lastly, it is worth thinking of an integral approach that tackles firms with very high marginal returns and no premises. Their ability to produce revenues is remarkable, but their incentives to reinvest and to approach institutions ought to be aligned. In conclusion, policies should contemplate the differentiated needs of each segment.

5.10 References

Ayyagari, M., Beck, T., and Demirguc-Kunt, A. (2007). Small and medium enterprises across the globe. *Small Business Economics*, 29(4):415–434.

Banerjee, A. V. (2001). Contracting constraints, credit markets and economic development. In *Advances in Economics and Econometrics: Theory and Applications*, volume III. Cambridge University Press.

Banerjee, A. V. and Duflo, E. (2005). Growth theory through the lens of development economics. *Handbook of Economic Growth*, pages 473–552.

Banerjee, A. V. and Newman, A. F. (1993). Occupational choice and the process of development. *Journal of Political Economy*, pages 274–298.

Beck, T., Demirguc-Kunt, A., and Levine, R. (2005). Small and medium enterprises, growth, and poverty: Cross-country evidence. 10(3):199–229.

Bigsten, A., Collier, P., Dercon, S., Fafchamps, M., Gauthier, B., Gunning, J. W., Oduro, A., Oostendorp, R., Patillo, C., Soderbom, et al. (2003). Credit constraints in manufacturing enterprises in africa. *Journal of African Economies*, 12(1):104–125.

Blinder, A. S. (1973). Wage discrimination: Reduced form and structural estimates. *Journal of Human Resources*, pages 436–455.

Boehme, M. H. and Thiele, R. (2014). Informal-formal linkages and informal enterprise performance in urban west africa. *The European Journal of Development Research*, 26(4):473–489.

Cepeda, L. E. T. and Ramos, L. F. C. (2015). Patterns of tfp growth in mexico: 1991-2011. *The North American Journal of Economics and Finance*, 34:398–420.

Chiquiar, D. and Ramos-Francia, M. (2009). Competitiveness and growth of the mexican economy. *Banco de Mexico, Documentos de Investigacion*, 11.

Cunningham, W. and Maloney, W. F. (1998). Heterogeneity among mexico s microenterprises: an application of factor and cluster analysis. *World Bank Publications*, (1999).

De Mel, S., McKenzie, D., and Woodruff, C. (2008). Returns to capital in microenterprises: Evidence from a field experiment. *The Quarterly Journal of Economics*, 123(4):1329–1372.

De Mel, S., McKenzie, D. J., and Woodruff, C. (2009). Measuring microenterprise profits: Must we ask how the sausage is made? *Journal of Development Economics*, 88(1):19–31.

Fafchamps, M., McKenzie, D., Quinn, S., and Woodruff, C. (2011). When is capital enough to get female enterprises growing ? evidence from a randomized experiment in ghana. *World Bank Policy Research Working Paper Series*, pages 1–44.

Fajnzylber, P., Maloney, W., and Rojas, G. M. (2006). Microenterprise dynamics in developing countries: How similar are they to those in the industrialized world? evidence from mexico. *The World Bank Economic Review*, 20(3):389–419.

Falco, P., Kerr, A., Rankin, N., Sandefur, J., and Teal, F. (2011). The returns to formality and informality in urban africa. *Labour Economics*, 18:S23–S31.

Grimm, M., Knorringa, P., and Lay, J. (2012). Constrained gazelles: High potentials in west africa's informal economy. *World Development*, 40(7):1352–1368.

Grimm, M., Krueger, J., and Lay, J. (2011a). Barriers to entry and returns to capital in informal activities: Evidence from sub-saharan africa. *Review of Income and Wealth*, 57(s1):s27–s53.

Grimm, M., Van der Hoeven, R., and Lay, J. (2011b). Unlocking potential: Tackling economic, institutional and social constraints of informal entrepreneurship in sub-saharan africa. main findings and policy conclusions. *World Bank Policy Research Working Paper Series*.

Hanson, G. H. (2010). Why isn't mexico rich? *Journal of Economic Literature*, 48(4):987–1004.

Harris, J. R. and Todaro, M. P. (1970). Migration, unemployment and development: A two-sector analysis. *The American Economic Review*, pages 126–142.

Hart, K. (1972). Income and equality: A strategy for increasing productive employment in kenya. *International Labour Organization Publication*.

Hsieh, C.-T. and Olken, B. A. (2014). The missing "missing middle". *Journal of Economic Perspectives*, 28(3):89–108.

Julien, P.-A. and Chicha, J. (1998). *The State of the Art in Small Business and Entrepreneurship*. Number Pierre-Andre. Ashgate, Aldershot, Hants, England, grepme-research group edition.

Leal-Ordonez, J. C. (2014). Tax collection, the informal sector, and productivity. *Review of Economic Dynamics*, 17(2):262–286.

Lewis, W. A. (1954). Economic development with unlimited supplies of labour. *The Manchester School*, 22(2):139–191.

Li, Y. and Rama, M. (2015). Firm dynamics, productivity growth and job creation in developing countries: The role of micro-and small enterprises. *The World Bank Research Observer*, 30(1):3–38.

Liedholm, C. and Mead, D. C. (1998). The dynamics of micro and small enterprises in developing countries. *World Development*, 26(1):61–74.

Lucas Jr, R. E. (1978). On the size distribution of business firms. *The Bell Journal of Economics*, pages 508–523.

McKenzie, D. and Woodruff, C. (2008). Experimental evidence on returns to capital and access to finance in mexico. *The World Bank Economic Review*, 22(3):457–482.

McKenzie, D. J. and Woodruff, C. (2006). Do entry costs provide an empirical basis for poverty traps? evidence from mexican microenterprises. *Economic Development and Cultural Change*, 55(1):3–42.

Mead, D. C. and Morrisson, C. (1996). The informal sector elephant. *World Development*, 24(10):1611–1619.

Moll, B. (2014). Productivity losses from financial frictions: Can self-financing undo capital misallocation? *The American Economic Review*, 104(10):3186–3221.

Nichter, S. and Goldmark, L. (2009). Small firm growth in developing countries. *World Development*, 37(9):1453–1464.

Oaxaca, R. (1973). Male-female wage differentials in urban labor markets. *International Economic Review*, pages 693–709.

Puyana, A. and Romero, J. (2012). Informalidad y dualismo en la economia mexicana. *Estudios Demograficos y Urbanos*, 27(2 (80)):449–489.

Siba, E. (2015). Returns to physical capital in ethiopia: Comparative analysis of formal and informal firms. *World Development*, 68:215–229.

Tybout, J. R. (1983). Credit rationing and investment behavior in a developing country. *Review of Economics and Statistics*, 65:598–607.

Tybout, J. R. (2000). Manufacturing firms in developing countries: How well do they do, and why? *Journal of Economic literature*, pages 11–44.

6 *Chapter 3.* Impact of Energy Price Changes on Performance

Hannes Greve and Ana K. Negrete-García

"While humankind has made enormous progress in improving material welfare over the past two centuries, this progress has come at the lasting cost of degradation of our natural environment. (...) Continuation along previously trodden economic growth pathways will further exacerbate the pressures exerted on the world's resources and natural environment, which would approach limits where livelihoods were no longer sustainable. Business as usual is thus not an option. (...) Hence, there is an urgent need to find new development pathways which would ensure environmental sustainability and reverse ecological destruction, while managing to provide, now and in the future, a decent livelihood for all of humankind. "

UNO, 2011. World Economic and Social Survey. p.V

Summary

Mexico is liberalizing its energy sector to address inefficiencies while simultaneously promoting climate change mitigation policies. In practice, combustible and electricity prices have increased recently. Despite the long term desirability of higher energy efficiency and lower pollution levels, the price increases will likely have an adverse impact on the performance of microenterprises in the short run. This paper thus studies how and by how much do changes in energy prices impact their performance. We highlight that microenterprises are predominant in the economic landscape of Mexico and that they provide both employment and income to poor individuals. The detailed firm-level dataset allows us to encompass informal and premise-lacking firms. First, we offer insights about energy use patterns and compute first-order impact estimates. Results show that energy use is highly heterogeneous across firms and that price increases of combustibles are expected to have stronger adverse effects than price increases of electricity on the microenterprise performance. Second, we estimate short run elasticities of input-demand and output-supply for a smaller subsample to assess further implications of rising energy prices, particularly with respect to labor demand. To our knowledge, this is the first study taking a microeconomic perspective on the short run implications of energy related reforms in Mexico.

6.1 Introduction

Mexico is undergoing a series of reforms aimed at three major policy fields related to the energy sector: energy production, energy consumption, and emission of greenhouse gases. These reforms thus assess three major challenges. First, state-owned companies that produce oil and electricity have been monopolies for decades with low reinvestment and upgrading levels. Furthermore, they remain profoundly intertwined with the government's budget. Second, subsidies have prevailed for decades and have introduced distortions in energy consumption for private and industrial purposes. Energy consumption growth is high relative to the economic growth that the country has experienced (Mehrara, 2007). Third, the disproportionally high energy consumption generates negative externalities for the environment. Climate change is a worldwide concern and Mexico is particularly vulnerable to its effects[67]. Due to its geographical features, the country is prone to droughts, floods, rising sea levels and other extreme events.

Increasing economic efficiency and halting environmental degradation have been addressed mainly with the introduction of the Energy Reform of 2013[68] and the General Law on Climate Change of 2012[69]. Both of them are based on market strategies and are expected to promote development in the long run. The corresponding liberalization of the energy sector and the introduction of a carbon tax are designed to influence energy prices and thus shall improve static and dynamic efficiency[70]. However, how and by how much energy prices will change is not clear. Complete liberalization is planned to occur in the upcoming years and, by definition, energy prices are supposed to fluctuate together with the global market prices. Nonetheless, there are some relatively foreseeable trends. On the one hand, it has been presumed that the energy reform will reduce prices by promoting competition and shifting production towards cheaper and cleaner energy sources (Alvarez and Valencia, 2016). On the other hand, the elimination of subsidies and the introduction environmental measures that consider the social and environmental costs of pollution are expected to increase energy prices. Thus, while energy prices are expected to decrease in the mid- to long-term, the short-term transition might result in higher energy prices for both consumers and producers.

[67] For a detailed description consult the SEMARNAT publication of the Special Climate Change Program 2014-2018.

[68] The reform promotes the liberalization of the electricity and oil markets. It encompasses various dimensions. Some of the most prominent aspects are (i) opening the oil state company (PEMEX) to private and foreign investment, and (ii) introducing competition in the electricity sector to reduce production costs.

[69] Climate policy is gaining a more prominent role in the government's agenda. In 2007 the National Climate Change Strategy was developed and there have been advances ever since. For example, the General Law on Climate Change of 2012 represented an important advance because it set binding emission reduction targets. Also, the country introduced a carbon tax scheme on fossil fuels in 2014 and a carbon offset market should be launched in 2017. Furthermore, the country ratified the Paris Agreement in 2016.

[70] Market-based instruments are more efficient from both static and dynamic perspectives (Milliman and Prince, 1989; Montgomery, 1972; Tietenberg, 1990). Some examples of instruments for environmental regulation are taxes and tradable permit schemes.

Indeed, the current observable trend is an increase of energy prices[71]. At least in the short run, energy price increases are likely to have adverse effects on the performance of producers. In this paper we focus on microenterprises because of their predominance in Mexico and vulnerability. These firms represent about 97 percent of the existent economic units[72] and exhibit constrained productivity (McKenzie and Woodruff, 2006, 2008). Price changes may thus become an additional constraint. Most importantly, microenterprises are the main source of employment and income of the poorest population.

Our paper estimates the impact of rising energy prices on microenterprise performance. This approach makes various contributions to the literature. Most importantly, our analysis offers detailed insights about potential short term impacts of reform-related energy price rises on firm performance. We focus on microenterprises, which are of considerable importance to the Mexican economy and which have been neglected in the academic literature thus far. The detailed dataset allows us to consider informal firms and firms without premises, thus shedding light on the effects over the majority of these productive units and on the population at the lower end of the income distribution. Furthermore, input-demand and output-supply elasticity estimates are derived from a translog profit-function estimation for a small subsample thus providing first insights about interlinkages between energy use, employment, production and investment.

We find that energy usage rates are highly heterogeneous across microenterprises and positively correlated with higher microenterprise performance. Price increases of combustibles are expected to have larger effects on microenterprise performance than price increases of electricity due to higher variable cost shares. We also find large differences in profit loss estimates across industries.

Our analysis emphasizes that, even when recent reforms are tackling relevant long term concerns, in the short run, the impact on a large proportion of microenterprises is likely to be negative. Microentrepreneurs and their employees are expected to have limited adaptation capacity to energy price increases. Therefore, current reforms could be complemented with measures that enable a smoother transition for these relevant economic units.

The paper is organized as follows. *Section 2* presents state of the art research by piecing together studies about energy use, climate change policies and microenterprise performance. *Section 3* provides a descriptive overview of microenterprises and their energy use patterns. *Section 4* computes first and second-order effects of rising energy prices on firm performance. The second-order effects are computed using a translog profit function framework to obtain input-demand and output-supply elasticities, which are then used as behavioral parameters to estimate profit losses. *Section 5* identifies the relationship between labor, capital and energy to classify the inputs as complements or substitutes. It further discusses the policy implications. *Section 6* concludes.

[71] During a one year span (Jan.2016-Jan.2017) the price of gasoline increased by approximately 20 percent (mainly between Dec.2016-Jan.2017); similarly, the price of electricity rose about 12 percent (*Appendix 3A*).

[72] This is an own computation based on merging the 2009 Economic Census and the National Survey of Microenterprises. By accounting for firms that are informal and for those that lack premises this statistic provides an objective overview of the economic panorama.

6.2 Related literature

Studying the energy-output causality relation is fundamental to guide policies. In particular, it allows obtaining insights about the likely impact that a change in the availability of energy resources would have over GDP levels. Therefore, a better understanding of the interrelation between energy use and GDP levels enables policy makers to promote economic growth while reconciling economic, social and environmental concerns.

