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# Patterns, Trends and Policy Implications of Private Spending on Skills Development in Mexico and the United States

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## **Abstract<sup>1</sup>**

This paper explores families' investment in skills development through education in a high-inequality, low-education quality country such as Mexico, comparing it to a lower-inequality, higher-quality education country such as the United States. The paper uses a series of high-quality Household Income and Expenditure Surveys for both countries spanning around 20 years and different methodological approaches. Of particular interest is the analysis of education expenditure patterns along the income distribution. Policy implications for both cases are discussed. While in Mexico stimulating private spending in education through public resources might be regressive, the opposite might be the case in the United States.

**JEL classifications:** D1, I2, J21

**Keywords:** Education, Inequality, Private spending, Skills formation

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## 1. Introduction

It is widely agreed that human capital accumulation is a key factor determining the level of prosperity of countries and individuals. Among its different components, education—broadly understood as the set of academic and non-academic skills developed by individuals—has been at the center stage of development analysis in large part due to its connection with innovation and technological progress, which are drivers of economic growth in the twenty-first century.<sup>2</sup> Understanding how such skills are developed, and especially, clarifying the ways in which government policies can enhance them, has become a major area of research.<sup>3</sup>

An element of complexity in this respect is that skills are developed by an intricate mix of inputs ranging from formal schooling, to interaction with parents and siblings, the influence of peers, extended family, community members, the media, and in recent years, increasingly social media and virtual networks. Official education systems have traditionally centered on the first of these elements, because it would be virtually impossible to influence through public policies the complete range of inputs that determine skills formation, many of which even belong to the private domain. On the other hand, in democratic societies governments have the Constitutional mandate of guaranteeing structured schooling services for all individuals as a basic right. These services are financed from public revenue, which in turn is generated through taxing and other sources. In theory, if the fiscal system is progressive, public education should be a vehicle for equality of opportunity and economic mobility.

When governments are successful in assuring their expected contribution to skills development by guaranteeing widespread access to high quality public schooling services to all individuals in society, generally speaking the educational role of private agents gathered in families and households could be complementary in reinforcing general areas such as moral values and principles, notions of citizenship, and idiosyncratic cultural or religious aspects that are not addressed by the public system due to their specificity to some population subgroups. Those agents could also be expected for them to play an active role in skills development simply if they have a particular preference in this regard as compared to investment in other items. In

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<sup>2</sup> A well-known example of the research along these lines is the work by Hanushek and Woessmann (2012) who provide estimates on the relation between the size and quality of skills in different economies, and growth in GDP.

<sup>3</sup> McEwan (2014), for instance, provides a meta-analysis of a series of studies examining different types of interventions.

this kind of setting, private educational efforts should not directly generate inequalities of opportunity across individuals, but would rather introduce some differentiation associated with household preferences, priorities, and identities. The policy question would thus be how public programs or interventions can enhance the private sector's *complementary* involvement in order to support individual preferences and accelerate skills development in society.

Unfortunately, this is not normally the case, especially in developing countries. When public education services do not offer equal access to all individuals or are perceived as of low quality, the engagement of the private sector might be motivated more as a *compensatory* effort for addressing the different deficiencies. For instance, if public schools are not available households may be forced to pay for the service privately or supply it themselves—e.g., through home schooling—if they want to access it. If public schools are available but are of unsatisfactory quality, families may have to search for other options that imply investing resources in addition to those already provided to the public system through their taxes. When this occurs in egalitarian societies where all households have access to similar economic resources, private investments whether in kind or through monetary expenditures would not necessarily be a source of inequality of opportunity either, since investments in education would necessarily imply fewer resources for other objectives. Again, educational inequities would be generated through differences in preferences, rather than in opportunity.

