Profits of human capital in microenterprises at the northern Mexican border

Rendimientos del capital humano en las microempresas de la frontera norte de México

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ABSTRACT

This paper aims to calculate and analyze the human capital returns of micro-enterprises on Mexico's northern border by examining the education levels of the micro-entrepreneurs in charge of the production unit. Analyzing data from the National Survey of Occupation and Employment from 2010 to 2019, we estimated econometric cross-section models based on Mincer equations. The results suggest that elementary education is not sufficient to achieve high monetary income in micro-enterprises, even its rates are negative, generating losses systematically. The turning point starts in high school, where positive rates are beginning to be observed. However, it highlights that undergraduate and postgraduate education doubles their positive returns, although the number of business owners with this education level is lower.

Keywords: 1. returns, 2. human capital, 3. micro-enterprises, 4. intangible assets, 5. northern border of Mexico.

RESUMEN

Este artículo tiene como objetivo calcular y analizar los rendimientos del capital humano de las microempresas en la frontera norte de México, al analizar el nivel de escolaridad alcanzado por el microempresario encargado de la unidad productiva. Analizando datos de la Encuesta Nacional de Ocupación y Empleo del año 2010 al 2019, se estimaron modelos econométricos de corte transversal con base en ecuaciones de Mincer. Los resultados sugieren que niveles de educación básica no son suficientes para alcanzar ingresos monetarios altos de las microempresas, incluso sus tasas son negativas, generando pérdidas de manera sistemática. El punto de inflexión se encuentra a partir de la educación media superior, donde se comienzan a observar tasas positivas; sin embargo, resalta que la educación superior y posgrado incrementan al doble sus rendimientos positivos, aunque el número de propietarios con este nivel de estudios es menor.

Palabras clave: 1. rendimientos, 2. capital humano, 3. microempresas, 4. activos intangibles, 5. frontera norte de México.

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INTRODUCTION

It is possible to consider that the concept of human capital started being analyzed, perhaps, in the work of Adam Smith, in which he stated that learning skills via schooling or training, is an individual's capital (Goldin, 2016, p. 57); later, in works by Mincer (1958), Schultz (1961) and Becker (1962), this concept became more relevant in the empirical analysis of economy. By and large, the idea is that people are able to acquire skills that will make them more productive, and that this improvement will become better incomes. Such statement prevailed and was widely accepted because a central part of the orthodox economic theory is that income level depends on the productivity of production factors, and being labor one of such factors, it was plausible to quantify its contribution to income from marginal products. This conjecture was useful to explain the differences in wages between workers under the supposition of wage and flexible mobility, which implies people may opt for one or other job in function of their skills and labor capacity (Fix, 2018, p. 16).

At present, it is possible to find studies that approach topics on human capital in various contexts and economic systems around the world at micro- and macroeconomic level in the literature on economics. A part of the contributions from human capital is its influence on the countries' economic growth and on the profitability of the income of people and enterprises. In this regard, it may be argued that a human capital increase in society may produce higher economic growth via innovation owing to the transmission of abilities and knowledge among people. In this sense, human capital has as an advantage that since individuals develop it via learning, it may generate profitability that grows over time. In many cases, developing human capital turns into technological innovation processes that make production processes more efficient (Diebolt & Hippe, 2019)

The variable productivity and incomes is maybe one of the most resorted to measuring the impacts of human capital on economic spheres, particularly in enterprises. From the increase in labor productivity, for example, the effects that human capital is able to generate in the economic profits of the workers in a productive unit are analyzed, referring to the theoretical supposition that the quotient of productivity must be equal to that of the remunerations from productive factors. In this way, the firms' development may serve as the integrating factor to explain the advancement in the economic development of the regions and that of individual benefits for people, whose basic element comes from human capital in both spheres.

Human capital usually comes from knowledge and skills formally acquired or by means of the practice an individual attains along his or her life. Generally speaking, a rational person, with perfect information, will choose the schooling level up to the point where their income level from an extra schooling year compensates the investment level made (commonly, time and money). Though, multiple are the factors that prevent people from finding out the rate of return of human capital, since various are the conditions underlying the labor market (Abbas & Foreman-Peck, 2008). In this regard, the construction of this capital is part of a holistic combination of tangible and intangible assets based on knowledge, which applied to firms' structures and processes, offers

competitive and sustainable advantages capable of generating value (Joya Arreola, Gámez Adame, Ortiz Paniagua, & Gálvez Fernández, 2015; Fuentes, Osorio, & Mungaray, 2016).

Moreover, it is important to point out that human capital profitability is different depending on the sort of firm; that is to say, their private profits are usually diverse in function of the production unit size (Grigore, 2008; Abduli, 2013; Melo & Machado, 2013), for many structural factors and externalities conjugate, both differenced according to region and business sector. This is why, the present research has a main goal to calculate and analyze the profits from human capital in firms at microscale, specifically at the northern Mexican border.

It is known that this region is tightly linked to the external sector and has a competitive dynamism synchronized with international markets, which makes the operational sustainability of microenterprises difficult. However, this sector has served as the group with the most entrepreneurial fluctuation with an important concentration of the economically active population. The enterprise and population concentration usually increase their percentage, even in recessions or economic crises, facing productive and competitive adjustments of medium-sized and large companies, especially multinationals.

In this sense, it is relevant to calculate the profits these microenterprises produce in function of human capital, since at once an increase in the schooling level of the local productive force has been noticed, which is not reflected in the mean incomes of the workers in larger firms, it is important however to calculate its returns in microscale enterprises. The main hypothesis is that owing to the competitive structure and dynamism of firms in this region, the graduate schooling level in microenterprises turns into a decisive factor in the generation of higher returns than those produced by lower schooling levels.

This article is composed of six sections. In the second, a particular theoretical and conceptual framework is presented, the main approaches that explain the importance of human development and the firms' productive cycle are specified. In the third section, an overall picture of the factors that characterize the economic system as regards the entrepreneurial and competitive structures in the north of Mexico is specifically described for microenterprises.

The fourth section describes in detail the utilized methodology and the econometric methods estimated to obtain empirical evidence. The fifth section explains the results and the interpretative scope of the models' coefficients. Finally, conclusions and opportunity areas for future research works are presented.

HUMAN CAPITAL AND MICROENTERPRISES: CHALLENGES AND RETURNS

Economic dynamism is defined, among other conditions, by the firms' productive and competitive capacity. Mexico's northern border is maybe one of the national regions with the most stressed entrepreneurial culture, with an important number of businesses linked to international chains and markets with a preference for export products. In principle, the set of these elements would seem complex for microscale firms to achieve their intended competition level in the local economy. The

competitive and productive level of firms must be reflected mainly in the accomplished monetary incomes, an essential short-term goal, under the premise that the higher the incomes the higher probability to access better wellbeing levels for people with the firms. Though, being competitive in markets with complex dynamisms has relevant challenges, which increase when the necessary factors for their efficient operation are missing.

The theory of industrial economy establishes that firms shall make use of external and internal factors in order to reach the optimal operation levels that produce the competitivity necessary to remain in the market and reach the desired wellbeing levels. As regards external factors, noticeable are the links with suppliers and trading partners through participation in firms' associations or networks that allow strategic collaboration which provides them with stability and certainty in the production and commercialization processes of their products and services. In like manner, among these factors, the macroeconomic and social stability of local and regional contexts is indispensable.