There is a wealth of literature studying the relationship between energy consumption and economic growth. It has been shown that there is a positive and significant correlation between energy use and GDP growth. However, there is no consensus about the direction of causality. The conclusion depends on the methodology, the case study, and the time period that are taken into consideration (Chontanawat et al., 2008; Ozturk et al., 2010; Sharmin and Khan, 2016; Shiu and Lam, 2004).

For the case of Mexico, Cheng (1997) found no evidence of causal linkages between energy consumption and economic growth. One decade later, the study of Mehrara considered Mexico together with other oil exporting countries and showed that there is a unidirectional strong Granger causality of economic growth on energy consumption. Both studies imply that energy use is neither a limiting factor nor a promoter of economic growth.

These two studies imply that, even if the newly introduced reforms reduced national energy consumption, there should be no backlash over growth. This conclusion has, however, a long term view. The energy-output literature is mostly composed of macroeconomic studies and time series data. Therefore, there is a research gap of microeconomic studies that assess short term implications. Furthermore, the study of Solow (1987) revisited the capital-energy complementarity debate and pointed out that micro level data diminishes aggregation bias[73].

There are few studies that assess the energy-output relationship from a microeconomic perspective. They conduct a more detailed analysis with firm level data by exploring the effect that energy price changes have over diverse outcomes that determine GDP levels. For example, Sadath and Acharya (2015) find that the fluctuation of energy prices adversely affects investment in the Indian manufacturing industry. Bardazzi et al. (2015) find that Italian manufacdturers are highly sensible to combustibles' price changes and that capital and energy are substitutes in the low technology sector.

Other studies specialized on price changes of either oil or electricity. Ratti et al. (2011) show that oil prices' fluctuation lowers investment levels of European firms. Henriques and Sadorsky (2011) find that oil prices' volatility promotes a U-shaped investment behavior because firms in the US strategically delay investment according to the level of uncertainty. Regarding electricity, Abeberese (2013) finds that higher prices impact the industry choices of Indian firms' and their productivity growth. These firms both reduce their energy consumption and switch to industries that are less electricity intensive.

[73]The intuition behind is that the estimates of the elasticity of substitution are likely to have a downwards bias when they are based on aggregate time-series because they capture more than just technological substitution.

Previous closely related studies have found that adjustments in energy tariffs result in welfare losses and suggest that complementary social measures might be desirable (Coady et al., 2006; Gomez-Lobo, 1996). However, they have focused on households' real income and there is barely any paper assessing the impact of energy price changes on the performance of productive units. The most similar work to our study that we are aware of is Haller and Hyland (2014). They rely on a translog cost function to estimate price elasticities and find that higher energy prices resulting from a carbon tax would not hinder capital investment in the Irish manufacturing sector.

6.3 Data and descriptive overview

6.3.1 Data set and basic descriptive statistics

The National Survey of Microenterprises (ENAMIN) is one of the most detailed and comprehensive surveys of its kind available for developing countries. The three-staged survey stems from the national employment survey (ENOE) and the data can be linked throughout all stages. This survey design provides a representative picture of formal and informal firms while also capturing those that lack premises. Therefore, the data collection is independent from microenterprises' administrative behavior and location. Furthermore, the ENAMIN is representative at the national level and its sampling design is probabilistic, stratified and conglomerated.

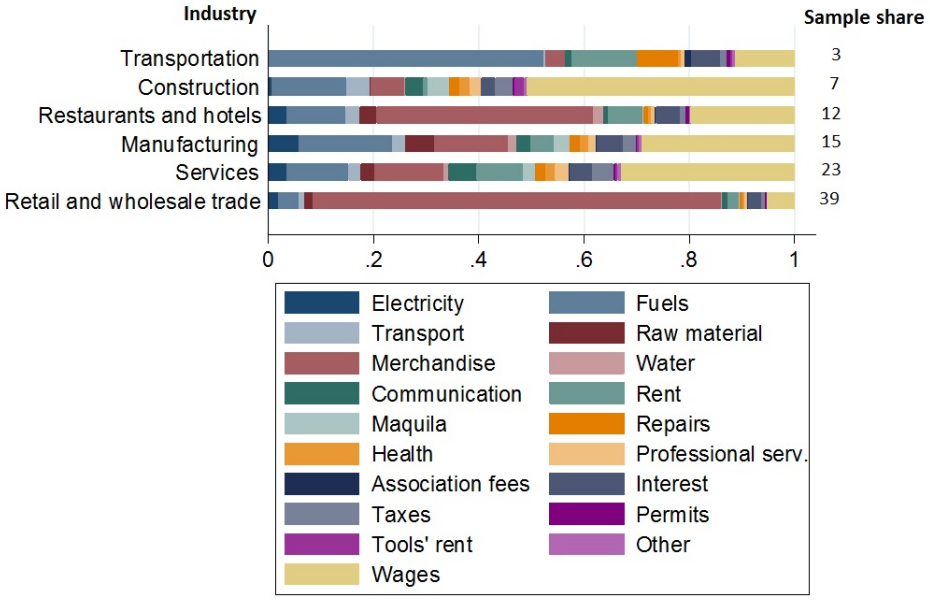
For the analysis, we pool together the cross-sectional surveys of 2010 and 2012. These are the most recent available surveys, they are highly homogeneous, and the production structure reported is very detailed. Furthermore, the whole Mexican territory is considered, meaning that 60 percent of the firms lie in urban areas[74] and the rest operate in rural areas. The considered microenterprises employ up to ten workers and the corresponding entrepreneurs may be men or women with a minimum age of 15 years. The final sample thus comprises 51,274 observations (approx. 25,500 per year)[75].

The data allows a disaggregation of up to 4 digits to identify economic activities. We group microenterprises into six industries, where retail and wholesale trade encompass the majority of the sample (39 percent). *Figure 9* depicts the relationship between energy use and industry composition. The relative importance of energy inputs measured by their cost share is high, but varies across industries. Firms engaged in transportation have the largest consumption share of combustibles (60 percent) and spend little in electricity (4 percent). Construction follows a similar pattern with 42 and six percent respectively. In general, the combustible expenditure share is relatively large across all industries. Microenterprises engaged in retail and wholesale trade are

[74]There are 32 major cities considered: Acapulco, Aguascalientes, Campeche, Cancún, Chihuahua, Colima, Cuernavaca, Culiacán, DF, Durango, Guadalajara, Hermosillo, La Paz, León, Mérida, Monterrey, Morelia, Oaxaca, Pachuca, Puebla, Querétaro, Saltillo, SLP, Tampico, Tepic, Tijuana, Tlaxcala, Toluca, Tuxtla, Veracruz, Villahermosa, Zacatecas.

[75]The nominal values of responses are first converted into 2016 MXP using the GDP deflator by considering that each ENAMIN wave was collected between October and December. Afterwards, each variable is converted into USD. This exchange rate volatility while allowing for comparability. The considered MXP-USD exchange rate is 18.102 which, just as the GDP deflator (INPC), corresponds to February 2016.

Figure 9: Average expenditure structure by industry



Notes: (1) The cost structure is comprised by the expenditure share of each input relative to total expenditure. The shares reported correspond to the observed average expenditure per output across industries. (2) The cost structure comprises all the expenditures reported by each microenterprise plus wages. It should be bear in mind that family labor and non-paid labor is a common feature among microenterprises. (3) The qualitative findings hold when wages are excluded. (4) The cost share further disaggregated by industry. Correspondingly, industry (share) indicates the percentage of microenterprises that engage in each industry. Adding up these percentages may exceed 100 because of rounding.

Table 21: Comparison of cost shares by profits quartiles

National level			Quartiles			
	Mean	Std. dev.	1st	2nd	3rd	4th
General Characteristics						
Physical capital (USD)	4,662.56	20,946.04	708.02	1,696.05	3,371.04	9,865.69
Monthly profits (USD)	311.65	526.58	43.95	135.70	272.96	803.99
Monthly wage per worker (USD)	223.92	315.90	83.52	128.67	190.20	269.87
Labor (weekly hours)	62.73	60.20	33.25	52.14	66.54	96.95
Firm size (total workforce)	1.62	1.14	1.23	1.42	1.60	2.20
Owner is a woman	0.50	0.50	0.80	0.59	0.38	0.23
Electricity						
Firms that spend in electricity	0.47	0.50	0.32	0.46	0.50	0.59
Expenditure share (full sample)	0.06	0.13	0.07	0.06	0.06	0.04
Expenditure share (electricity users)	0.12	0.16	0.19	0.13	0.11	0.07
Average expenditure of users (USD)	14.10	57.81	3.42	8.66	13.29	28.85
Consumption in kWh	125.40	218.17	58.26	97.20	125.94	207.06
Combustibles						
Firms that spend on combustibles	0.44	0.50	0.20	0.37	0.51	0.69
Expenditure share (full sample)	0.16	0.27	0.10	0.14	0.19	0.20
Expenditure share (combustibles users)	0.33	0.30	0.44	0.36	0.35	0.28
Average expenditure of users (USD)	52.56	186.91	7.00	22.23	50.91	127.15
Observations	51,274	51,274	12,069	11,672	12,034	11,679

Notes: (1) As explained in *Appendix 3B*, the consumption in kWh was estimated by taking into consideration block tariffs. (2) Nominal values correspond to 2016 MXP and are reported in USD.

the only exception since they have low expenditure shares for both energy inputs. The firms with the largest expenditure in electricity (14 percent) belong to manufacturing and also have high consumption of combustibles (26 percent). All service industries show a similar proportion.

In what follows we present the characteristics of microenterprises together with their energy consumption profile. The average microenterprise in the sample engages in retail trade, has no premises and is owned by a 45 year old man. He is the head of household and finished primary school. He has been running his business for about ten years and has experience as a wage worker. He usually works on his own, but if he happens to have employees, he relies on family members without paying them. The business operates with about 4663 USD of capital[76] and generates around 312 USD per month on profits[77]. The firm is registered with neither government institutions, nor trade associations.

[76]Physical capital, also referred as capital throughout the text, is measured by the replacement costs of tools, utensils, machinery, furniture, equipment, land, and vehicles that are property of the entrepreneur and employed for business purposes. It excludes firm inventories because this concept is further disaggregated into specific inputs of the cost structure.

[77]We use monthly profits as captured by the question: "How much do you normally earn after deducting expenses?", because the measurement error is smaller relative to the computation of income minus costs De Mel et al. (2009).

Regarding energy use, the data shows that it is slightly more common that microenterprises spend on electricity (47 percent) than on combustibles (44 percent). However, combustibles represent a higher share of total costs. For instance, the average monthly expenditure of microenterprises on electricity is 14 USD and 53 USD on combustibles[78].

Table 21 shows some descriptive statistics by profit quartiles to highlight heterogeneous characteristics based on differences of performance. It can be observed that the more profits microenterprises make, the more common it is that they spend on electricity and combustibles. Interestingly, the take up rate is higher for the case of combustibles. Also, there is a positive correlation between profits and the consumption of electricity (kWh). Correspondingly, the higher the monthly profits are, the higher the monthly expenditure on electricity is in absolute terms. However, if electricity expenditure is considered as a cost share, then it can be observed that firms with high profits pay relatively less for electricity.

Overall, the poorer firms are[79], the more expensive energy becomes relative to their expenditure in other production inputs. This showcases vulnerability of poor firms that are energy intensive to energy price increases. When this analysis is done by further differentiating among rural and urban areas, the qualitative conclusions are the same.

6.3.2 Descriptive characterization of energy use

Most microenterprises (68 percent) have at least one sort of energy expenditure. However, only 23 percent of the firms rely on both electricity and combustibles as inputs. *Appendix 3C* shows a detailed description of the firms' characteristics and partitions the data into subsamples of users and non-users[80]. Depending on the considered subsample, the share of energy expenditures differs[81]. For example, electricity users have similar cost shares for electricity (12 percent) and combustibles (11 percent). Contrarily, firms that rely in combustibles have a relatively low expenditure on electricity (four percent) and high expenditure on combustibles (33 percent).

Although the majority of microenterprises use at least one source of energy, about one third of them use neither electricity nor combustibles. Firms without energy expenditures perform substantially below average. The exact opposite occurs with those that rely in both combustibles and electricity. For example, firms that report using both types of energy sources have about 17 times more physical capital and generate 3 times more profits than those reporting none.

[78]The dataset allows differentiating between zero expenditure and missing values for all inputs; including energy inputs. However, it is not possible to distinguish whether all microenterprises reporting zero expenditure on energy in fact do not consume any energy input at all or whether they get it illegally. In the case of electricity, CFE periodically reports that part of its production is lost due to the pervasive practice of using the so called "diablitos", which are devices to steal electricity. During 2014 the loss was estimated to be around fourteen percent of production in the metropolitan area of Mexico City.

[79]The word "poorer" is considered from an income perspective. The partitioning of *Table 21* was done by profits quartiles; however, when capital is considered, then the qualitative conclusions are the same.

[80]Section 3.2 is mainly based on *Appendix 3C*.

[81]Wages are excluded from the sample because non-paid labor is very common.

Overall, energy consumption of both, electricity and combustibles has a positive and significant correlation with the following variables: (i) Performance indicators such as monthly profits, hours worked per week, and firm size. (ii) Input usage such as physical capital and human capital. (iii) Formality either measured as payment of taxes or provision of health services. The correlation is higher when fiscal contribution is used as an indicator of formality. For example, about 78 percent of microenterprises do not pay taxes and 84 do not provide health services. These percentages decrease to 55 and 77 respectively when firms use both types of energy resources.

The positive correlations that were just described are in line with some empirical evidence. For example, Tybout (2000) highlights that access to energy is a decisive infrastructure component for enterprise success. The literature has mainly focused on electricity, though. Some studies have found that electricity access is fundamental to increase productivity and the overall performance of small scale firms (e.g. Kirubi, 2006; Fakira, 1994; Little, 1987). Also, Grimm et al. (2013) show a positive impact on the upgrade of machinery and processes in African microenterprises.

Contrarily, there is a negative correlation between energy use and certain firm characteristics; namely, female ownership, one-person firms, and the share of paid workers. The correlation is not significant in the cases of owner's age, credit usage and firm's age.