However, in unequal societies, deficient or insufficient education services can become a source of greater inequalities precisely due to the role of the private sector. In extreme situations under limited schooling access, only those with enough resources to obtain the service privately will be able to progress in the education system. Similarly, when public education quality is perceived as inadequate, a direct link between family resources and the quality of education would also be expected. In this kind of setting, poor public education can become a source for perpetuating or accentuating inequalities, rather than being a mechanism for levelling the playing field. Moreover, in this context, policies that incentive or facilitate private investments in education—i.e., through fiscal incentives—may exacerbate inequalities even more.

This paper explores how much families invest in skills development through education in a high inequality and low education quality country such as Mexico, and how they do so. We focus on the monetary resources invested, and explore whether private education spending can

be a force perpetuating inequality in the country. We compare Mexico with the case of the United States (US), which is of interest due to the lower inequality, higher education access, and greater schooling quality in the US education system, as compared to the situation in the latter. We would expect private spending in education to be of a *compensatory* nature and to be higher and more unequalizing in Mexico, and under the same logic, we would expect these investments to be more of a *complementary* nature in the United States.

Based on our analysis we discuss policy implications for both cases. For instance, while in Mexico stimulating private spending in education through public resources might be regressive, the contrary might be the case in the United States. If so, it would follow that public resources in Mexico would be preferably devoted to improving the public education system in order to enhance the sector's equalizing potential.

For our exploration, we use a series of high-quality Household Income and Expenditure Surveys for both countries spanning around 20 years and engage in different methodological approaches that provide a broad picture of the situation in each case.

The paper is organized in six sections, including this introduction. Section 2 presents the data and the main stylized facts on the extent to which households use private and public education services in Mexico and in the United States, and the volume of private resources devoted to education in each country. Of particular interest is the analysis of education expenditure patterns along the income distribution.

Section 3 offers an innovative approach to the analysis of household educational expenditures by performing cohort analysis. This consists of following the full schooling trajectories of more than 20 generations born between the 1960s and the 1990s, which are observed at different points in time in different surveys. This in turn will allow estimating age, cohort and time patterns related to changes in the economic context in which households live.

Section 4 estimates the income elasticity of private household expenditures in education for a period of around two decades, which allows establishing a clear link between household resources and human capital investment. Household expenditures are decomposed by item in order to estimate elasticities individually as well. For Mexico we additionally estimate the elasticity of household expenditures in education to changes in the prices of education-related

goods and changes in the prices of other complementary goods. Crossed-price elasticities with respect to other complementary and substitute goods are also estimated.

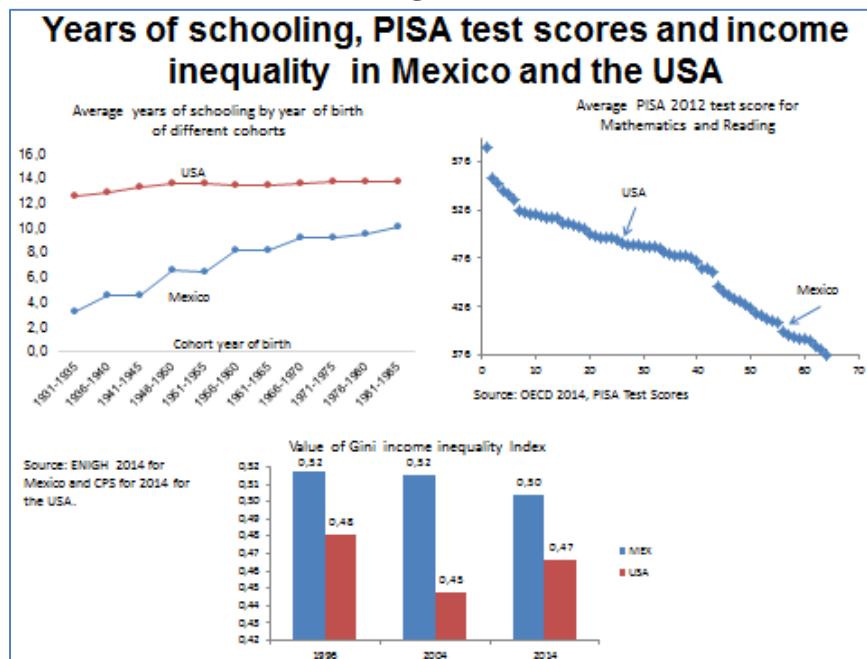
Section 5 presents an analysis of the relationship between household private investments in skills formation through the schooling system and personal, household, community and macro variables for Mexico. This is possible by linking household survey information to information on the local availability of services and local labor market conditions, among other possibilities. Of particular interest is the estimation of the association between household private expenditures in education and the availability and quality of education services. Section 6 concludes with some reflections of the policy implications of our analysis.