As for internal factors, in principle, the importance of the so-called tangible assets was established, these are for instance, financial and technological resources, infrastructure, equipment, machinery, among others. In this way, the paradigm according to which high levels of production and competitiveness could be maintained, mainly in under the supposition that such productive units would have the capacity to access such tangible assets and reach mass production and increasing returns proportionately. At once, it was established that the latter might make higher levels of economic incomes and welfare possible (Fuentes *et al.*, 2016).

Even if tangible assets are important for the optimal performance of firms, it has been verified that the main factors are intangible, specifically for microenterprises. In spite of operating with limited resources, small-scale firms maintain an important presence in regional and sectorial spaces in the economy, even in markets with competitive dynamism such as in Mexico's northern border owing to returns from intangible factors. These produce increasing scale returns, defining new ways for entrepreneurial behavior (Mungaray & Ramírez, 2007)

Intangible factors are all the resources that are basically knowledge or information with no material identity, thereby, these are not to be touched or perceived in a specific manner (Fernández, Montes, & Vázquez, 1998, p. 83). Some of the main intangible resources a firm can have are business identification, reputation, experience, training or updating of employees, among others.

A differencing characteristic as regards tangible factors is that intangibles are difficult to acquire in the same manner as any other product on sale, for in this case, most of it has to be intrinsically developed by the individual, little by little. Indubitably, intangible resources must be considered another asset of the business unit, they also generate incomes and increasing scale returns owing to their characteristics as differentiating elements between firms, their condition of not being depreciated with use, on the contrary, it gains value as it accumulates, via developing externalities and associations.

In this way, thinking of a firm as a set of resources and capacities implies it has the ability to obtain cooperation and commitment from its personnel by means of socializing and motivating

them, resorting to certain elements that make the firm difficult to imitate, for instance, organizational design, shared values, leadership, management capacities, incentives and creation of organizational routines (Hernández, Mendoza & González, 2008). All of these elements are mainly composed of intangible assets.

For instance, organizational culture is an intangible asset determinant to structure entrepreneurial competitiveness, as it may supply a sustainable competitive advantage if there are conditions for such culture to become valuable; that is to say, in order for it to allow the firm to do things that produce economic value. Organizational culture is a resource that commonly explains what other resources cannot as regards the firm's situation, it is considered an asset not physically palpable that might lead the enterprise to disappear, or else, remain. Organizational culture is a fundamental part in the development of organizational routines (Hernández, Mendoza & González, 2008).

The human capital factor, understood as every resource invested on people, mainly, on schooling, training and accumulated experience (Mungaray & Ramírez, 2007); it is a concept underscored in the entrepreneurial literature when referring to the development of intangible assets, as it may be considered the element that integrates all the other resources. Suárez and Martín (2008) argue that human capital is fundamental for a firm's success and linked to other attributes –such as organizational culture– provides a solid framework for the business, regardless of its size, and succeeds in carrying out a sustained growth process through the increase of its monetary incomes (Delfín & Acosta, 2016).

Therefore, for this approach firm size comes second as a competitive factor, for it is more important the operation capacity and generation of internal strategies that link innovation and training efforts of its workers, to the extent that greater identity and learning retention are fostered (Portales and De la Rosa, 2017). These elements are intrinsic to the construction of human capital. Likewise, Campuzano, Ziadet and Echeverría (2016) argue that human talent must be strengthened as intangible capital, for it is an important element for the firm for it makes more efficient and optimal the enterprise's operative processes.

Then, human capital must be considered a relevant asset of firms and as such, it must produce a profit for them (Alnachef & Alhajjar, 2015). A great deal of this capital is developed in education institutions and enables people to gain abilities from knowledge acquisition without neglecting experience in the field, which also has an important role in the composition of this asset. Therefore, it may be stated that the higher the schooling level of the workforce, the higher the profit generated in a firm, not leaving aside that knowledge *per se* has to be constantly updated (Kumar, Jaiswal, Singh, & Yogi, 2015).

In this way, Torres, Pineda and Mendoza (2007) mention that human capital has competence between people as an important factor, such competence is based on their capability to act in certain circumstances, for which experience and formal technical schooling stand out. However, it is known that this capital has to be complemented by deliberate and continuous investments on the commercial knowledge of the market where the firm unfolds (Ehrlich, Li, & Liu, 2017). This

capacity in relation to the knowledge of the market is also part of human capital and collaborates with profitability. The above defines the pattern to establish the cost of developing human capital, since it has to be seen as an investment, not an expense (Fernández, Ruiz-Carrillo, & Fernández, 2006). Not only does the idea of having higher education degrees leads to cease investments have to disappear, but firms also have to train their staff as a way to hone the skills they already have.

It is worth pointing out that building up human capital is not only dependent on individual decisions, but regarding many aspects it is in function of the guidelines of the implemented public policies and systematized structures, for instance, improvements in education systems, in social infrastructure, civil society organizational capacity, entrepreneurial support policies, among others (Tchanturia, Beridze, & Kurashvili, 2015). And this is why the context in which firms and people develop influences in a defining manner as well.

This way, human capital has become, in point of fact, one of the explanatory variables of growth and economic endogenous development models. Hansson, Johansson and Leitner (2004) argue that human capital is a factor that generates growth and wellbeing, so investments on this capital are a concern for people, governments and enterprises. Pasban and Nojedeh (2016) state that human capital contributes in many ways to regional economic development, as it provides individuals with the necessary knowledge tools to carry out productive activities for a remuneration, which generate added value and increase the productivity of factors, leading to greater efficiency in income (Añez & Nava, 2009).

Works such as that by Kolstad and Wiig (2015) approach the relation between education and business returns in developing countries; the goal of this work was to explore whether education, mainly basic, is a competitive element of the firms. To do so, the authors resorted to an instrumental approach, avoiding a possible endogeneity in the education variable, which is measured by the entrepreneur's years of schooling. As a consequence, their results exhibit education as a significant factor in the enterprises' returns, where an additional year of education of the entrepreneur adds a considerable profit margin.

Similar to the above, the article by Dimova and Pela (2018) studies the impact of the entrepreneurs' skills on their businesses' returns in each of the economic sectors, particularly in agriculture, manufacture and services. To account for such skills, the entrepreneurs' age and schooling are considered. Resorting to a multinomial logistic model, Dimova and Pela (2018) found that entrepreneurs in the service sector receive correspondingly higher incomes as their education level increases, in comparison with agricultural entrepreneurs, whose returns are significant when they hold a low schooling level; whereas in the manufacturing industry, there is no relevant relation in statistical terms.

Furthermore, Iversen, Malchow-Moller and Sorensen (2010) argue that education returns in self-employment are not linear, unlike those in salaried work. Their research finds that low schooling levels are associated with meager incomes, and that these considerably increase when lengthy education is attained.

In addition to education and experience, the entrepreneurs' sex is an element capable of affecting the performance of a firm. Marlow and McAdam (2013) mention that female entrepreneurs' firms are associated with low performance compared with those owned by a man, though the authors state that female entrepreneurs' returns should be considered restricted, not low.