Regarding gender, female entrepreneurs tend to spend less in combustibles as a share of total expenditure. However, there is no difference among men and women when electricity is considered[82]. There are fewer firms (37 percent) led by women that simultaneously use electricity and combustibles.

One person firms are the most common type of microenterprises representing two out of three firms. This kind of self-employment has a strong negative correlation with overall firm performance. In terms of energy use, it is observed that there is no relevant difference between energy costs shares of one person firms and employment providers. For example, the former exhibit an average expenditure of 17 percent on combustibles and 7 percent on electricity. The corresponding percentages for larger firms are 14 and 5 percent respectively. However, it is significantly less common that one person firms use energy inputs.

Only about 35 percent of firms have employees. On average, 72 percent of these workers are family members and 47 percent of them are paid a wage. The data shows that there is a negative correlation between energy expenditure and the share of paid workers. The correlation is positive with respect to reliance on family labor. Also, microenterprises that exclusively employ family members and do not use any kind of energy inputs perform significantly below average.

A major observation is that having a permanent establishment for daily operations is a strong predictor of energy use and firm success. Only about 35 percent of microenterprises have premises and they perform above average. For example, the average monthly profits of firms with premises roughly two folds those without premises. The corresponding ratio for capital is about five to one. Interestingly, most microenterprises

[82]The average cost share that fuels represent in female lead microenterprises is eleven percent. This share is five percent for electricity. The corresponding shares for male lead microenterprises are 21 and five percent respectively.

(88 percent in this case) that have premises also have electricity, whereas the proportion lowers to one in four when firms lack premises[83]. Contrastingly, there is almost no difference in the expenditure pattern of combustibles (49 and 41 percent respectively).

Lastly, an imperfect financial market is often portrayed as a major constraint for efficient production in microenterprises (e.g. Bigsten et al., 2003; Tybout, 1983). However, the data suggests that energy use is not a constraint that microenterprises usually solve with credit. The correlation between energy expenditure and credit use is in fact negative, though insignificant. Interestingly, there is no substantial difference in credit reliance between energy users and non-users. Indeed, the share of firms that use credit ranges between seven and eight percent across all subsamples[84]. Therefore, the insight about the need of complementing access to electricity with access to credit[85] (Motta and Reiche, 2001) may not be unequivocal for the case of Mexico.

6.4 First-order estimation of profit losses

In this section we compute first-order (FO) estimates of the impact of rising energy prices on firm profits by multiplying the initial cost share with a one percent price increase. It should be noted that this simplification does not take into account firms' adjustments of their production structure after price increases . Nevertheless, it is useful to think of it as an upper bound to the short-term impact. By construction, any variation of the FO impact stems from variation in the variable cost share[86]. Thus, we provide a first insight about the magnitude and heterogeneity of effects of rising energy price on microenterprises in Mexico.

$$FO_E = \Delta P_E * \frac{expenditure_E}{Total\ expenditure} \tag{34}$$

$$\text{Where } E = electricity, combustibles$$

To characterize the impacts' heterogeneity, we first divide average estimates into full sample and a subsample containing microenterprises with strictly positive energy demand. Second, we provide impact measures over profit percentiles as a proxy for performance . Lastly, we expect that microenterprises without premises have different

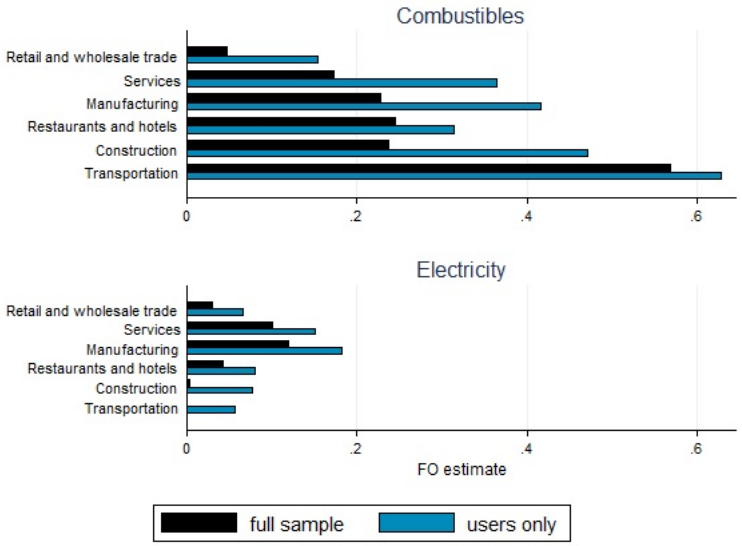
[83] When firms report not having premises and are using electricity, then they are most commonly operating from home (45 percent). About three fourths of microenterprises that operate in premises use them for trade and to provide services. When firms use both, electricity and combustibles, then the share that operates workshops increases to about one in four.

[84] About 8.2 percent of firms that use both types of energy sources relied on credit to start their business. The corresponding percentage is 7.8 percent for firms that use either electricity or combustibles. Lastly, about 7.6 percent of firms that do not use any source of energy for their daily operations report having relied on credit.

[85] In their report about a rural electrification project in Nicaragua, Motta and Reiche (2001) suggest that access to energy should be complemented with other services such as credit in order to have a meaningful impact on microenterprise performance.

[86] This can be seen in the formula: When energy prices increase by the same amount for every firm, any variation stems from the ratio between energy expenditure to total expenditure.

Figure 10: FO impact of a one percent price increase on profits by industries



production technologies than firms with premises. Thus, we look at how FO-estimates differ between these two groups.

Figure 10 shows FO estimates for a 1 percent price increase by industries, where the industries are ordered by sample-share in descending order. As already discussed, combustibles play a larger role in the production process of microenterprises than electricity in terms of variable cost share, which translates into higher FO estimates. The data shows that, on average, the FO estimate for combustibles is 0.15 percent, and for electricity 0.7 percent. The highest effects for combustibles are found in the transportation service (0.57 percent) and construction industry (0.35 percent). The magnitude of this result is considerable. Firms in these industries seem to be highly specialized in energy-intensive economic activities, which translates into high vulnerability towards rising energy prices.

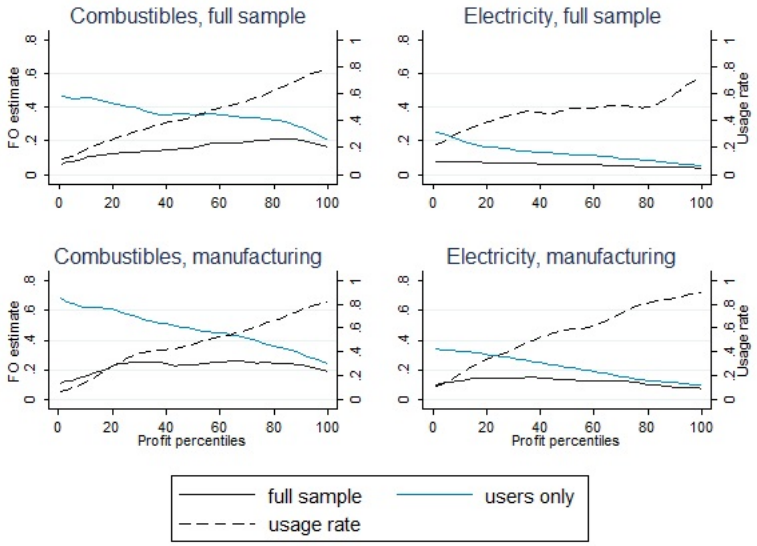
Some differences between full sample averages and "users only" averages exist, depending on the usage rate within each industry. In fact, we observe that FO estimates for microenterprises within the trade, services, manufacturing and construction industries differ substantially between samples, reflecting that microenterprises are heterogenous in terms of energy usage. In comparison to the FO impact figures for combustibles, electricity price increases are much smaller. Additionally, the order of industries which are most affected is reversed (except for the trade industry): FO estimates for electricity are largest in the manufacturing (0.18 percent) and services (0.15 percent) industries.

Figure 11 shows the incidence of estimated FO effects as well as the average energy usage rate over profit percentiles for the full sample and the manufacturing industry[87]. We pay particular attention to the manufacturing industry due to the high energy intensity and relatively large size of the industry[88]. First, we observe that energy use

[87]The graph shows nonparametric distributional curves calculated with a kernel-weighted local polynomial regression using the Epanechnikov kernel function.

[88]The average usage rate of energy inputs in the manufacturing sector is slightly higher than for

Figure 11: FO impact over profit percentiles for different samples



and profitability are positively correlated, as the usage rate of energy inputs increases steadily over profit percentiles for both combustibles and electricity. Second, average figures of the full sample suggest that profit losses are slightly regressive for electricity and progressive for combustibles. However, this pattern reverses when excluding firms that do not use energy inputs: firms with strictly positive energy demand at the low end of the profit spectrum would be particularly affected by energy price increases. Lastly, the same patterns emerge in the manufacturing industry, although the magnitude of estimated profit losses is higher due to the comparatively high average energy intensity.

Interestingly, manufacturing firms at the low end of the profit spectrum seem to have similarly low usage rates compared to the whole sample, and it is only at the top of the profit spectrum that microenterprises exhibit higher energy usage rates. Thus, rising energy prices are more likely to affect high performing firms (especially in the manufacturing industry). However, the low performing ones that use energy as inputs are potentially the most vulnerable. In those cases, firms are energy intensive while having fewer resources to adapt to price shocks. From a structural change perspective, their engagement in the manufacturing sector in spite of facing severe challenges seems promising. They participate in output production despite constraints and entry costs. Additionally, higher energy prices may become an entry barrier for specific economic activities for firms that do not (yet) use energy as an input.

Table 22 shows FO-estimates by premise-ownership. For combustibles, we observe that microenterprises without premises (Sample (1)) are particularly vulnerable to price increases, with a profit loss estimate that is twice as large. This is also true when computing average figures for firms with strictly positive combustible demand, although

the whole sample. About 47 percent of manufacturing firms report using combustibles and 56 percent electricity as an input, compared to 44 percent and 47 percent for the whole sample. Results for other industries are available upon request.

Table 22: FO impact by premise-ownership

	Without premises	**With premises**
	mean	**mean**
	(1)	**(2)**
Combustibles: FO estimate - Full sample	0.19	0.10
Combustibles: FO estimate - User	0.43	0.19
Combustibles: Usage rate	0.41	0.50
Electricity: FO estimate - Full sample	0.05	0.08
Electricity: FO estimate - User	0.17	0.09
Electricity: Usage rate	0.26	0.88
Observations	33438	17836

Notes: Mean estimates are found to be significantly different from each other between sample (1) and (2), as tested by two-sample t-tests with equal and unequal variances.

the magnitude roughly doubles. Usage rates for combustibles are only slightly differing for both firm categories (0.41 percent and 0.5 percent). Thus, we can conclude that differences in profit loss estimates for firms with and without premises are mainly driven by differences in variable cost shares.

The picture differs markedly for electricity. First, differences between average figures for the full sample are not as pronounced as for combustibles; and firms with premises are slightly more affected by rising prices. Second, differences in means between sample (1) and sample (2) are mainly driven by differences in usage rates rather than differences in variable cost shares. As a result, when computing the FO impact for firms with strictly positive demand, estimates are higher for firms that do not own premises. It is not surprising that firms with premises receive access to the electricity grid more easily. However, when firms without premises (meaning they operate on the streets or at home) use electricity, they are particularly vulnerable to rising electricity prices[89].

6.5 Input-demand and output-supply elasticities

We derive input-demand and output-supply elasticities (in quantities) for tortilla producers. We choose this relatively small subset of observations for two reasons. First, it is the firm-category with the most observations[90], so that we can credibly estimate output prices from the data (see *Appendix 3B*). Second, we want to estimate the production function for a homogenous group of producers to achieve highest precision of estimates.

Input-demand and output-supply elasticities provide valuable information about second-order effects for policy makers. When equipped with reliable estimates, we can provide sophisticated conjectures about short-term consequences of energy price

[89]The electricity case exemplifies that it is inherently difficult to disentangle business and household activities for these firm categories.

[90]We consider microenterprises whose only product is corn tortillas. This is equivalent to 486 observations. The sample is further reduced to 195 observations because of the missing values and the estimation procedure.

rises for labor demand, energy demand and production output. Specifically, we are interested whether labor and energy are complements or substitutes. When they are complements, negative short-term consequences of an energy price increase spill over to the population due to falling labor demand by microenterprises. In the case that they are substitutes (which is the usual assumption in production theory), we expect that negative consequences for economic welfare can be at least partially alleviated due to higher labor demand.

Some caveats should be mentioned: First, we assume that microenterprises do not exit the market due to higher energy prices. To the extent that microenterprises become unprofitable, we underestimate welfare impacts on the Mexican population. Second, we estimate elasticities for a very small subset of microenterprises. We choose high internal validity over external validity. Therefore, generalizations should be taken with precaution. The empirical exercise is useful because it provides initial insights into production dynamics on certain microenterprises in Mexico.

To obtain input-demand and output-supply elasticities, we use a transcendental logarithmic (translog) profit function approach for a single-output case[91]. The translog profit function approach has been formally developed by Diewert (1973) and Lau (1976) (among others) and is based on duality between the production possibilities set, transformation and profit functions. We choose to estimate a profit function rather than a cost function because a profit function treats output as endogenously determined, whereas a cost function assumes that output is exogenously determined. Thus, economic behavior is more realistically captured. In general, a translog function provides flexibility in the sense that any production function can be approximated to the second order, which allows greater variation in substitution possibilities (Christensen et al., 1973). This happens at the cost of degrees of freedom, since we are forced to include more parameters in our estimation than in, for example, the Cobb-Douglas case.

In our pooled cross-section dataset, variation in prices stem from spatial as well as time variation[92]. For electricity, we are able to obtain even more variation by matching estimated consumption levels to the price schedule of the residential increasing block tariff (see *Appendix 3B* for details). For combustibles, price variation originates mainly from time variation. In order to estimate the translog profit function we have to make some additional identifying assumptions. First, microenterprises are assumed to be price-takers without enough market power to influence input-factor or output prices. Second, capital is treated as fixed input, which is a reasonable assumption for the shot-run[93]. Third, only electricity, combustibles and labor are treated as variable inputs. Thus, we implicitly assume separability between these and all other inputs, meaning that the entrepreneur does not take into account the usage-level of other variable input

[91] Our approach allows us to make fewer assumptions about the price of each concept captured in the structure cost. A detailed dataset that separates prices and quantities for each concept could obtain a broader insight into the production dynamics by using a cost function approach, which takes output as exogenous. In this case, the sample size would increase significantly because we are not confined to firms that produce the same product. Further, it would be able to treat capital as endogenously determined.