## 2. General Stylized Facts and Data Used for the Analysis

### 2.1 Background

The data in Figure 1 provide the basis for hypothesizing that private investments in skills formation in the education system are of a more compensatory nature in Mexico, while they would have a rather complementary profile in the United States (US).

**Figure 1.**



The top left panel takes a long-term view of the extent and speed of education progress in both countries by plotting the average years of schooling of individuals belonging to different cohorts, reported in the latest household survey available for each country, namely the National Household Income and Expenditure Survey for Mexico (ENIGH), and the Current Population Survey (CPS) for the US, both for 2014.<sup>4</sup> According to these estimations, individuals belonging to the cohort born in 1931-35 in Mexico, and who were ages 79-83 in 2014, attained on average 3.8 years of schooling, while their counterparts in the US already registered around 12 years. The cohort towards the right of the figure was born between 1981 and 1985, and thus belongs to the 29-33 age group in 2014. In Mexico this cohort achieved around 10 years of schooling, while in the US it registered almost 14. Evidently, education achievement has been much more widespread in the US, since while the average individual in this country already reached levels above High School five decades ago, in Mexico the average is still of only Lower Secondary.

The top right panel in the figure reports the results from the PISA<sup>5</sup> international test for 2012 and points out the ranking of both countries. These data are normally interpreted as a measure of education quality and show that Mexico is one of the lowest performers, while the US is an above-average country, closer to the top performers. Finally, the bottom panel plots the value of the Gini inequality index for household per capita income for both countries in 2014 from the ENIGH and the CPS, and it shows that the level of inequality in Mexico is significantly higher (although slightly declining) than in the US.

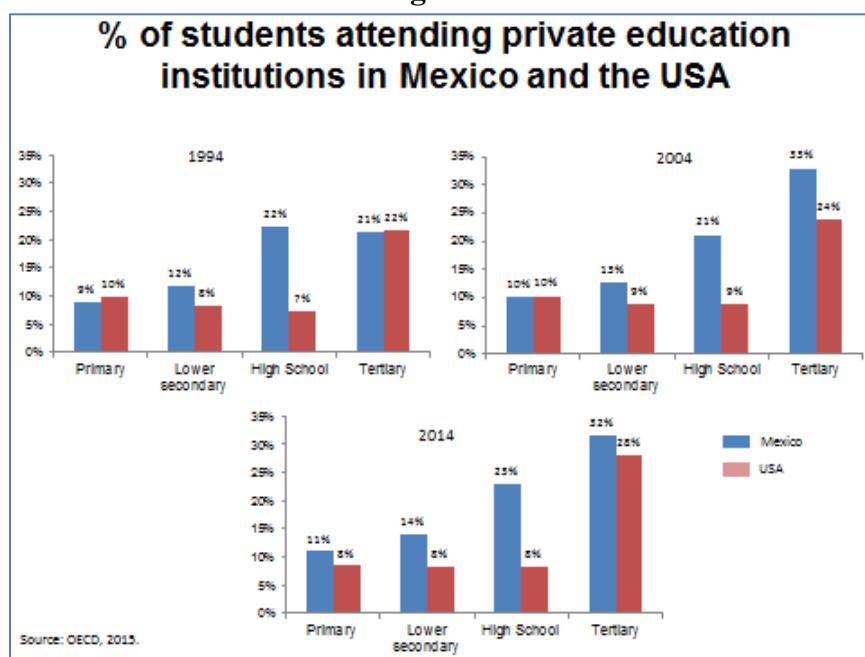
Thus, Mexico is characterized by lower education levels (suggesting more limited access to the service), lower schooling quality, and higher income inequality than the US. This combination of circumstances seems likely to make private investment in skills development an inequality-reinforcing factor.