The entrepreneurs' sex is used as a control variable in income studies on independent workers incomes (Guataquí, García, & Rodríguez, 2009). Likewise, the marital status appears as a factor able to influence on the decision of starting a company (Jaimes, Jaramillo, & Pérez, 2017). In this sense, Guataquí *et al.* (2009) consider the entrepreneur's marital status as a socioeconomic factor that might influence on the occupation of the individual.

Another interesting factor in the study of business returns is the participation of the family. In Molina, Botero and Montoya (2017), it is discussed in which way family management in a firm may worsen, improve or have no effect on the enterprise performance. In the face of this diversity of results, it is recommended to include other elements in the analysis. In like manner, Buelvas-Meza and Mejía-Alfaro (2014) describe the role of accounting information on the firms' profitability; they verify that accountancy is a tool that favors the returns of the company.

Moreover, the research work by Cruz-Milán, Jimeno and Sonda (2014) finds a positive relation between firm size and returns, in such manner that smaller enterprises receive lower revenues, as opposed to their larger counterparts.

To sum up, the analysis of education returns turns into a useful tool to locate behavioral and human capital development patterns, which have to be reflected in indicators such as increased sales, higher economic revenues, increase in market share, surplus in the firms' market value, among others. Perhaps in microenterprises, it may increase its importance as it is one of the assets that can be built and noticed in running the business, being a determining factor for competitiveness and permanence (Fuentes *et al.*, 2016), even in markets with international competence, as in the northern Mexican border.

ENTREPRENEURIAL STRUCTURE AT THE NORTHERN BORDER

It is known that a large part of the entrepreneurial structure in Mexico is composed of micro, small and medium-sized enterprises. In particular, microenterprises are distinguishable in this set, considering the number of economic units and the numbers of people hired (graph 1) in this sector. According to *Encuesta Nacional para la Productividad y Competitividad*, Enaproce [National Survey on Productivity and Competitiveness], microenterprises account for about 97 percent of the economic units in the country and hires 75 percent of the employed population, however it is the sector with the largest restrictions in resources (Enaproce, 2018).

Graph 1. Units personnel income of microenterprises in Mexico
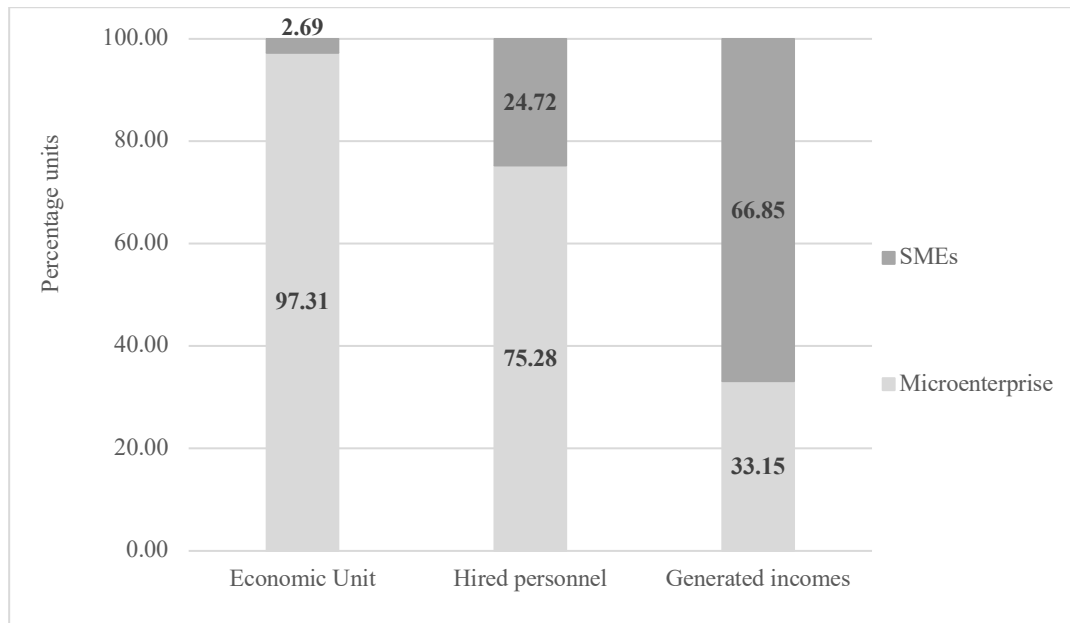
Source: own elaboration with data from Enaproce (2018).

Regarding intangible assets, specifically human capital, microenterprises have a relatively low percentage (graph 2). 2.95 percent of microenterprise employees do not have any sort of instruction. Around 49 percent holds basic education, up to elementary or secondary. Out of the rest of workers: 30.47 percent studied high school or holds a technician degree; and 17 percent holds a graduate or postgraduate degree or are engineers.

Graph 2. Schooling level of individuals hired in microenterprises in Mexico
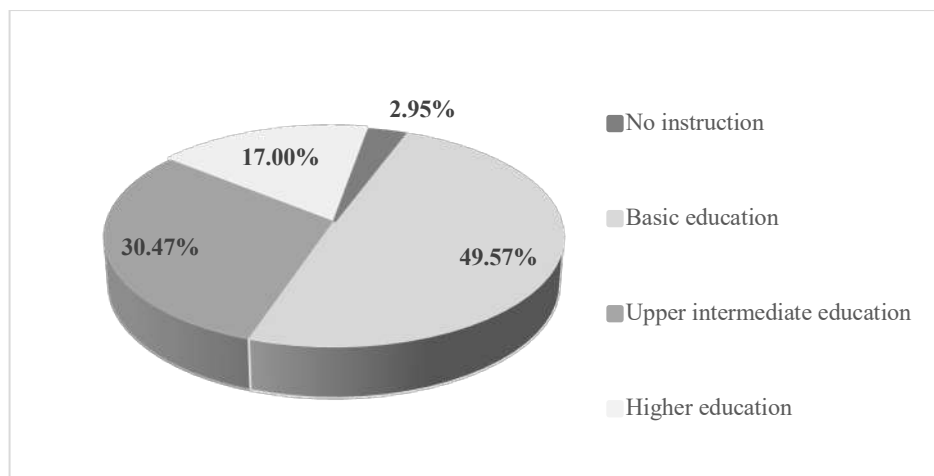
Source: own elaboration with data from Enaproce (2018).

According to data from *Instituto Nacional de Estadística y Geografía* (INEGI, 2019) [National Institute of Statistics and Geography], the entrepreneurial structure of the northern border is not different from the national one in terms of proportion of economic unit for each size stratum because microenterprises are the majority (graph 3). However, the northern border does have a

structure different from the country's as regards hired employees; large enterprises account for the largest proportion of employment, though micro and small enterprises hire 29.7 and 26.8 percent, respectively.

When considering revenues, a clear domain of large firms is noticed, while microenterprises display a small margin. Noticeable is that small enterprises receive higher incomes than medium-sized ones.