[92] See *Appendix 3B* for an overview of the price data, as well as the source.

[93] Capital stock is measured as the replacement cost of tools, utensils, machinery, furniture, equipment, land, and vehicles that are property of the entrepreneur and employed for business purposes.

in his decision on the level of electricity, combustibles or labor. Fourth, we add additional explanatory variables to each estimated equation to reduce the risk of omitted variable bias[94].

We base our empirical model on two empirical specifications. Deno (1988) applies the framework to US data on manufacturing firms to retrieve input-demand and output-supply elasticities with respect to public capital. We closely follow the technical explanations by Sidhu and Baanante (1981), who estimate a translog profit function in the context of wheat production in India.

The translog profit function is defined as follows:

$$ln\pi^* = \alpha_0 + \sum_{i=1}^{n} \alpha_i lnP_i^* + \tfrac{1}{2}\sum_{i=1}^{n}\sum_{h=1}^{n} \gamma_{ih} lnP_i^* lnP_h^* + \sum_{i=1}^{n}\sum_{k=1}^{m} \delta_{ik} lnP_i^* lnZ_k +$$

$$\sum_{k=1}^{m} \beta_k lnZ_k + \frac{1}{2}\sum_{k=1}^{m}\sum_{j=1}^{m} \theta_{kj} lnZ_k lnZ_j + \sum_{l=1}^{L} \varphi_l lnX_l \tag{35}$$

Here, $\pi^*$is defined as monthly profits normalized by output price , P_i^* are input prices of variable inputs normalized by output price ($n = 3$ for our case) and Z_k are fixed inputs ($m = 1$ for our case). We also add additional explanatory variables X_l to credibly obtain consistent estimators ($L = 8$ for our case). The remaining terms are parameters that need to be estimated. In addition, a total of three variable input in profit share equations have to be estimated[95]. These are defined as follows:

$$S_i = -\frac{P_i^* X_i}{\pi^*} = \alpha_i + \sum_{i=1}^{n} \gamma_{ih} lnP_h^* + \sum_{k=1}^{m} \delta_{ik} lnZ_k \tag{36}$$

We estimate *Equations (35)* and *(36)* simultaneously using the seemingly unrelated regression (SUR) method developed by Zellner (1962) using generalized least squares (see regression results in *Appendix 3D*). SUR allows errors to be correlated across equations for each observation, so that we account for the interdependence of input-use and profits. Motivated by production theory, we impose symmetry constraints ($\gamma_{ih} = \gamma_{hi}$) and linear parametric constraints across *Equations (35)* and *(36)*[96]. To estimate input-demand and output-supply elasticities, we use the formulas provided by Sidhu and Baanante (1981).

Table 23 shows elasticity estimates for tortilla-producing microentrepreneurs. Due to the small sample size, we do not expect highly precise estimates. For that reason, we pay more attention to the sign of the elasticities (when significantly different from zero), rather than the exact magnitude. Before discussing the results in general, we will focus on the most relevant findings in this paragraph. From a social welfare perspective, we are mostly interested in potential labor demand effects. The elasticities show that

[94]We include age of entrepreneur, age of entrepreneur squared, sex-dummy of entrepreneur, age of the firm, years of education and year dummies (as usual in pooled cross-section analyses) as additional explanatory variables.

[95]The system of equations theoretically includes the output-supply equation, which can be ignored in the estimation.

[96]Note that the parameters in equations (36) are all equal to some parameters in equation (35).

Table 23: Input-demand and output-supply elasticities

Concept	Symbol	Price of electricity	Price of combustibles	Price of labor	Price of output	Capital
		Tortilla production (N=195)				
Electricity	η_{ei}	-3.34	**-3.21**[a]	**1.08**	5.48	0.36[b]
Combustibles	η_{ci}	**-0.45**[b]	(-1.55)	**0.44**[a]	(1.56)	(0.19)
Labor	η_{li}	**0.36**	**1.04** [a]	-0.91	(-0.49)	(-0.34)
Output supply	ϵ_{yi}	-2.45	(-4.97)	(0.66)	(6.76)	(-0.01)

Notes: Unless otherwise indicated, estimates are significant at the 1 percent-significance level.[a]Significant at the 5 percent-level.[b]Significant at the 10 percent-level. Numbers in parentheses are not significant at the usual significance levels. T-statistics and resulting significance levels are computed using the delta method.

electricity and (formal, i.e. paid) labor as well as combustibles and labor are substitutes (positive sign). Thus, we suspect labor demand to increase as a response to rising energy prices. Further, we observe that combustibles and electricity are complements, meaning that entrepreneurs cannot switch between energy inputs when relative prices change, further complicating transitional adjustments.

As expected, all own-price elasticities of inputs are negative (although not all are significant). Out-supply elasticities are insignificant, except for electricity, where we find that output supply declines when electricity prices rise (and that electricity demand rises when output prices rise). The underlying reason for the mainly insignificant elasticity estimates is that output prices for tortillas do not differ much, so that we have too little variation in prices for correct identification. At last, we find that a higher capital stock is associated with higher electricity demand.

6.6 Conclusion

The current energy reforms in Mexico aim at enhancing efficiency in the energy sector and promoting environmental protection. Therefore, it is expected that they will promote long term sustainable development. However, there might be negative short term effects for economic welfare during the transition that should be addressed by policy makers. In this study we provided a first assessment about the vulnerability of Mexican microenterprises to rising energy prices. We specifically investigate heterogeneity in vulnerability along (1) industry, (2) profit-level, (3) energy usage and (4) premise-ownership dimensions. In general, price increases of combustibles are expected to have larger impacts on the performance of microenterprises due to higher variable cost shares.

There are large differences in profit loss estimates (in percentage of total losses) across industries depending on relative energy intensity. The most vulnerable to combustible price increases are transportation and construction; and most vulnerable to electricity price increases are the manufacturing and services industries. Combustible price increases tend to affect industries that are relatively small in size and whose expansion would be desirable from a structural change perspective. This is especially problematic given the possibility of a further increase of firms employed in trade related

activities. From a long-term economic development perspective, this potential structural change is considered to be disadvantageous because trade related activities do not produce as much value-added as e.g. firms in the manufacturing industry. Energy price increases are likely to accelerate the tendency of an expansion of trade oriented microenterprises that has been observed since 1994[97]. As shown, the energy intensity of the trade industry is low and a shift is likely to occur.

Microenterprises that are more profitable usually have higher energy usage rates as well as higher energy intensities. As a result, FO estimates are higher for more profitable firms in the case of combustible price increases. For electricity price increases, average figures suggest a neutral distribution of FO estimates. However, microenterprises that are less profitable but depend on energy inputs would be particularly vulnerable, thus requiring special consideration.

The production function estimation for tortilla-producing micro entrepreneurs gives first insight into production dynamics. The results show that rising energy prices might lead to higher labor demand. We also find that electricity and combustibles are complementary inputs, so that firms cannot substitute between these different forms of energy when relative prices change (at least in the short run). It should be noted that these are results for a small subsample with high internal validity, but limited generalizability.

The ongoing reform of the Mexican energy sector should take into consideration that energy price increases might have substantial adverse effects on the Mexican productive units. In Mexico, microenterprises are the most common enterprise category and are the sources of income and employment for large parts of the poorest population. Our findings provide insights on possible effects of electricity and combustible price increase, which can help to design counter-measures to palliate negative short term effects. This would ensure a smoother transition towards the long-term goal of an efficient energy market. Future studies should evaluate diverse social measures that could potentially serve as complementary measures; for example through separate transfers to low level income households[98]. In principle, a redistributive program should be feasible given the increased governmental income due to the reduction of subsidy-payments. A comprehensive approach would ensure that related goals are being balanced: fostering productivity, energy efficiency, the adoption of cleaner sources of energy and the protection of social welfare.

[97] This computation is available under request.

[98] Related insights can be found in Mehrara (2007). For the case of Mexico, an example of an existing redistribution measure is the conditional cash transfer program *Oportunidades*.

6.7 References

Ama Baafra Abeberese. Electricity cost and firm performance: Evidence from india. *Columbia University Paper Series*, (1213-26):1–66, 2013.

Jorge Alvarez and Fabian Valencia. Made in mexico: Energy reform and manufacturing growth. *Energy Economics*, 55:253–265, 2016. ISSN 0140-9883.

Rossella Bardazzi, Filippo Oropallo, and Maria Grazia Pazienza. Do manufacturing firms react to energy prices? evidence from italy. *Energy Economics*, 49:168–181, 2015. ISSN 0140-9883. doi: 10.1016/j.eneco.2015.01.014.

Arne Bigsten, Paul Collier, Stefan Dercon, Marcel Fafchamps, Bernard Gauthier, Jan Willem Gunning, Abena Oduro, Remco Oostendorp, Cathy Patillo, Soderbom, et al. Credit constraints in manufacturing enterprises in africa. *Journal of African Economies*, 12(1):104–125, 2003.

Benjamin S. Cheng. Energy consumption and economic growth in brazil, mexico and venezuela: A time series analysis. *Applied Economics Letters*, 4(11):671, 1997. ISSN 13504851.

Jaruwan Chontanawat, Lester C. Hunt, and Richard Pierse. Does energy consumption cause economic growth?: Evidence from a systematic study of over 100 countries. *Journal of Policy Modeling*, 30(2):209–220, 2008.

Laurits R. Christensen, Dale W. Jorgenson, and Lawrence J. Lau. Transcendental logarithmic production frontiers. *The review of economics and statistics*, pages 28–45, 1973.

David P. Coady, Moataz El Said, Robert Gillingham, Kangni Kpodar, Paulo A. Medas, and David Locke Newhouse. The magnitude and distribution of fuel subsidies: evidence from bolivia, ghana, jordan, mali, and sri lanka. *International Monetary Fund*, 06(247), 2006.

Suresh De Mel, David J. McKenzie, and Christopher Woodruff. Measuring microenterprise profits: Must we ask how the sausage is made? *Journal of Development Economics*, 88(1):19–31, 2009.

Kevin T Deno. The effect of public capital on us manufacturing activity: 1970 to 1978. *Southern Economic Journal*, pages 400–411, 1988.

W Erwin Diewert. Functional forms for profit and transformation functions. *Journal of Economic Theory*, 6(3):284–316, 1973.

Hamida Fakira. Energy for microenterprises. *Energy and Development Research Centre*, 12:16–25, 1994.

Andres Gomez-Lobo. The welfare consequences of tariff rebalancing in the domestic gas market. *Fiscal Studies*, 17(4):49–65, 1996.

Michael Grimm, Renate Hartwig, and Jann Lay. Electricity access and the performance of micro and small enterprises: Evidence from west africa. *European Journal of Development Research*, 25(5):815–829, 2013.

Stefanie A. Haller and Marie Hyland. Capital-energy substitution: Evidence from a panel of irish manufacturing firms. *Energy Economics*, 45:501–510, September 2014. ISSN 0140-9883. doi: 10.1016/j.eneco.2014.08.003.

Irene Henriques and Perry Sadorsky. The effect of oil price volatility on strategic investment. *Energy Economics*, 33(1):79–87, 2011. URL `http://www.sciencedirect.com/science/article/pii/S014098831000143X`.

Charles Kirubi. How important is modern energy for micro-enterprises? evidence from rural kenya. *Energy and Resources*, 2006.

Lawrence J Lau. A characterization of the normalized restricted profit function. *Journal of Economic Theory*, 12(1):131–163, 1976.

Ian MD Little. Small manufacturing enterprises in developing countries. *The World Bank Economic Review*, 1(2):203–235, 1987.

David McKenzie and Christopher Woodruff. Experimental evidence on returns to capital and access to finance in mexico. *The World Bank Economic Review*, 22(3): 457–482, 2008.

David J. McKenzie and Christopher Woodruff. Do entry costs provide an empirical basis for poverty traps? evidence from mexican microenterprises. *Economic Development and Cultural Change*, 55(1):3–42, 2006.

Mohsen Mehrara. Energy consumption and economic growth: The case of oil exporting countries. *Energy Policy*, 35(5):2939–2945, May 2007. ISSN 0301-4215.

Scott R. Milliman and Raymond Prince. Firm incentives to promote technological change in pollution control. *Journal of Environmental economics and Management*, 17(3):247–265, 1989.

W. David Montgomery. Markets in licenses and efficient pollution control programs. *Journal of economic theory*, 5(3):395–418, 1972.

M. Motta and K. Reiche. Rural electrification, microfinance, and micro and small business development: Lessons for the nicaragua off-grid rural electrification project. *Internal World Bank Paper*, (PSI Learning Board), 2001.

Ilhan Ozturk, Alper Aslan, and Huseyin Kalyoncu. Energy consumption and economic growth relationship: Evidence from panel data for low and middle income countries. *Energy Policy*, 38(8):4422–4428, 2010.

Ronald A. Ratti, Youn Seol, and Kyung Hwan Yoon. Relative energy price and investment by european firms. *Energy Economics*, 33(5):721–731, September 2011. ISSN 0140-9883.

Anver C. Sadath and Rajesh H. Acharya. Effects of energy price rise on investment: Firm level evidence from indian manufacturing sector. *Energy Economics*, 49:516–522, May 2015. ISSN 0140-9883. doi: 10.1016/j.eneco.2015.03.011.

SEMARNAT. *Special Climate Change Program 2014-2018*. Ministry of the Environment and Natural Resources, Mexico, 2014.

Farzana Sharmin and Mohammed Robayet Khan. A causal relationship between energy consumption, energy prices and economic growth in africa. *International Journal of Energy Economics and Policy*, 6(3):477–494, 2016.

Alice Shiu and Pun-Lee Lam. Electricity consumption and economic growth in china. *Energy policy*, 32(1):47–54, 2004.

Surjit S. Sidhu and Carlos A. Baanante. Estimating farm-level input demand and wheat supply in the indian punjab using a translog profit function. *American Journal of Agricultural Economics*, 63(2):237–246, 1981.

John L. Solow. The capital-energy complementarity debate revisited. *The American Economic Review*, pages 605–614, 1987.

Thomas H. Tietenberg. Economic instruments for environmental regulation. *Oxford Review of Economic Policy*, 6(1):17–33, 1990.

James R. Tybout. Credit rationing and investment behavior in a developing country. *Review of Economics and Statistics*, 65:598–607, 1983.

James R. Tybout. Manufacturing firms in developing countries: How well do they do, and why? *Journal of Economic literature*, pages 11–44, 2000.

Arnold Zellner. An efficient method of estimating seemingly unrelated regressions and tests for aggregation bias. *Journal of the American statistical Association*, 57(298): 348–368, 1962.

7 Appendix

Figure 12: 0A. GDP per capita, Headcount Ratio and Gini Coefficient

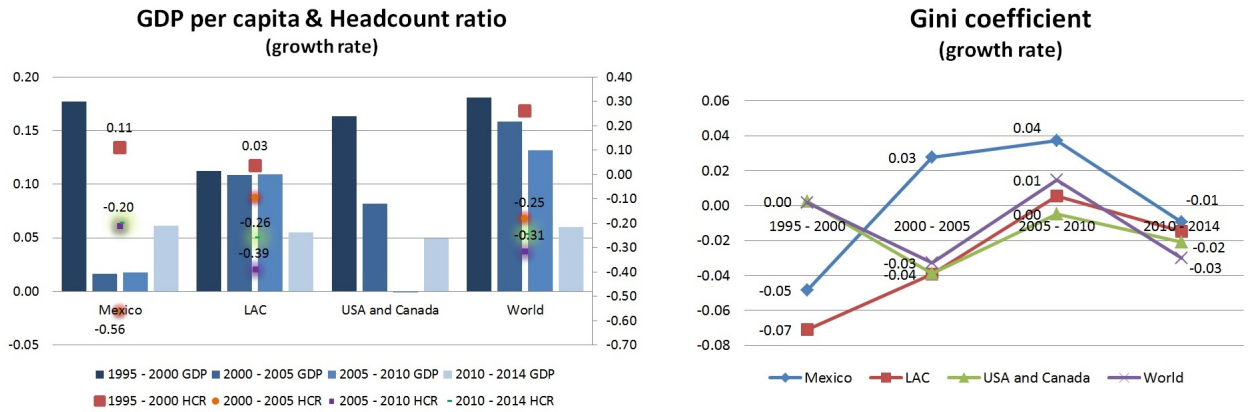
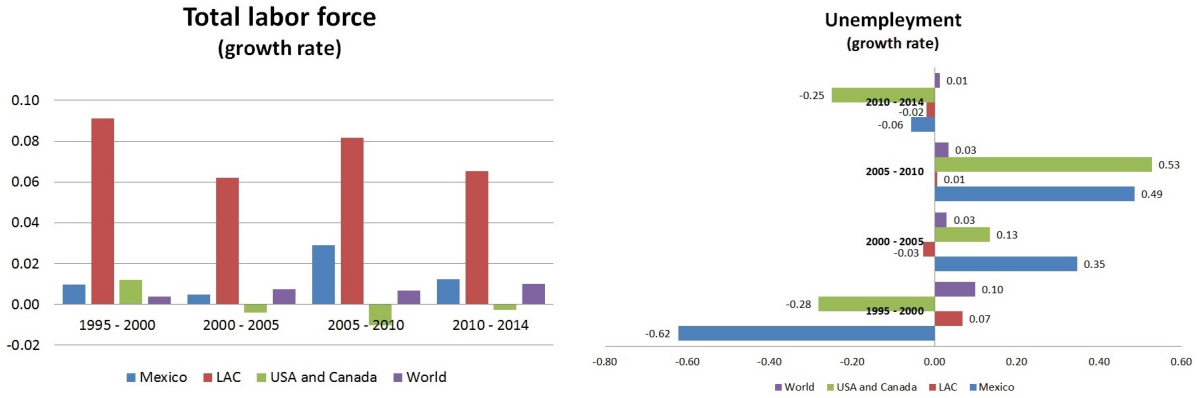


Figure 13: 0B. Total labor force and unemployment



Notes: (1) All the graphs in this appendix are based on the data of the UNDP and the WB. The growth rates are reported in decimal notation. For example, 0.01 is equivalent to one percent. (2) There are few cases where the value was proxied by the nearest available one. For example, the head count ratio and the Gini coefficient are not annually collected in each country. Therefore, the missing values were substituted by the previous or the following year. Also, in some other cases (like CO_2 emissions) the latest available data was 2013.

Figure 14: 0C. Female labor participation and Life expectancy at birth

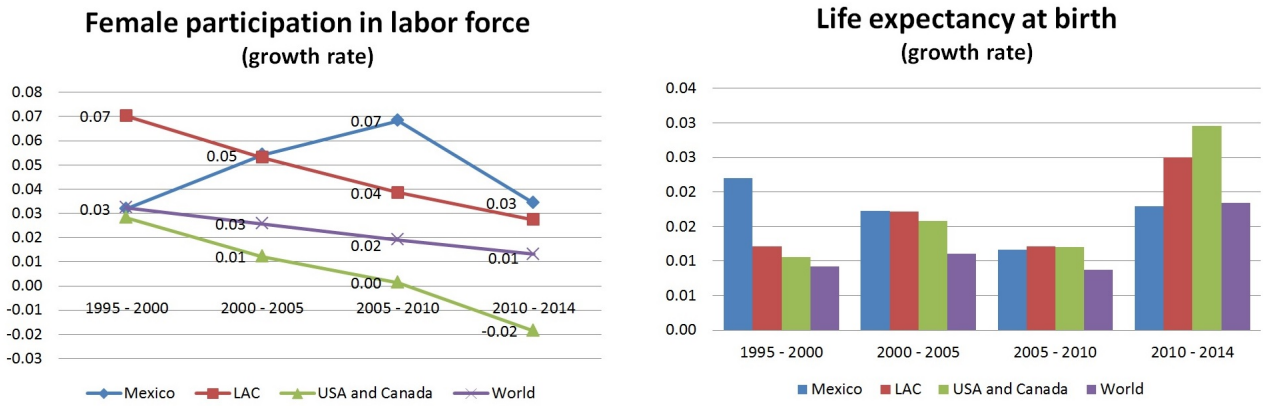


Figure 15: 0D. Regional comparison of labor productivity

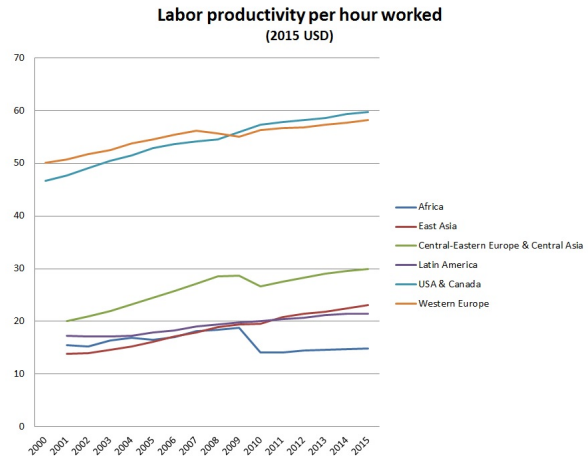


Figure 16: 0E. Years of schooling and internet users

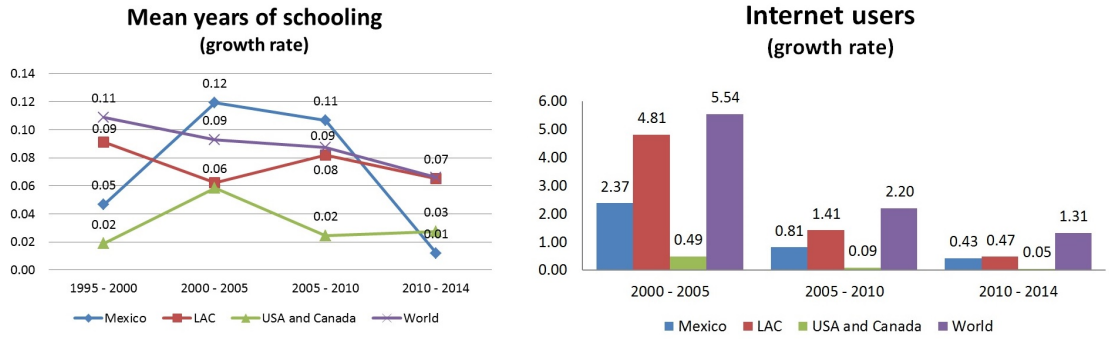


Figure 17: 0F. Number of homicides and CO_2 emissions

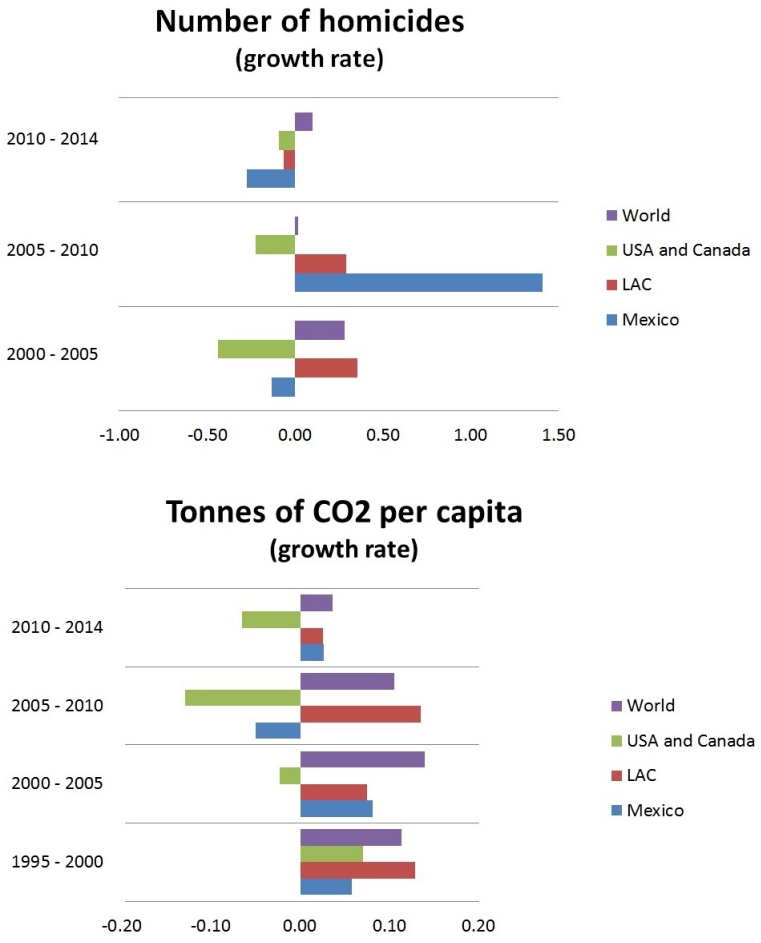


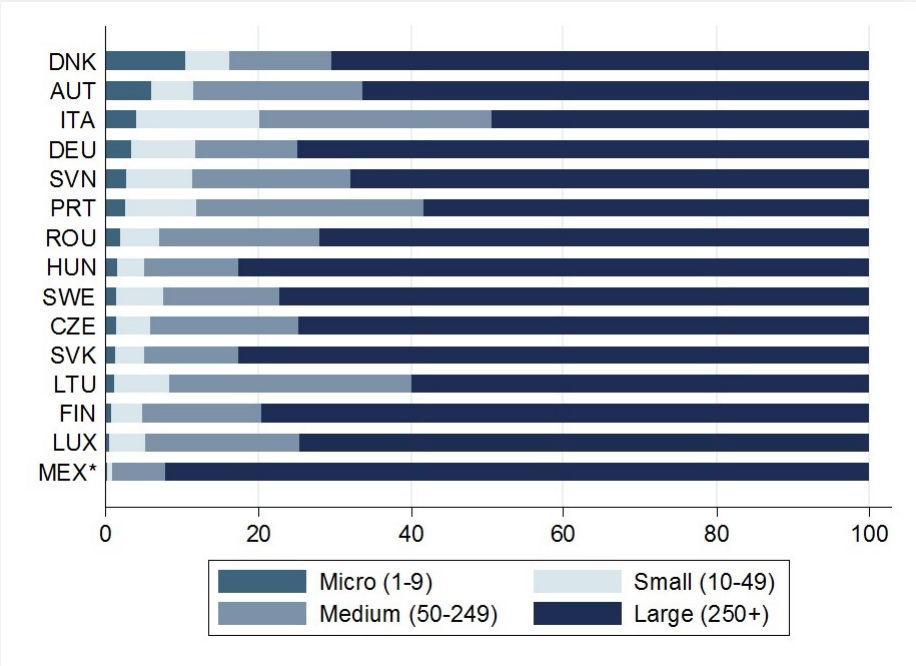
Table 24: 0G. Sample of qualitative interview

Tema	Inicios
Preguntas principales	¿Qué vende en su negocio y porqué decidió iniciar esta actividad?
Preguntas complementarias	- ¿Tiene usted otro negocio o trabajo aparte de éste?
	- ¿Por qué eligió dedicarse a esta actividad y no a otra?
	- ¿Siempre se ha dedicado a esto o ha cambiado de giro a través de los años?
	- ¿Vende usted más o menos que cuando empezó su negocio?
Tema	Organización
Preguntas principales	¿Qué vende en su negocio y porqué decidió iniciar esta actividad?
	¿Cómo es que usted maneja su negocio?
Preguntas complementarias	- ¿Cómo encuentra a sus clientes? ¿Cuál es su relación con ellos?
	- ¿Cómo los mantiene? ¿Y con sus proveedores?
Tema	Retos y oportunidades (externos)
Preguntas principales	¿Cuándo fundó su negocio?
	¿Cuáles han sido los principales retos y oportunidades que ha vivido desde entonces?
Preguntas complementarias	- ¿Cómo es que estos retos afectan a su negocio? ¿Cómo es que usted lidia con ellos?
	- ¿Estos retos le afectan de alguna manera a su familia? ¿Cómo lidia con ello?
	- ¿Qué retos ve usted en el futuro? - ¿IDEM oportunidades.
Tema	Limitaciones y fortalezas (internas)
Preguntas principales	¿Qué errores suyos o de su personal le han hecho perder clientes?
	¿Cuáles fortalezas, por el contrario, le han dado ventajas con respecto a la competencia?
Preguntas complementarias	- ¿Cree que estas situaciones o acciones le han permitido crecer como empresa o permanecer en el negocio?
	- ¿Cómo calificaría usted mismo la calidad de su producto y la organización de su negocio?
	- ¿Cómo identifica usted oportunidades para mejorar?
Tema	Empleo
Preguntas principales	¿Sus empleados son familiares o personas ajenas a usted?
Preguntas complementarias	- ¿Qué ventajas cree usted que tiene que su familia trabaje para usted?
	- ¿Por qué cree usted que la mayoría de las empresarios prefieren que sus familiares sean parte de su empresa?
	- ¿Cómo negocia el salario con sus empleados? ¿Y sus contratos y prestaciones?
	- ¿Cree que sus familiares ganarían más si trabajara para otra empresa?