Graph 3. Entrepreneurial structure at the northern Mexican border according to firm size
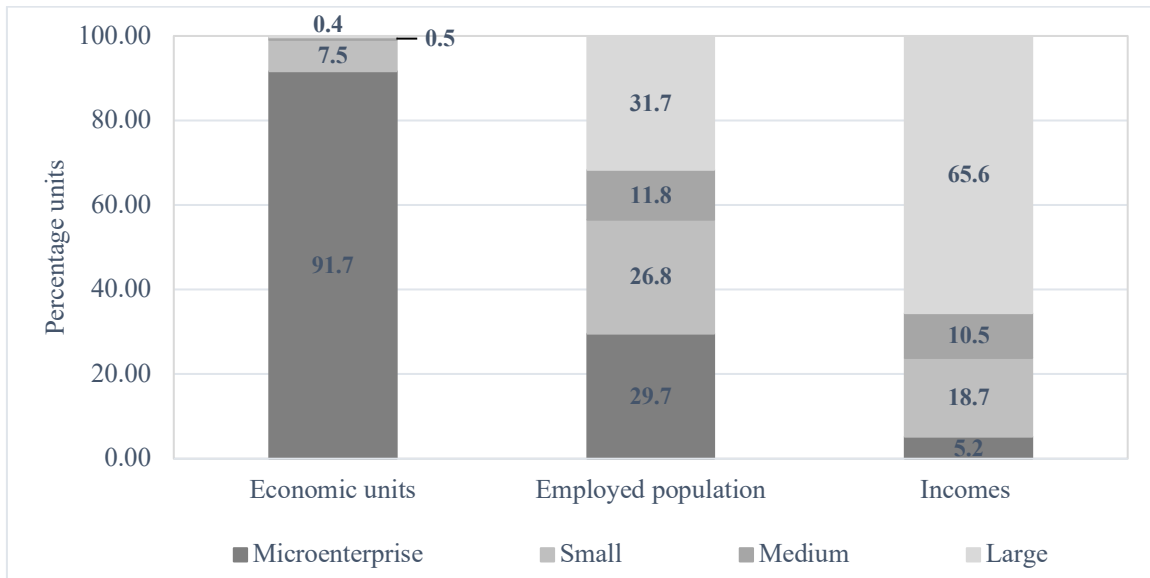
Source: own elaboration with information from INEGI (2019).

Besides, the most noticeable economic activities in this region are manufacturing, trade and services (graph 4). Manufacturing industry accounts for a large number of people employed and incomes with 38.96 percent of employment and 51.24 percent of incomes at the border. When analyzing the economic units, services and trade together account for 89.76 percent of the total at the border, 44.14 and 45.62 percent, respectively. Though trading companies accumulate more than twice the incomes of the service sector.

Graph 4. Entrepreneurial structure by economic activity at the
northern Mexican border
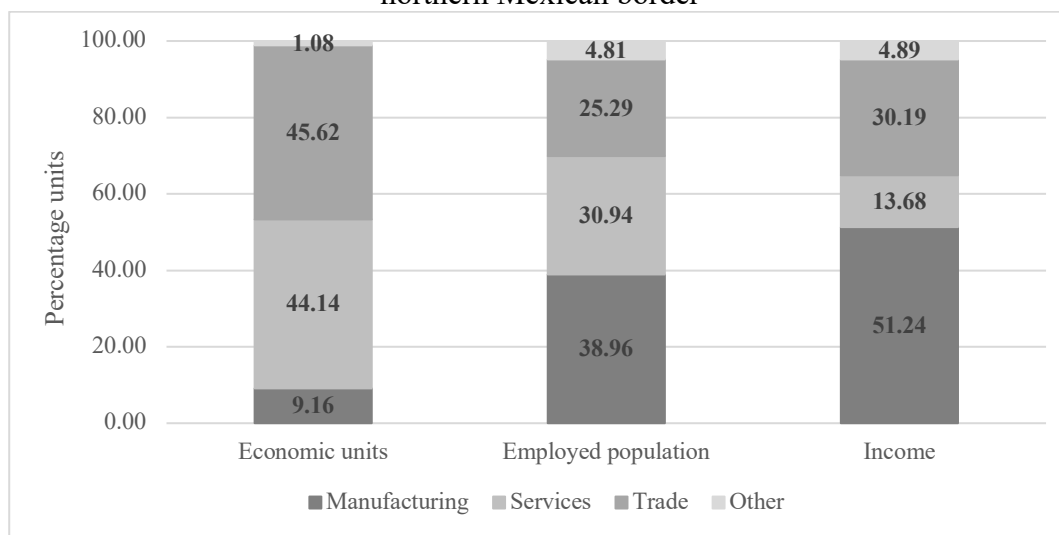
Source: own elaboration with information from INEGI (2019).

When the entrepreneurial structure is analyzed by sort of activity, a considerable contribution in terms of economic units, hired population and incomes is noticed from the service and trade sectors (graph 5). Regarding number of firms, services and trade also have similar figures, with 46.48 and 44.16 percent of the microenterprises in the region, respectively.

However, the difference between these activities is stark when employees and revenues are analyzed, since the service sector hires 50.36 percent of the personnel with microenterprises, 13 percentage units more than trading firms. While trade is the economic activity with the most capacity to generate revenues in the microenterprises in the north, this activity surpasses in seven percent the incomes in the service sector and in 37 percent in manufacturing microenterprises.

Graph 5. Microenterprise structure by economic activity at the
northern Mexican border
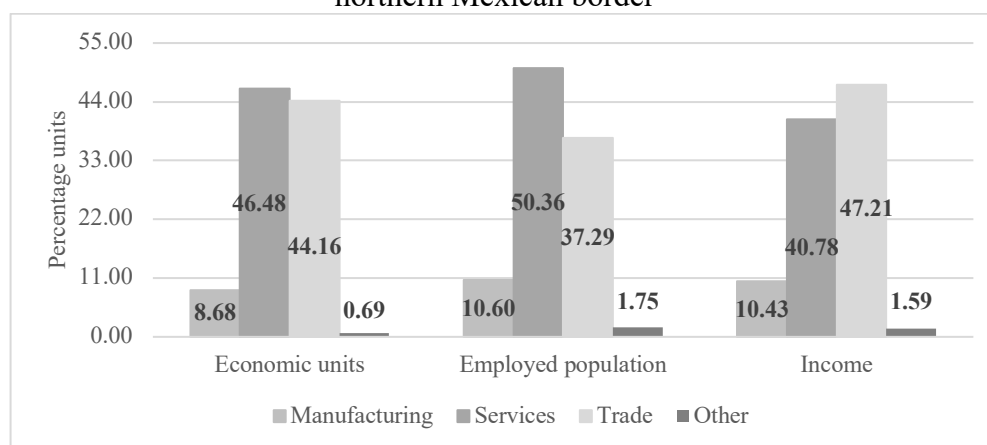
Source: own elaboration with information from INEGI (2019).

At the northern Mexican border, human capital in microenterprises is mainly characterized by holding basic education, which comprises pre-school, elementary and secondary; such schooling level accounts for 83.53 percent of entrepreneurs in this sector (graph 6). Whereas those who hold high school or a technician degree, considered upper intermediate education, account for 9.16 percent, i.e., 3.06 percent more than university education, which accounts for individuals who hold graduate and postgraduate degrees. Finally, 1.22 percent of the rest does not hold any education degree.