Table 25: 0G. ... *Continuation*

Tema	Ahorro e inversión
Preguntas principales	¿Cómo decide qué proporción de los ingresos del negocio usará para el gasto personal o familiar?
	¿Cómo decide cuánto reinvertirá en la empresa?
Preguntas complementarias	- ¿A qué actividades destina lo que decide reinvertir en su negocio?
	- ¿De dónde obtiene recursos para hacer frente a gastos imprevistos de la empresa?
	- ¿Usted separa sus ahorros personales de los ahorros de su empresa?
Tema	Crecimiento
Preguntas principales	¿Si usted tuviera una buena racha, qué preferiría hacer para que su negocio creciera:
	(a) contratar empleados, (b) abrir otra sucursal,
	(c) iniciar otro negocio con otro giro además del que actualmente tiene?
Preguntas complementarias	- ¿Por qué? ¿Lo ha intentado alguna vez? - ¿Cuál ha sido su experiencia?
Tema	Exportación
Preguntas principales	¿Cree usted que si intentara vender su producto en otra región o en otro país lo contratarían?
Preguntas complementarias	- ¿Lo ha intentado alguna vez? - ¿Qué limitaciones percibe usted?
	- ¿Alguna vez ha escuchado de facilidades para exportar?
	- ¿Suponiendo que tuviera éxito, cree que se podría mantener como un proveedor constante?
Tema	Innovación
Preguntas principales	¿Usted o alguno de sus empleados han ideado alguna vez algún producto nuevo?
	¿Han encontrado un proceso que les ayude a disminuir sus costos o aumentar sus ganancias?
Preguntas complementarias	- ¿Usted utiliza tecnología para llevar a cabo su actividad? E.g. computadoras, celulares, etc.
Tema	Costo de oportunidad
Preguntas principales	¿Si alguien le ofreciera un trabajo remunerado„ cuánto le tendría que pagar para que usted dejara su negocio?
Preguntas complementarias	- ¿Sí usted tuviera que cerrar este negocio qué otra actividad consideraría hacer para ganar dinero?
Tema	Percepción sobre las microempresas
Preguntas principales	¿Cómo cree usted que al país le iría mejor o peor si las microempresas y los negocios familiares cerraran?
Preguntas complementarias	- ¿Por ejemplo, con las tenerías, cree usted que esto benefició o afectó a la población?
	- ¿Cree usted que las personas estarían mejor o peor si,
	en lugar de tener su propia microempresa, consiguieran un trabajo en una empresa grande?
Tema	Gobierno
Preguntas principales	¿Cómo cree usted que el gobierno podría incentivar para que crezcan o contraten más personas?
Preguntas complementarias	- ¿Considera usted el pago de impuestos es apropiado? - ¿Cómo lidia usted con la burocracia y las cargas fiscales?
	- ¿Qué cree usted que el gobierno podría hacer para que la gente estuviera dispuesta a pagar impuestos?

Figure 18: 1A. International comparison by firm size of exporters in the manufacturing sector



Source: Author's computation based on data from the OECD and the INEGI.
Note: (1) The figure only considers the manufacturing sector. (2) The shares of correspond to 2007, which is the most up to date information available that enables international comparison. (3) There are two countries that slightly differ. First, the data for Germany includes all industries and is from 2011. Second, the data for Mexico includes one person more per category. The compilation of this sort of data is a very recent effort of INEGI.

Table 26: 1B. Description of variables

Monthly profits
Monthly earnings of the self-employed which are directly reported in the question: "How much do you normally obtain as earnings after deducting expenses?"

Capital Stock
Is measured as the replacement cost of tools, utensils, machinery, furniture, equipment, land, and vehicles that are property of the entrepreneur and employed for business purposes plus the market price of all firm inventories. In the case of the 1990s data the category "other type of capital" is not considered to make it comparable with the 2010s.

Labor
Owner's labor is defined as the number of weekly hours that are usually allocated to serve clients, stock up the merchandise for sale, buy materials, make repairs, and carry out business transactions. The labor of employees is similarly defined. The data allows to distinguish between unpaid and paid labor.

Firm size
This categorical variable comprises all the workforce and thus includes both the entrepreneur and the workers. In the considered sample, it ranges from one to six to enamble comparability across decades.

Firm age
Number of years since the owner began the activity or became head of the business. Age squared is also included.

Average wage
It refers to the average hourly wage in a given state and industry for the corresponding year. This data is obtained from the labor survey (ENEU and ENOE).

Owner's age
Continuous variable.

Owner's education
Categorical variables for (i) less than primary school, (ii) primary school, (iii) secondary school, (iv) high school, (v) at least undergraduate education. The reference category is "less than primary school".

Owner's gender
Dummy variable. Reference category: men.

Marital status
Dummy variable. Reference category: not married people.

Motivation to start the business
There are four categorical variables grouping the main motives for which microenterpreneurs decided to start operations: (i) family tradition or obtaining a higher income, (ii) not finding a job or being laid off, (iii) Found a good business opportunity or another reason. The reference category is: complementing family income or having more flexible hours. These groupings were defined based on McKenzie and Woodruff (2006) to enable comparability with their estimates and promote the accumulation of scientific knowledge.

Industry
There are four main sectors that are considered throughout the document: manufacturing, services, commerce and transport. This groupping is made to ensure an easier comparison with the statistics provided by INEGI. This classification is used for the descriptive statistics and main insights.
In the econometric analysis, all four sectors are further distinguished into nine industies: Construction,

Table 27: 1C. Robustness Checks

Robustness Check 1 (RC1): Exclusion of ability proxies:
$ln\pi_i\left(K_i, L_i\right) = \alpha_i + \beta_K lnK_i + L_i^{'}\beta_L + Z_i^{'}\beta_Z + \varepsilon_i$

Robustness Check 2 (RC2): Estimated profits (ρ_i) corresponds to the difference between sales and expenditures:
$ln\rho_i\left(K_i, L_i\right) = \alpha_i + \beta_K lnK_i + L_i^{'}\beta_L + Z_i^{'}\beta_Z + \theta_i^{'}\beta_\theta + \varepsilon_i$

	2010s					
	RC1			**RC2**		
	Log monthly profits (self reported)			***Log monthly profits (sales - costs)***		
	Very low	**Low**	**Intermediate**	**Very low**	**Low**	**Intermediate**
Log of capital	0.161***	0.214***	0.173***	0.097	0.094	0.331**
	(0.012)	(0.0104)	(0.007)	(0.052)	(0.077)	(0.0724)
Family tradition or to increase income				-0.219	0.106	0.0161
				(0.193)	(0.250)	(0.362)
Could not find a job or was laid off				0.502*	0.324	-0.562
				(0.200)	(0.213)	(0.416)
Entered business for another motive				-0.106	-0.111	-0.188
				(0.175)	(0.123)	(0.257)
Book keeping				0.206	0.081	0.206
				(0.156)	(0.131)	(0.205)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,926	6,965	5,573	5,250	5,653	4,813
Robust R-squared	0.443	0.343	0.367	0.228	0.192	0.162

*** p<0.001, ** p<0.01, * p<0.05

Table 28: *...Continuation*

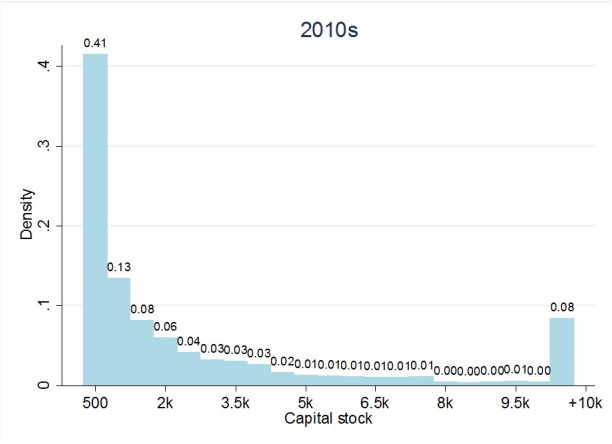
	1990s					
	RC1			RC2		
	Log monthly profits (self reported)			*Log monthly profits (sales - costs)*		
	Very low	**Low**	**Intermediate**	**Very low**	**Low**	**Intermediate**
Log of capital	0.103***	0.163***	0.199***	0.092***	0.145***	0.196***
	(0.005)	(0.007)	(0.003)	(0.011)	(0.007)	(0.009)
Family tradition or to increase income				0.242***	0.223***	0.227***
				(0.028)	(0.035)	(0.040)
Could not find a job or was laid off				0.030	-0.012	0.046
				(0.018)	(0.044)	(0.051)
Entered business for another motive				0.0601*	0.0773	0.039
				(0.025)	(0.043)	(0.069)
Book keeping				0.143*	0.145*	0.130*
				(0.044)	(0.046)	(0.048)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,255	7,324	6,826	8,355	7,067	6,615
Robust R-squared	0.515	0.396	0.381	0.422	0.299	0.276

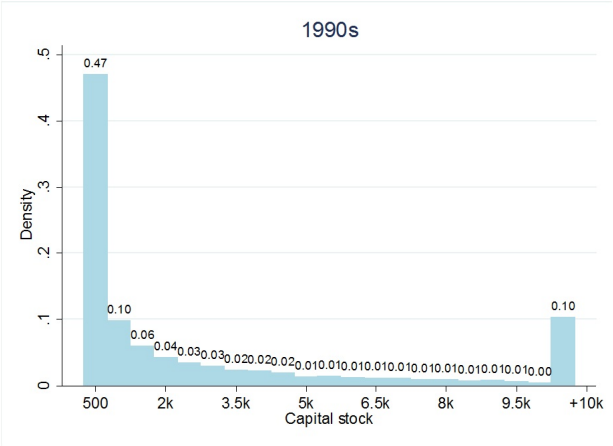
*** p<0.001, ** p<0.01, * p<0.05

Table 29: 1D. Marginal returns to capital derived from robustness checks

		2010s (percent)			1990s (percent)		
Robustness		**Very low**	**Low**	**Intermediate**	**Very low**	**Low**	**Intermediate**
Checks		*(0,250]*	*(250,1250]*	*(1250,6200]*	*(0,250]*	*(250,1250]*	*(1250,6200]*
RC1	**m**	68	12	3	69	10	5
RC2	**m**	38	5	9	56	8	3
RC1	**p50**	27	9	2	19	6	2
RC2	**p50**	9	2	3	17	6	2

Figure 19: 2B. Distribution of capital stock by decades





Note: Each bin is equivalent to 500 USD.

Table 30: 2A. Firm characteristics by capital percentiles

		p10	p25	p50	p75	p90
General characteristics						
Capital stock	**2010s**	24	68	375	1,606	35,295
	1990s	21	63	350	1,628	27,426
Monthly profits	**2010s**	142	180	264	397	904
	1990s	210	208	279	556	960
Labor (weekly hours)	**2010s**	36	41	55	70	112
	1990s	39	44	55	73	113
Firm size (total staff)	**2010s**	1.2	1.3	1.5	1.7	2.4
	1990s	1.1	1.2	1.4	1.7	2.4
Entrepreneur is a woman	**2010s**	0.52	0.44	0.34	0.25	0.22
	1990s	0.38	0.33	0.35	0.25	0.16
Age of entrepreneur	**2010s**	47	46	45	44	46
	1990s	44	44	42	42	44
Age of microenterprise	**2010s**	10	10	10	11	14
	1990s	7	8	8	7	9
Share of one person firms	**2010s**	0.86	0.80	0.69	0.58	0.34
	1990s	0.90	0.84	0.72	0.57	0.31
Firm has premises	**2010s**	0.05	0.09	0.27	0.47	0.74
	1990s	0.03	0.05	0.17	0.43	0.71
Industry						
Construction	**2010s**	0.11	0.16	0.12	0.06	0.02
	1990s	0.08	0.13	0.08	0.04	0.02
Manufacturing	**2010s**	0.15	0.15	0.15	0.15	0.18
	1990s	0.13	0.12	0.20	0.16	0.21
Miscellaneaous services	**2010s**	0.18	0.17	0.20	0.18	0.13
	1990s	0.43	0.39	0.27	0.23	0.15
Personal services	**2010s**	0.02	0.01	0.02	0.03	0.06
	1990s	0.01	0.01	0.01	0.01	0.01
Professional services	**2010s**	0.00	0.01	0.03	0.05	0.05
	1990s	0.02	0.02	0.04	0.07	0.09
Repair services	**2010s**	0.06	0.04	0.01	0.02	0.01
	1990s	0.00	0.00	0.00	0.00	0.00
Restaurants and hotels	**2010s**	0.18	0.18	0.16	0.09	0.04
	1990s	0.08	0.10	0.16	0.10	0.04
Retail and wholesale trade	**2010s**	0.28	0.27	0.29	0.36	0.35
	1990s	0.25	0.22	0.22	0.33	0.3
Transportation services	**2010s**	0.02	0.01	0.01	0.06	0.15
	1990s	0.01	0.01	0.01	0.06	0.19

Table 31: 2C. Description of variables

Please refer to *Appendix 1B* for an extended description of the variables. In this section only the newly incorporated variables are described.