Graph 6. Schooling level of microenterprise entrepreneurs at the
northern Mexican border
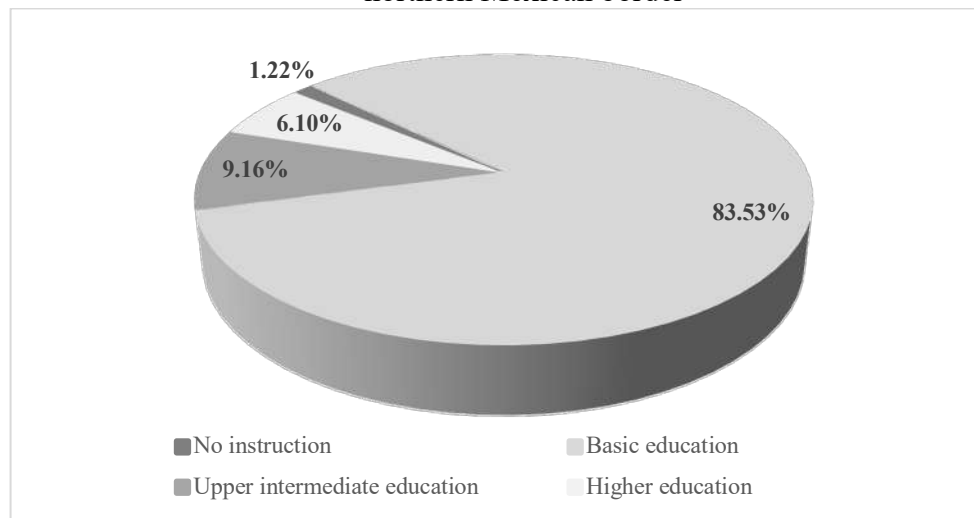
Source: own elaboration with information from ENOE (2019).

Microenterprises are important components in the entrepreneurial structure, as it accounts for an absolute majority of economic units at the northern border of the country. Though in terms of employed population, they contribute considerably to the national level, since it is the second employment source at the border. In any case, this sort of firms does not stand out as their larger counterparts when analyzing revenues.

Furthermore, human capital in this sort of business is relatively higher at national level than at the border, for most of the latter only hold elementary and secondary schooling. When the entrepreneurial structure by economic activity at the border is examined, a dominance of the manufacturing industry in the concepts on hired employees and incomes is observed, though that clear representation of such industry disappears when only microenterprises are considered, as this sort of small enterprises are abundant in services and trade, which are superior in each of the categories studied.

METHODOLOGY

To measure human capital returns through monetary incomes in microenterprises at the northern Mexican border, the classic Mincer (1974) equation was resorted to, which proposes that income

level depends on education and labor experience, both in terms of schooling years and participation in labor markets in years, respectively. Mincer equation was added the variable experience squared in order to ascertain the diminishing returns facing an additional year of experience. The semilogarithmic equation proposed by Mincer is presented as follows:

$$Ln(y)_i = \beta_0 + \beta_1 Edu_i + \beta_2 Exp_i + \beta_3 Exp_i^2 + \mu_i \tag{1}$$

Where:

$Ln(y)$ = natural logarithm of monetary income.

Edu = schooling years.

Exp, Exp^2 = Experience and experience squared, respectively.

μ = error term.

$\beta_{0,1,2,3}$ = Parameters to estimate. It is expected that coefficients in the model are positive for beta one and beta two, and negative for beta three ($\beta_1 > 0$; $\beta_2 > 0$; $\beta_3 < 0$).

Equation (1) has been widely used in the calculation of education marginal returns. Though after the publication of works by Mincer (1974) and Griliches (1977), some biases of the equation have been pointed out: i) the single education flat rate of return; ii) omission of structural and context variables in Mincer equation. Adding to the above, the selection bias that comes from selecting only the employed population in the final sample.

To solve these biases the following was done: 1) in the face of the bias of the education flat rate of return, the variable education was disaggregated according to schooling levels from the creation of dichotomic variables; 2) for omission of variables, the rates of return were calculated by means of an extended human capital model considering control variables, which according to empirical literature on microenterprises are income determinants; 3) for sample selection, even if Heckman's (1979) methodology is commonly utilized, mainly in labor market analysis when employed and unemployed population is analyzed, in this case, the intention is to measure the returns obtained by microentrepreneurs, hence only this specific population sector is analyzed.

Due to the foregoing, the calculated model is the following:

$$Ln(y)_i = \alpha + \beta_j s_i' + \delta x_i + \theta x_i^2 + \mu \tag{2}$$

Where:

$\ln(y)$ = natural logarithm of monetary income.

s_i' = vector of schooling variables.

x = experience.

μ = estimation error, $\mu \sim N(0, \sigma^2)$.

$\alpha,\ \beta_j, \delta, \theta =$ coefficients to estimate.

$i =$ economic unit (microenterprise).

The extended model is structured as:

$$Ln(y)_i = \alpha + \beta s_i' + \delta x_i + \theta x_i^2 + \gamma z_i' + \mu \qquad (3)$$

Where:

$\ln(y) =$ natural logarithm of monetary income.

$s_i' =$ vector of schooling variables.

$x =$ experience.

$z_i' =$ vector of control variables.

$\mu =$ estimation error, $\mu \sim N\,(0, \sigma^2)$.

$\alpha, \beta, \delta, \theta, \gamma =$ Coefficients to estimate.

$i =$ economic unit (microenterprise).

Data were obtained from *Encuesta Nacional de Ocupación y Empleo*, ENOE [National Survey on Employment and Occupation] and correspond to the first quarter of each year, from 2010 to 2019. In total, data from 36 225 microenterprises were taken for the analysis period, corresponding to six federated states in northern Mexico: Baja California, Sonora, Chihuahua, Coahuila, Nuevo León and Tamaulipas (ENOE, 2019). In function of this, independent and dependent variables were built in the following manner:

Dependent variable:

- *Y*: it was built from current monthly incomes reported by the microenterprises. The natural logarithm was obtained to facilitate the interpretation of results as elasticities.

Independent variables are:

- *Exp:* age of the individual reported at the moment of the survey as a proxy variable of experience.
- *Expˆ2*: this variable was designed from age squared with a view to controlling the decreasing factor as the age of the individuals increases.
- *Prim:* it takes the value of 1 when the highest schooling degree is elementary, and zero in any other case (iaoc).
- *Sec:* it takes the value of 1 when the highest schooling degree is secondary, and zero iaoc

- *Prep:* it takes the value of 1 when the highest schooling degree is high school, and zero iaoc.
- *Prof:* it takes the value of 1 when the highest schooling degree is graduate, and zero iaoc
- *Posg:* it takes the value of 1 when the highest schooling degree is postgraduate, and zero iaoc.

Control variables:

- *Sexo:* it takes the value of 1 when the microentrepreneur is a man, zero iaoc.
- *Neg_Fam:* it takes the value of 1 when it is a family firm, zero iaoc.
- *Sist_Cont:* it takes the value of 1 when the company has an accounting system, zero iaoc.
- *E_Civil:* it takes the value of 1 when the microentrepreneur is married, zero iaoc.
- *Emple:* it takes the value of 1 when the company has more than one employee, zero iaoc.

The regression models were calculated by the transversal cut method, owing to the data structure for the analysis of comparative statistics.[4] In the case of construction of education binary variables, it was normalized with people with no schooling years.

RESULTS

Results from the basic and extended models are shown in tables 1 and 2, respectively. At first, it is noticed that in table 1 that the supposition that returns from experience are positive is met, though decreasing in later years. The above may be explained by the individuals' age factor, that is to say, because there is a point at which at later ages returns related to income decrease, in spite of experience accumulation, which is maybe due to the individuals' physical or mental dexterity diminution.

The basic model for 2010 states that elementary education returns are negative, that is to say, income generated by the economic unit decreases in 36.5 percent when the proprietor has this schooling as highest. The above repeats for secondary, where income decreases 11.55 percent. At the same time, the logical congruence of the data is noticeable, as the negative impact is greater when schooling reaches high school, graduate or postgraduate degrees, for returns are 7.08, 51.4 and 96.6 percent, respectively (Zepeda, & Ghiara, 1999). This is associated to the supposition that at a higher education level, income returns are higher. However, the gargantuan leap in the coefficient these schooling levels produced is noteworthy. This provides solid arguments to mention that, by and large, given the entrepreneurial structure at the northern border is not sufficient to have elementary and secondary education to reach positive returns in a microenterprise.

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[4] For the case of Mexico, this strategy has been implemented in studies by Zepeda and Ghiara (1999), and Ordaz-Díaz (2008) for the periods from 1987 to 1993, and from 1994 to 2005, respectively.

For 2011 values resemble the 2010 scenario. It was found that education returns are important from high school onward. Elementary education still generates a negative return of 22.2 percent. It is noticed that the variable postgraduate is the one that produces the most returns. In 2012, the returns of the equation were also increasing, being the graduate and postgraduate education the ones that produced the most returns. In like manner, private returns from elementary and secondary are negative. For 2013, as 2012, all the values were statistically significant and the theory of ascending returns is met. A negative return on the income from elementary and secondary education is repeated, while for graduate and postgraduate education is positive.

In 2014, all the coefficients were statistically significant. It is noticed that the return from education is ascending. Likewise, returns from education are similar to those recorded in 2013. Despite high school education was not statistically significant, the sign is positive. The last five analyzed years report coefficients with the same tendency and structure as previous years, then the same behavioral logic at various statistical periods is verified. It is worth mentioning that in the face of rejecting the null hypothesis of White tests, the coefficients and their error terms were robust.

Table 2 shows the results of the extended model for the same period, in which important data are noticed. Firstly, the variable sex reflects that just by being a man there are positive returns for the firm, which may be associated to the still existing discrimination in the productive sector in such states; this variable was statistically significant for all the years.

The variable family firm was statistically significant only for some years and, for them, the value was positive. As regards the use of accounting systems, the results were statistically significant and positive in sign; thereby, it may be inferred that, on average, having an accounting system contributes with a positive return for income of 40 percent. Marital status (living with a partner) was statistically significant and with a positive value for nine of the 10 years under analysis, and on average, retributes income with 7 percent. Finally, the variable related to the firm having more than one employee is statistically significant and with a positive impact at the income level for the final years of the study.

As regards experience in the extended model, the results were congruent with the theory, as it represents a positive impact on income level. However, if that very same exponential variable is analyzed, it is decreasing, which might mean that experience on its own has certain limit in its capacity to generate positive returns. That is to say, after a certain point, it is important to gain diverse knowledge that boosts the firms' competitive development. In relation to education variables, the results were consistent with the observations of the basic model. It is distinguishable that graduate and postgraduate schooling corresponds to the schooling levels that produce the most returns as regards income in general. It is worth pointing out that high school had statistically significant coefficients and positive for the last five years, with an increasing tendency.

In graph 7, the growth rates of returns in function of schooling are shown. It is noticed that in general there is a positive tendency in the most recent years, which indicates that, indeed, human capital built from formal education has an influence on income, at various rates though, which are

neither proportional nor linear according to schooling level. An important divide is noticed from higher education, unlike basic. It is worth mentioning that postgraduate schooling is the one with the highest rate of return, though the gap between graduate and postgraduate is virtually twice as much, and also that between high school and graduate studies. Once again, it is important to point out the logical consistence expressed by the data in relation to the existing association of higher rates of return as schooling increases. This piece of evidence may shed light to discuss the relevance formal education has, which is difficult to replace with informal learning, on the basis of empirical knowledge or experience.

Graph 7. Returns of the microenterprise in function of the schooling of the entrepreneur at the northern Mexican border, basic model
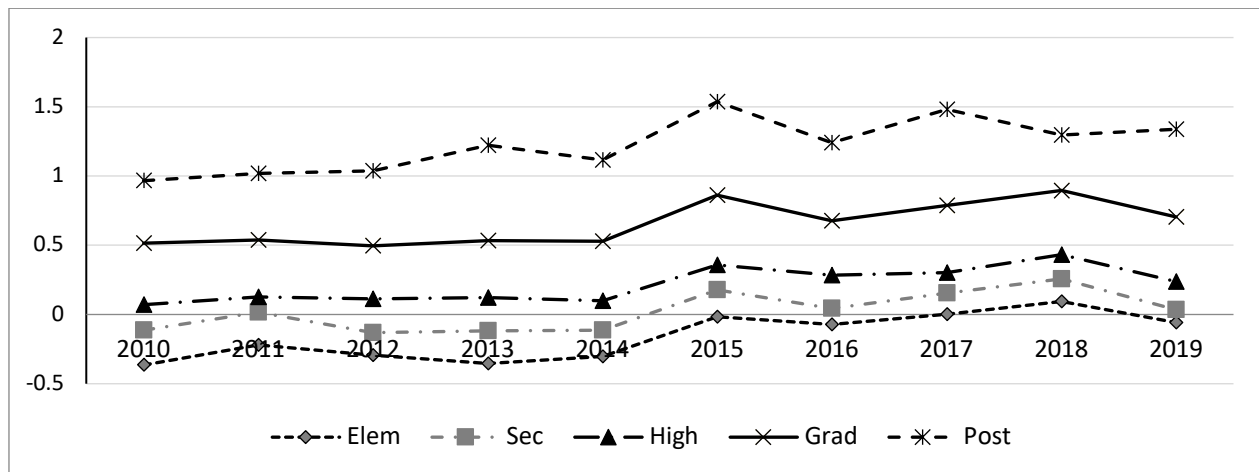
Source: own elaboration based on data from ENOE (2019).

That same exercise is carried out for the extended model in graph 8. It is shown that, by and large, the results are congruent with the theory and evidence displayed. As in the basic model, the divide between the returns from elementary education and secondary is more noticeable for the levels of graduate and postgraduate education. Returns from elementary and secondary, which are basic education, do not help increase the firms' income levels, most of the years have negative returns. The above produces solid arguments to establish that, by and large, the minimum schooling level to obtain positive returns from income is high school at the northern Mexican border.