Motivation to start the business
There are three categorical variables grouping the main motives for which microenterpreneurs decided to start operations: (i) family tradition or obtaining a higher income, (ii) complementing family income, not finding a job or being laid off. The reference category encompasses all the other motivations captured in the survey. For example, finding a good business opportunity, having more flexible hours, etc.

These groupings were defined based on the insights derived from the probit analysis (simple version).

Industry
Categorical variable for nine industries: Construction, manufacturing, miscellaneous services, personal services, professional services, repair services, restaurants and hotels, retail and wholesale trade, transportation services. Reference category: Manufacturing.

Figure 20: 2G. Marginal returns to capital by capital percentiles

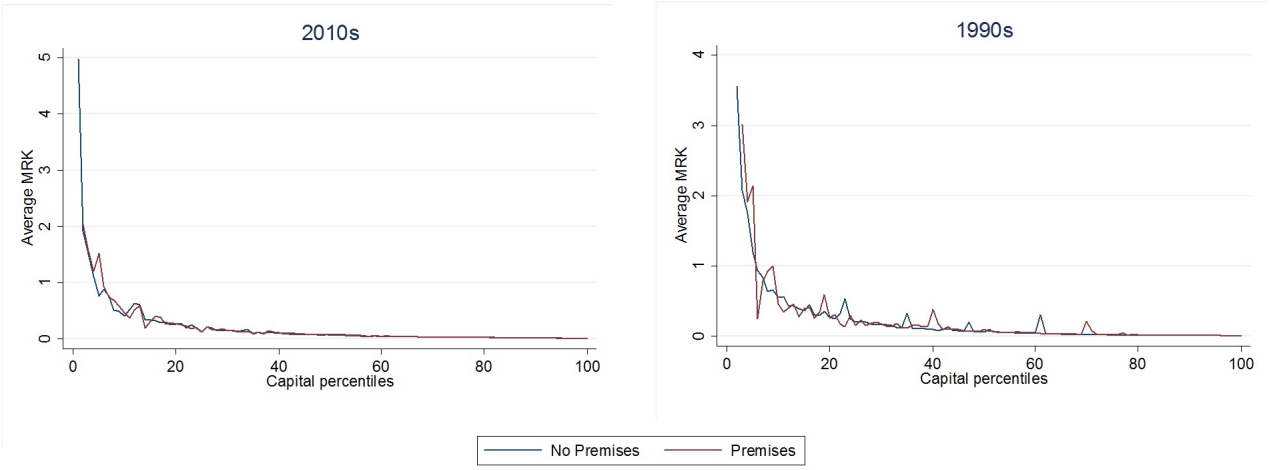


Table 32: 2D. Binary response model (robustness check with value added)

Control variable	I_i^{Up}	
	2010s	**1990s**
Age of entrepreneur	-0.007	0.039***
	(0.028)	(0.007)
Age squared of entrepreneur	-0.000	-0.000***
	(0.000)	(0.000)
Female entrepreneur	-0.490***	-0.262***
	(0.125)	(0.069)
Married	0.040	0.219***
	(0.062)	(0.039)
Primary school	0.198	0.152**
	(0.188)	(0.053)
Secondary school	0.056	0.383***
	(0.190)	(0.062)
High school	0.392*	0.498***
	(0.165)	(0.080)
At least undergraduate studies	0.722**	0.628***
	(0.267)	(0.093)
Age of firm	0.042***	0.020***
	(0.013)	(0.004)
Age of firm squared	-0.001***	-0.000***
	(0.000)	(0.000)
Family tradition or increase income	0.159*	0.316***
	(0.078)	(0.036)
Book keeping	0.489***	0.581***
	(0.085)	(0.086)
Firm has premises	0.606***	0.533***
	(0.064)	(0.050)
One person firm	-0.051	-0.292***
	(0.097)	(0.044)
Share of paid workers	0.635***	0.514***
	(0.157)	(0.034)
Contact with government	0.161	0.157*
	(0..172)	(0.005)
Contact with trade associations	0.307	0.272*
	(0.173)	(0.041)
Constant	-1.924**	-3.282***
	(0.630)	(0.201)
Year effects	Yes	Yes
Industry effects	Yes	Yes
Observations	2,291	18,126
Pseudo R-squared	0.3276	0.3459

	(US)	**(MS)**	**(LS)**
Share of segments (refined probit)			
2010s	11	14	74
1990s	11	17	71
Marginal returns (mean and median)			
2010s (m)	9	24	54
(p50)	3	7	13
1990s (m)	3	32	77
(p50)	2	6	16
Descriptives by firm segments			
2010s			
$(\hat{Pr}(I_i^{Up}))$	0.38	0.38	0.04
Capital	18,518	3,357	672
Profits	1,293	449	302
Value added	3,744	418	339
Hours worked	109	74	49
Firm size	2.5	1.9	1.4
Woman	0.16	0.33	0.36
1990s			
$(\hat{Pr}(I_i^{Up}))$	0.36	0.36	0.03
Capital	22,926	4,854	1,293
Profits	1,061	600	324
Value added	3,032	1,128	519
Hours worked	118	89	55
Firm size	2.5	2.0	1.4
Woman	0.15	0.19	0.32

*** p<0.001, ** p<0.01, * p<0.05

Table 33: 2E. Log-log model (robustness check with value added)

Control variable	**log monthly profits**	
	2010s	**1990s**
Log of capital	0.199***	0.152***
	(0.025)	(0.008)
Log of entrepreneur's s total labor hours	0.148***	0.418***
	(0.026)	(0.018)
Log of paid workers' total labor hours	0.036	0.078***
	(0.044)	(0.012)
Log of unpaid workers' total labor hours	-0.001	0.027*
	(0.036)	(0.010)
Age of entrepreneur	0.015	0.011**
	(0.012)	(0.003)
Age squared of entrepreneur	-0.000	-0.000***
	(0.000)	(0.000)
Female entrepreneur	-0.543***	-0.359***
	(0.039)	(0.022)
Married	-0.087	0.058*
	(0.037)	(0.021)
Primary school	-0.057	0.054***
	(0.069)	(0.006)
Secondary school	-0.082	0.109***
	(0.088)	(0.015)
High school	0.112	0.240***
	(0.093)	(0.037)
At least undergraduate studies	0.108	0.327***
	(0.082)	(0.051)
Age of firm	0.008	0.010***
	(0.004)	(0.001)
Age of firm squared	-0.000	-0.000**
	(0.000)	(0.000)

*** p<0.001, ** p<0.01, * p<0.05

Table 34: ... *Continuation*

Control variable	**log monthly profits**	
	2010s	**1990s**
Log of average hourly wage per industry and state	0.245	0.227**
	(0.151)	(0.064)
Family tradition or increase income	0.044	0.210***
	(0.058)	(0.016)
Book keeping	0.205**	0.185***
	(0.050)	(0.018)
Firm has premises	0.049	-0.095**
	(0.051)	(0.022)
One person firm	-0.222	-0.021
	(0.352)	(0.078)
Share of paid workers	0.096	-0.143
	(0.651)	(0.186)
Contact with government	0.010	0.037
	(0.068)	(0.040)
Contact with trade associations	0.273	0.068*
	(0.070)	(0.021)
Constant	3.336**	2.855***
	(0.621)	(0.204)
Year effects	Yes	Yes
Industry effects	Yes	Yes
Observations	2,126	16,583
Robust R-squared	0.367	0.627

*** p<0.001, ** p<0.01, * p<0.05

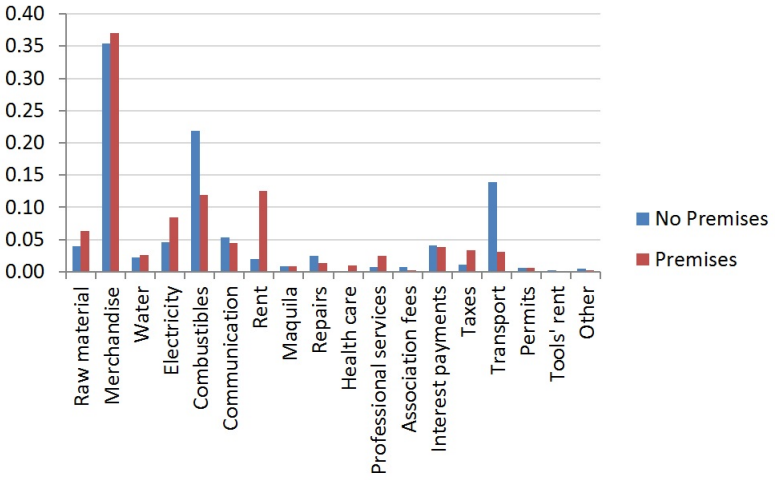
Table 35: 2F. Corresponding results when considering the subsample of firms with premises

Share of firms over time		
Segments	**2010s**	**1990s**
Upper	10	10
Middle	25	20
Lower	65	69

Marginal returns to capital		
Segments	**2010s**	**1990s**
Upper	0.38	0.77
Middle	2	0.02
Lower	6	4

Note. The regression tables with the estimates and their significance are available under request.

Figure 21: 2H. Average expenditure shares of firms with and without premises

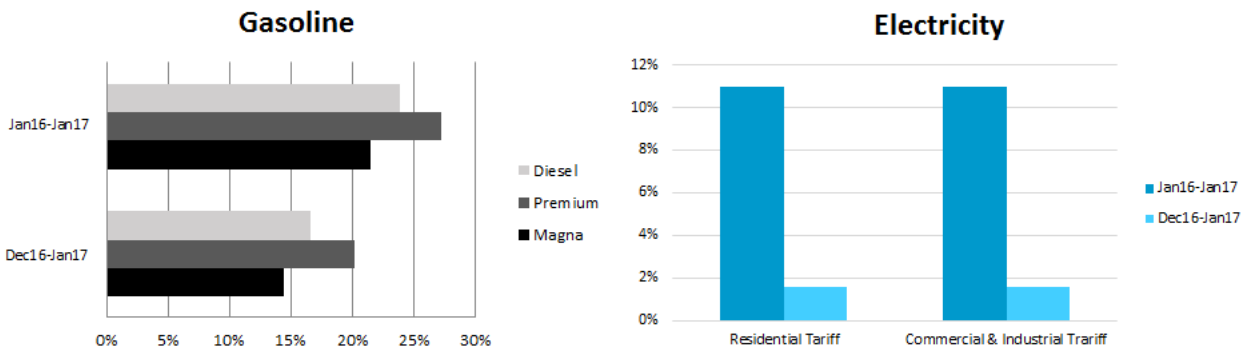


Notes. (1) All sectors are included. (2) Only years 2008 and 2010 are taken into consideration because these ENAMIN surveys provide a very detailed overview of microenterprises expenditures.

Table 36: 2I. Mean marginal returns to capital by location (firms without premises)

Location	(US) 2010s	(MS) 2010s	(LS) 2010s
Operates in public thoroughfare (improvised)	0.01	0.04	0.38
Operates in public thoroughfare (semifixed)	0.02	0.22	0.19
Operates at an open-air market (improvised)	0.02	0.02	0.22
Operates at an open-air market (semifixed)	0.01	0.09	0.12
Operates in a vehicle	0.01	0.09	0.17
Operates at the client's home	0.01	0.09	0.38
Operates in the own home	0.01	0.09	0.21
Operates as an ambulant firm	0.02	0.19	0.85
Other	0.01	0.06	0.12

Figure 22: 3A. Energy price increases (one year and one month)



Source: Self elaboration based on data from PEMEX and CFE.
Notes: (1) Diesel, Premium and Magna are the main gasolines for motor vehicles sold by PEMEX. Premium and Magna mainly differ in octane. (2) The electricity tariff for residential use that is reported above corresponds to a fixed payment (pago fijo). This is a modality introduced by CFE. (3) The electricity tariff for commercial and industrial purposes (demanda facturable) corresponds to a weighted average of the different prices charged to enterprises depending on the region and the hour of the day (energía de punta, intermedia y base). The data is provided by CFE.

Appendix 3A shows that the price increases of electricity occurred gradually. In the case of gasoline, the rise in prices mostly happened during a one-month span.

Table 37: 3B. Data overview of variable inputs (prices and quantities) and output prices.

Electricity and combustibles data source
Before 2011 the Mexican Central Bank (Banco de México) used to collect the data and then this task was taken over by the national statistical office (INEGI).

Electricity
The total kWh consumption is estimated by matching electricity prices with the survey's data on firms' expenditure. Due to data availability, we assume that the entrepreneurs receive bills for residential rather than commercial customers. This is a credible assumption because 65 percent of microenterprises lack premises. We also observe that that 44 percent of microenterprises operate either at their own home or at their clients' home.

We consider the fact that the electricity cost structure follows an increasing block tariff. The available data provides us monthly average prices at different levels of consumption for 46 cities. Therefore, regional and seasonal fluctuations are captured. For example, in warmer climate regions, tariffs are separated into summer and non-summer rates mainly due to air conditioning costs.

To estimate quantities of electricity consumption, we follow several steps: First, the official price levels are assigned to all firms operating in the cities under consideration. Microenterprises based in minor cities or in rural areas are assigned the average price that is prevalent in their respective state. Second, the block price structure is considered by assigning the average electricity price that corresponds to the microenterprise expenditure. This allows converting the values into prices per kWh and estimating the amount of electricity that the firm consumes each month. Note that it is possible that microentrepreneurs receive electricity from households or other firms near the place they usually operate. In this case, it could be that they pay a premium on electricity, which would introduce an upward bias to the kWh-estimate.

Combustibles
The ENAMIN survey aggregates all LPG, natural gas, gasoline, coal and "others" into a single category. Given that it is not possible to observe combustible-inputs at a more disaggregated level, we cannot assign the exact price to each input for the profit function estimation. As the largest share within the combustibles category is expected to be gasoline, we use gasoline prices for tortilla-producing firms.