Graph 8. Microenterprise returns in function of the schooling of the entrepreneur
at the northern Mexican border, extended model
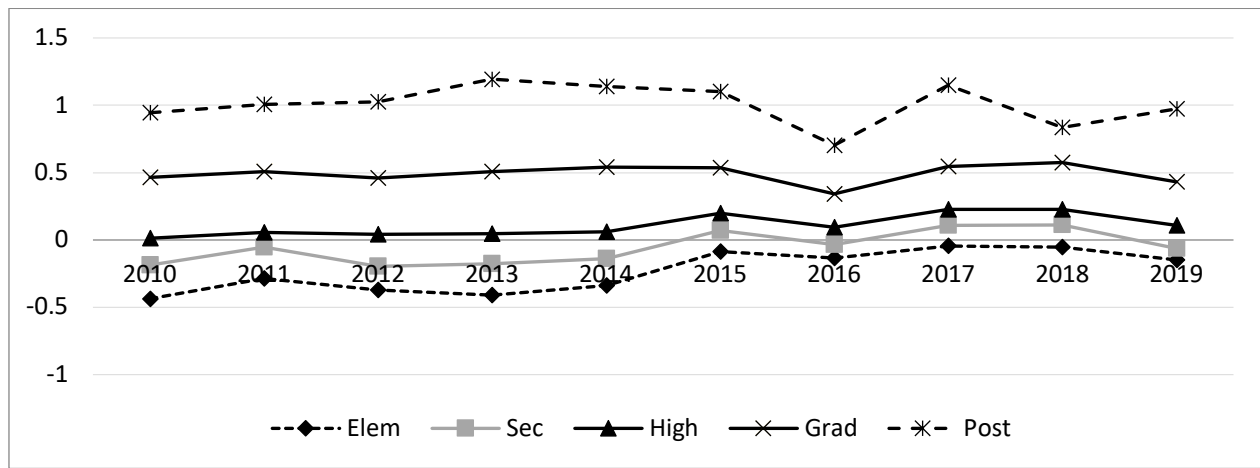
Source: own elaboration with data from ENOE (2019).

The above agrees with stances proposing that the service life of knowledge and skills of the workers is increasingly shorter, owing to the accelerated and continuous innovations in the productive and technological forces used in the entrepreneurial processes and competitive markets. Due to the foregoing, basic education is no longer sufficient if the intention is to reach sustained income, even in microentrepreneurial sectors.

Evidence makes it clear that running a firm where the entrepreneur holds basic education may lead to income losses, instead of an earning. This may be one of the explanatory factors that add to the large numbers of microenterprises that close down a few months after their inception. In many cases their organization is usually deficient due to poor knowledge regarding management and productive structure.

Even if one of the main characteristics of the microentrepreneurial world is gathering people with low human capital levels, it is necessary to incorporate policies and entrepreneurship development programs on the basis of training and support so that they can survive as a self-employment instance by serving local, residual or specific markets. From this standpoint, microenterprises that have these conditions produce great value from the paradigm of economic development, for it may even reach incomes superior to the precarious wages of important sectors at the northern border, for example, in manufacturing or maquilas (Mungaray & Osorio, 2018).

However, if the goal is that the microenterprise adds to the dynamic economic growth, then evidence shows the imperative need to incentivize human capital based on increasing formal education that provides sufficient tools to maintain positive returns in competitive markets. By systematically increasing schooling, it is more likely the acquisition of technologic and management mechanisms that become externalities and increasing returns in shorter operating time and financial expenditures.

Profits of human capital in microenterprises at the northern Mexican border
Osorio-Novela, G., Martínez-Sidón, G., & Saavedra-Leyva, R.

Table 1. Results of the Human Capital Basic Model

Variables	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Exp	0.0707***	0.0658***	0.0660***	0.0590***	0.0591***	0.0536***	0.0570***	0.0641***	0.0581***	0.0621***
	(0.0049)	(0.0048)	(0.0050)	(0.0047)	(0.0052)	(0.0056)	(0.0059)	(0.0056)	(0.0057)	(0.0051)
Exp2	-0.0008***	-0.0007***	-0.0007***	-0.0006***	-0.0006***	-0.0006***	-0.0006***	-0.0007***	-0.0006***	-0.0007***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
prim	-0.3650***	-0.2223***	-0.2940***	-0.3530***	-0.3033***	-0.0164	-0.0746	0.0002	0.0939*	-0.0576
	(0.0468)	(0.0488)	(0.0509)	(0.0514)	(0.0572)	(0.0498)	(0.0547)	(0.0556)	(0.0540)	(0.0517)
sec	-0.1155**	0.0140	-0.1311***	-0.1190**	-0.1134**	0.1763***	0.0437	0.1534***	0.2571***	0.0333
	(0.0454)	(0.0472)	(0.0491)	(0.0496)	(0.0540)	(0.0508)	(0.0555)	(0.0564)	(0.0543)	(0.0519)
prep	0.0708	0.1254**	0.1113**	0.1232**	0.1007*	0.3559***	0.2857***	0.3034***	0.4321***	0.2356***
	(0.0510)	(0.0526)	(0.0547)	(0.0537)	(0.0570)	(0.0569)	(0.0611)	(0.0613)	(0.0601)	(0.0558)
prof	0.5148***	0.5367***	0.4956***	0.5326***	0.5294***	0.8599***	0.6745***	0.7884***	0.8959***	0.7058***
	(0.0499)	(0.0519)	(0.0547)	(0.0549)	(0.0608)	(0.0589)	(0.0627)	(0.0634)	(0.0613)	(0.0573)
posg	0.9661***	1.0184***	1.0351***	1.2233***	1.1146***	1.5365***	1.2391***	1.4830***	1.2940***	1.3370***
	(0.1100)	(0.1314)	(0.1195)	(0.1571)	(0.1354)	(0.1800)	(0.1512)	(0.1427)	(0.1544)	(0.1411)
Constant	6.9312***	7.0335***	7.0636***	7.2798***	7.2942***	6.9505***	7.0899***	6.8984***	6.9553***	7.1272***
	(0.1042)	(0.1050)	(0.1084)	(0.1039)	(0.1134)	(0.1376)	(0.1456)	(0.1399)	(0.1412)	(0.1263)
Num of obs	3 104	2 684	2 677	2 531	2 385	4 311	4 391	4 392	4 389	5 361
Adjusted R2	0.2035	0.1858	0.1964	0.2148	0.1924	0.1257	0.1104	0.119	0.1166	0.1176
F test (F likelihood)	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
White test (Chi2 likelihood)	0.0001	0.0000	0.0001	0.0000	0.0000	0.0324	0.0178	0.0008	0.0005	0.0000

NB: for each model White test was made, whose null hypothesis is homoscedasticity. For all the cases, the null hypothesis was rejected at a significant level of 5%. *, **, and *** denote a significance level of 10, 5 and 1 %, respectively. The coefficients in parentheses denote the standard error.

Source: own elaboration based on data from ENOE (2019).

Table 2. Results of the Human Capital Extended Model

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Exp	0.0710***	0.0655***	0.0654***	0.0551***	0.0517***	0.0392***	0.0431***	0.0447***	0.0450***	0.0458***
	(0.0051)	(0.0049)	(0.0050)	(0.0050)	(0.0052)	(0.0049)	(0.0051)	(0.0051)	(0.0051)	(0.0046)
Exp2	-0.000***	-0.0007***	-0.0007***	-0.0006***	-0.0006***	-0.0004***	-0.0005***	-0.0005***	-0.0005***	-0.0005***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
prim	-0.436***	-0.2859***	-0.3731***	-0.4083***	-0.3364***	-0.0857**	-0.1361***	-0.0453	-0.0513	-0.1465***
	(0.0460)	(0.0474)	(0.0496)	(0.0505)	(0.0546)	(0.0434)	(0.0467)	(0.0496)	(0.0477)	(0.0457)
sec	-0.185***	-0.0519	-0.1961***	-0.1775***	-0.1395***	0.0681	-0.0320	0.1088**	0.1114**	-0.0647
	(0.0447)	(0.0460)	(0.0477)	(0.0487)	(0.0516)	(0.0443)	(0.0472)	(0.0501)	(0.0479)	(0.0458)
prep	0.0130	0.0538	0.0420	0.0486	0.0588	0.1978***	0.0941*	0.2251***	0.2272***	0.1077**
	(0.0499)	(0.0511)	(0.0531)	(0.0528)	(0.0545)	(0.0497)	(0.0521)	(0.0545)	(0.0529)	(0.0493)
prof	0.4670***	0.5070***	0.4613***	0.5055***	0.5422***	0.5374***	0.3422***	0.5433***	0.5753***	0.4292***
	(0.0488)	(0.0503)	(0.0530)	(0.0537)	(0.0581)	(0.0524)	(0.0541)	(0.0572)	(0.0547)	(0.0514)
posg	0.9452***	1.0081***	1.0274***	1.1942***	1.1409***	1.1005***	0.7035***	1.1507***	0.8352***	0.9747***
	(0.1073)	(0.1271)	(0.1157)	(0.1534)	(0.1293)	(0.1576)	(0.1299)	(0.1273)	(0.1366)	(0.1251)
sexo	0.3281***	0.3569***	0.3615***	0.2921***	0.3813***	0.7019***	0.7999***	0.6651***	0.7081***	0.6843***
	(0.0269)	(0.0273)	(0.0275)	(0.0276)	(0.0273)	(0.0256)	(0.0254)	(0.0264)	(0.0259)	(0.0231)
neg_fam	0.0062	-0.0259	-0.0458	0.0150	-0.0012	0.4729***	0.4690***	0.1028*	-0.0443	0.1934***
	(0.0394)	(0.0402)	(0.0439)	(0.0467)	(0.0475)	(0.0604)	(0.0649)	(0.0607)	(0.0624)	(0.0578)
sist_cont	0.0090	0.0384	-0.0293	-0.0281	-0.0132	0.4099***	0.5138***	0.4135***	0.3959***	0.4008***
	(0.0373)	(0.0361)	(0.0392)	(0.0375)	(0.0394)	(0.0396)	(0.0402)	(0.0423)	(0.0425)	(0.0369)
e_civil	0.0768***	0.0900***	0.0554*	0.0876***	0.1434***	0.0543**	0.0723***	0.0255	0.0840***	0.0680***
	(0.0294)	(0.0285)	(0.0294)	(0.0299)	(0.0296)	(0.0275)	(0.0277)	(0.0289)	(0.0281)	(0.0252)
empleados	0.0197	-0.0039	-0.0258	-0.0025	-0.0111	0.4727***	0.4226***	0.4700***	0.4516***	0.4137***
	(0.0275)	(0.0278)	(0.0289)	(0.0286)	(0.0292)	(0.0282)	(0.0275)	(0.0295)	(0.0282)	(0.0258)
_cons	6.7331***	6.8504***	6.9452***	7.1761***	7.1442***	6.3178***	6.4071***	6.7623***	6.8649***	6.8388***
	(0.1119)	(0.1108)	(0.1154)	(0.1150)	(0.1196)	(0.1339)	(0.1377)	(0.1373)	(0.1370)	(0.1258)
Num of obs	3 104	2 684	2 677	2 531	2 385	4 311	4 391	4 392	4 389	5 361
Adjusted R2	0.2447	0.2415	0.2507	0.2544	0.2668	0.3414	0.3614	0.3065	0.3246	0.3167
F test	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

	(F likelihood)									
White test (Chi2 likelihood)	0.0001	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

NB: for each model White test was made, whose null hypothesis is homoscedasticity. For all the cases, the null hypothesis was rejected at a significant level of 5%. *, **, and *** denote a significance level of 10, 5 and 1 %, respectively. The coefficients in parentheses denote the standard error.

Source: own elaboration based on data from ENOE (2019).

CONCLUSIONS

Entrepreneurial development is a topic that unfolds in the agenda of economic growth and development. At the northern border of Mexico, the productive structure revolves around markets with exposition to international competence; however, it has a structure in which most of the productive units are microenterprises, largely considering the importance of their intangible assets. In this sense, human capital is maybe one of the most relevant intangible factors owing to its capacity to generate positive externalities in the use of other assets. One way to analyze the impact and magnitude of this resource is by means of analyzing monetary returns that human capital produces according to the schooling level.

Human capital is recognized as a concept that integrates the skills and capabilities an individual accumulates to later harness in favor of their monetary income. It is recognized that a large part of the tools and qualities developed by an individual is gained via formal education. There is also informal learning, nevertheless, which comes from experience accumulated over the years. In this sense, it would be optimal maybe to look for complementariness between these dynamics for the running of a firm.

In this article the impact generated by human capital on the firms' monetary incomes is assessed by means of analyzing the accomplished schooling level of the microentrepreneurs in the context of the norther Mexican border. It is concluded that private returns from human capital were congruent as a whole, seeing that returns that depended on education defined the patterns to establish that it is not enough to have elementary or secondary to reach the returns necessary for microscale businesses, for in the models in which they were statistically significant, even their effects were negative.

The above is explained by the fact that the skills that are acquired by running a firm have to be even more demanding than the tools learnt at such level. For the rest of the schooling levels, income returns were increasing for most of the models, though neither proportional nor linear, standing out graduate and postgraduate levels.

The gap between the returns of those who hold a graduate and postgraduate degree is virtually twice as much, and at these two is where the most retribution from human capital is obtained. It is worth mentioning that the market conditions at the northern Mexican border, high school is needed in order for human capital returns to start to be positive. This defines paths for future research on the minimal schooling level necessary to obtain a positive return on income in other regions in Mexico.

The control variables, which on the one side, allowed the results to be more robust, they also evinced the importance of some factors in the determination of income. For example, it was demonstrated that experience, considered an element that contributes to human capital from empirical knowledge, has positive returns, but decreasing as more recent years were analyzed.

Likewise, indicators such as gender, use of accounting systems or the marital status of the entrepreneurs are determinant for the operative performance of microbusiness, reflected on earnings. Particularly noticeable is sex, for only the fact of being a male entrepreneur marks an important difference, which is maybe a symptom of the still existing discrimination according to sex in the productive market of the region.

Entrepreneurship support programs shall aim at strengthening human resources or human capital, in such manner that the knowledge acquired, either formal or informal, will not dilute over time, and on the contrary, is strengthened, complemented and allows developing and harnessing the individuals' capacities with a view to fostering their continual training. It is important that more people with access to graduate and postgraduate studies see a self-employment alternative in the creation of firms, for as it was verified, having graduate and postgraduate studies provides the necessary intrinsic conditions to attain high returns on income levels.

Translation: Luis Cejudo-Espinosa

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