Labor
Based on the workers' information reported on the ENAMIN we construct a price measure for labor (as a production input). Specifically, we consider the median wage for nine industries and 75 municipalities. The 46 main cities are independently considered while the remaining geographical locations correspond to the surrounding rural areas of each state.

Output prices
We extract output price data from the ENAMIN dataset by computing state-specific median values. We choose median over mean values because they are generally less sensitive to outliers. Further, by computing region-wise values instead of taking idiosyncratic data, we avoid a bias in the estimation based on unobserved heterogeneity. We chose to investigate tortilla-producing microenterprises because it is the largest group in the data.

Table 38: 3C. Firm characteristics by use of energy inputs

Concept	Full	Electricity		Combustibles		Elect. & Comb.	
	Sample	No	Yes	No	Yes	None	Both
Basic firm characteristics							
Physical capital[n]	4662.56	1823.12	6890.81	2139.49	7036.55	589.10	10112.59
Monthly profits[n]	311.65	242.36	390.82	202.38	449.52	168.81	538.58
Average monthly wage of paid workers [n]	223.92	212.76	229.88	184.76	240.49	186.21	246.19
Labor (weekly hours)	62.73	45.93	81.43	50.04	78.83	37.93	97.52
Firm size (total workforce)	1.62	1.36	1.91	1.37	1.94	1.24	2.29
Energy expediture							
Share of firms that spend on electricity	0.47	0.00	1.00	0.43	0.53	0.00	1.00
Share of expenditure on electricity	0.06	0.00	0.12	0.08	0.04	0.00	0.07
Total expenditure on electricity[n]	14.10	0.00	29.95	9.62	19.74	0.00	37.67
Share of firms that spend on combustibles	0.44	0.40	0.49	0.00	1.00	0.00	1.00
Share of expenditure on combustibles	0.16	0.21	0.11	0.00	0.33	0.00	0.22
Total expenditure on combustibles[n]	52.56	50.41	54.96	0.00	119.19	0.00	112.07
Characteristics of entreprenuers							
Woman	0.50	0.51	0.49	0.61	0.37	0.61	0.37
Head of household	0.58	0.57	0.59	0.51	0.66	0.51	0.66
Married	0.57	0.55	0.61	0.53	0.63	0.50	0.65
Age	45.29	44.80	45.84	45.78	44.69	45.16	45.06
Years of work experience	29.28	28.96	29.64	29.28	29.28	28.94	29.53
Used to be a wage worker	0.47	0.46	0.48	0.41	0.54	0.41	0.55
Education of entreprenuers.							
Less than primary school	0.06	0.08	0.04	0.08	0.04	0.09	0.02
Primary school	0.35	0.38	0.32	0.39	0.30	0.42	0.27
Secondary school	0.28	0.29	0.26	0.28	0.27	0.29	0.26
High school	0.16	0.15	0.17	0.14	0.18	0.13	0.18
At least undergraduate education	0.16	0.11	0.22	0.11	0.22	0.08	0.28
Firm characteristics							
Age	10.44	9.89	11.06	10.13	10.83	9.77	11.52
Share of paid workers	0.47	0.48	0.47	0.36	0.55	0.43	0.56
Offers contract to workers	0.04	0.01	0.05	0.02	0.05	0.01	0.06
Follows book keeping	0.38	0.23	0.54	0.31	0.47	0.19	0.63
Used credit to start business	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Reports not having needed financing	0.14	0.20	0.06	0.17	0.09	0.25	0.05
Expects to continue operations next year	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Share of one person firms	0.64	0.76	0.51	0.75	0.51	0.83	0.38
Main motive to become entrepreneur							
Family tradition	0.06	0.05	0.07	0.05	0.07	0.04	0.09
Complement family income	0.28	0.31	0.24	0.33	0.21	0.35	0.18
Obtain a higher income	0.20	0.20	0.20	0.18	0.23	0.18	0.22
Could not find a job or was laid off	0.07	0.08	0.05	0.06	0.07	0.07	0.06
Flexible hours	0.02	0.02	0.02	0.02	0.02	0.02	0.01
Other	0.31	0.29	0.34	0.30	0.32	0.29	0.35
Relationship with institutions							
Ministry of Economy (registration)	0.02	0.01	0.04	0.01	0.03	0.00	0.05
Municipality (registration)	0.24	0.11	0.38	0.19	0.30	0.07	0.41

Table 39: ... *Continuation*

Concept	Full	Electricity		Combustibles		Elect. & Comb.	
	Sample	No	Yes	No	Yes	None	Both
Informality							
Do not pay taxes	0.78	0.93	0.61	0.84	0.70	0.96	0.55
No not provide health services	0.84	0.87	0.81	0.87	0.81	0.88	0.77
Premises							
Firm has premises	0.35	0.08	0.65	0.31	0.40	0.08	0.68
Owned by the entrepreneur	0.56	0.57	0.56	0.60	0.53	0.57	0.52
Specific location of firms with premises							
Premises for trade and services	0.73	0.74	0.73	0.79	0.66	0.77	0.66
Premises used as production workshop	0.05	0.05	0.05	0.02	0.08	0.02	0.08
Premises used as repair workshop	0.19	0.13	0.20	0.16	0.23	0.12	0.24
Specific location of firms without premises							
Operate in public thoroughfare	0.06	0.06	0.05	0.05	0.07	0.06	0.08
Operate at an open-air market (tianguis)	0.06	0.07	0.03	0.05	0.08	0.06	0.04
Operate in a vehicle	0.09	0.11	0.03	0.03	0.17	0.04	0.05
Operate at the client's home	0.27	0.35	0.04	0.28	0.25	0.36	0.06
Operate in the own home	0.31	0.24	0.49	0.34	0.26	0.27	0.42
Operate as an ambulant firm	0.10	0.12	0.02	0.13	0.05	0.17	0.02
Main reported problem							
Low sales	0.27	0.24	0.30	0.27	0.27	0.24	0.29
High competition	0.17	0.17	0.16	0.16	0.18	0.16	0.16
Low profits	0.01	0.01	0.01	0.02	0.01	0.02	0.01
Lack of credit or resources	0.03	0.03	0.04	0.03	0.03	0.03	0.04
Conflict with workers	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Clients have not paid back yet	0.04	0.05	0.03	0.04	0.04	0.06	0.03
Problems with the authority	0.01	0.01	0.00	0.00	0.01	0.01	0.00
Other	0.21	0.18	0.23	0.18	0.24	0.16	0.26
No problem	0.27	0.30	0.22	0.30	0.23	0.34	0.20
Industry							
Retail and wholesale trade	0.39	0.40	0.38	0.49	0.27	0.49	0.27
Services	0.23	0.17	0.29	0.23	0.22	0.18	0.28
Manufacturing	0.15	0.13	0.18	0.15	0.16	0.14	0.21
Restaurants and hotels	0.12	0.11	0.13	0.05	0.21	0.06	0.22
Construction	0.07	0.12	0.01	0.07	0.07	0.12	0.01
Transportation	0.03	0.06	0.00	0.01	0.07	0.01	0.01
Number of observations	51274	27001	24263	28566	22700	16253	11952
Sample share	1.00	0.53	0.47	0.56	0.4	0.32	0.23

Notes: (1) Nominal values (n) correspond to 2016 MXP and are reported in USD. (2) The variable "average monthly wage of paid workers" only takes into consideration microenterprises that pay a salary to at least one of their workers. (3) The variable "used to be a wage worker" refers to the share of microenterprise owners that were salaried workers before starting their business. (4) Family firms refer to microenterprises that exclusively employ family members. Non-family firms are those where employees have not kinship with the owner. Mixed firms employ family and non-family alike. (5) The shares listed in the section "relationship with institutions" refer to the proportion of microenterprises that established a connection with the government or trade associations by registering themselves. (6) The share of informal firms from the perspective of health care provision includes IMSS, ISSTE and other health institutions. The variable considers coverage for both the owner and the employees. (7) Premises refer to the operation modality where microenterprises do business in a fixed location that does not require to be periodically dismantled. (8) The addition of shares may exceed one in some cases because of rounding.

Table 40: 3D. Restricted parameter estimates of the Translog Profit Function

Translog profit function	$ln\pi^*$	(1)
Log real prices electricity	lnP_e	-0.93***
		(0.27)
Log real prices combustibles	lnP_c	-2.73
		(1.40)
Log real prices wage	lnP_w	1.16**
		(0.42)
Interaction of log prices (electricity)	lnP_e* lnP_e	-0.27***
		(0.04)
Interaction of log prices (combustibles)	lnP_c * lnP_c	-1.08
		(3.01)
Interaction of log prices (wages)	lnP_w * lnP_w	-0.08
		(0.09)
Interaction of log prices (electricity and combustibles)	lnP_e * lnP_c	-0.45**
		(0.16)
Interaction of log prices (electricity and wages)	lnP_e * lnP_w	0.08**
		(0.03)
Interaction of log prices (combustibles and wages)	lnP_c * lnP_w	0.08
		(0.15)
Log expenditure in capital	lnZ_k	0.44*
		(0.18)
Interaction (log prices of electricity and log capital expenditure)	lnP_e * lnZ_k	0.01
		(0.01)
Interaction (log prices of combustibles and log capital expenditures)	lnP_c * lnZ_k	-0.01
		(0.05)
Interaction (log wages and log capital expenditures)	lnP_w * lnZ_k	-0.07**
		(0.03)
Interaction of log expenditure in capital	lnZ_k * lnZ_k	-0.01
		(0.01)
Age of owner	age_{own}	-0.04
		(0.04)
Age of owner squared	age^2_{own}	3.6e-4
		(3.6e-7)
Female entrepreneur (dummy)	$woman$	-0.41*
		(0.17)
Age of microenterprise	age_{me}	0.01
		(0.01)
Log of schooling years	$educ$	0.26
		(0.22)
Firm has premises (dummy)	$premises_{me}$	0.23
		(0.17)
Time fixed effects (2010)	d_{10}	-0.25
		(0.24)
Northeastern region	r_{NE}	0.23
		(0.34)
North-Central region	r_{NC}	0.10
		(0.27)
South-Central region	r_{SC}	0.47
		(0.35)
Western region	r_W	0.10
		(0.23)
Eastern region	r_E	0.17
		(0.31)
Southeastern region	r_{SE}	-0.18
		(0.32)
Southwestern region	r_{SW}	0.19
		(0.26)
Intercept	α_0	1.72
		(1.58)
N		195

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: The subsample corresponds to tortilla producers.

Table 41: ... *Continuation*

		S_c	S_e	S_w
Log real prices electricity	lnP_e	-0.45**	-0.27***	0.08**
		(0.16)	(0.03)	(0.03)
Log real prices combustibles	lnP_c	-1.08	-0.45**	0.08
		(3.01)	(0.16)	(0.15)
Log real prices wage	lnP_w	0.08	0.08**	-0.08
		(0.15)	(0.03)	(0.09)
Log expenditure in capital	lnZ_k	-0.01	0.01	-0.07**
		(0.05)	(0.01)	(0.03)
Age of owner	age_{own}	3.0e-3	-3.2e-3	-0.01
		(0.04)	(6.7e-4)	(0.02)
Age of owner squared	age^2_{own}	-1.0e-4	3.4e-5	1.1e-4
		(4.3e-4)	(8.2e-5)	(2.2e-4)
Female entrepreneur (dummy)	$woman$	-0.23	-0.10*	-0.10
		(0.20)	(0.04)	(0.12)
Age of microenterprise	age_{me}	-1.7e-3	-1.2e-3	-0.01
		(0.01)	(1.8e-3)	(5.5e-3)
Log of schooling years	$educ$	0.60*	0.06	0.03
		(0.25)	(0.05)	(0.14)
Firm has premises (dummy)	$premises_{me}$	-0.30	-0.01	-0.33**
		(0.20)	(0.04)	(0.12)
Time fixed effects (2010)	d_{10}	-0.26	-0.20***	-0.02
		(0.56)	(0.04)	(0.10)
Northeastern region	r_{NE}	0.02	0.11	-0.47*
		(0.45)	(0.08)	(0.23)
North-Central region	r_{NC}	0.30	0.10	0.02
		(0.42)	(0.06)	(0.17)
South-Central region	r_{SC}	0.23	0.09	0.02
		(0.56)	(0.08)	(0.23)
Western region	r_W	-0.19	-0.03	-0.29
		(0.27)	(0.06)	(0.17)
Eastern region	r_E	0.04	0.10	0.13
		(0.66)	(0.06)	(0.16)
Southeastern region	r_{SE}	0.45	-0.03	0.31
		(0.40)	(0.08)	(0.25)
Southwestern region	r_{SW}	-0.10	0.13*	0.05
		(0.40)	(0.06)	(0.16)
Intercept	α_0	-2.73	-0.93***	1.16**
		(1.40)	(0.27)	(0.41)
N		195	195	195

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: The subsample corresponds to tortilla producers.

Daron Acemoglu and James A. Robinson. *Why Nations Fail: The Origins of Power, Prosperity, and Poverty*. Crown Business, New York, 2013. ISBN 978-0-307-71921-8.

Cristina Gomez. *El reto de la informalidad y la pobreza moderada. Memorias 2004. IBERGOP - MEXICO*, volume VI. Editorial Porrua, SA de CV, Mexico, 2006. ISBN 970-07-6979-8.

Elhanan Helpman. *The Mystery of Economic Growth*. Harvard University Press. Harvard University Press, Cambridge, Massachusetts, 2010 edition, 2009. ISBN 978-0-674-01572-2.

UNO. World economic and social survey 2011. the great green technological transformation. United Nations Department of Economic and Social Affairs, 2011.

8 Affidavit

Ich versichere, dass ich die Arbeit selbstständig und ohne Benutzung anderer als der angegebenen Hilfsmittel angefertigt habe. Alle Stellen, die wörtlich oder sinngemäß aus Veröffentlichungen oder anderen Quellen entnommen sind, sind als solche kenntlich gemacht.

Place and Date	Ana Karen Negrete García