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<sup>4</sup> Encuesta Nacional de Ingresos y Gastos de los Hogares. Both the ENIGH and the CPS, are the main source of information for labor force characteristics in Mexico and the U.S. population. They include a wide range of data on income, education, employment, unemployment, earning, hours of work, and other indicators. In addition, they include a detailed demographic characterization of households including age, gender, race, marital status, and household composition, among other features, which are all important for our analysis.

<sup>5</sup> Program for International Student Assessment, by the Organization of Economic Cooperation and Development (OECD).

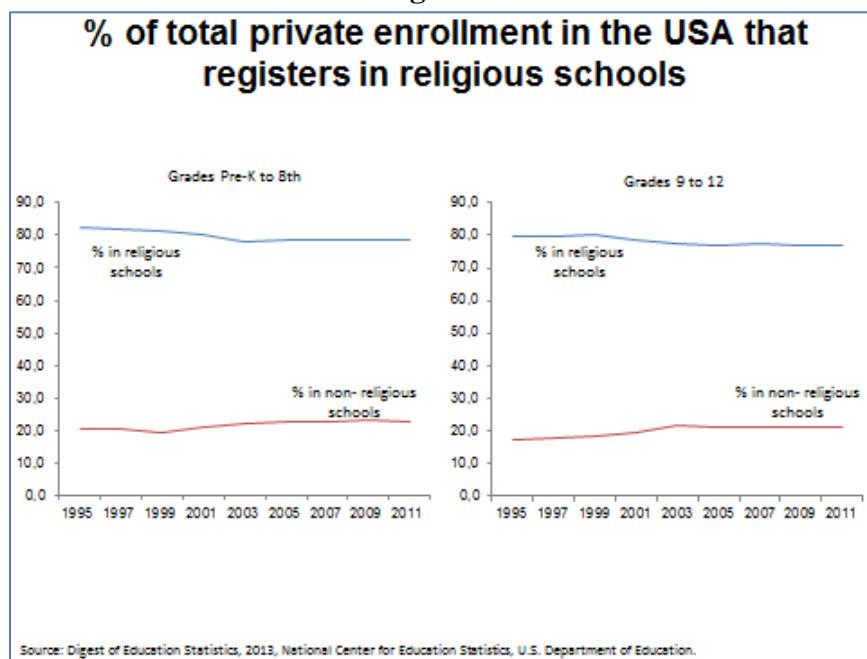
**Figure 2.**



This general hypothesis is reinforced by the view provided by aggregate data on school enrollment in private and public education systems in both countries, available from the OECD (Figure 2).<sup>6</sup> At the primary level, where there is practically universal coverage in both countries, the proportion of students enrolled in private education services is very similar, at around 10 per cent—with a difference of about 3 points in 2014. However, at the Lower Secondary, Upper Secondary and Tertiary levels, where education coverage is significantly lower in Mexico, the share of students in the private sector is higher in Mexico, reaching differences of 6, 15 and 4 percentage points, respectively, by 2014. The greatest differences are observed at the Upper Secondary level, where around one fifth of total enrollment in Mexico has been private for the past 20 years, which contrasts with levels of between 7 and 9 percent in the US. As shown by Bentouet-Kattan and Székely (2015) this level appears to be the bottleneck of the Mexican education system, showing the lowest access, highest dropout and substantial quality limitations. These features provide the greatest incentives for households to invest monetary resources to compensate for the public sector's deficiencies.

<sup>6</sup> OECD Education Statistics, 2015 [http://www.oecd-ilibrary.org/education/data/education-database\\_edu-db-data-en](http://www.oecd-ilibrary.org/education/data/education-database_edu-db-data-en). The figures plot the share of all students enrolled in each education level that attend private institutions.

**Figure 3.**

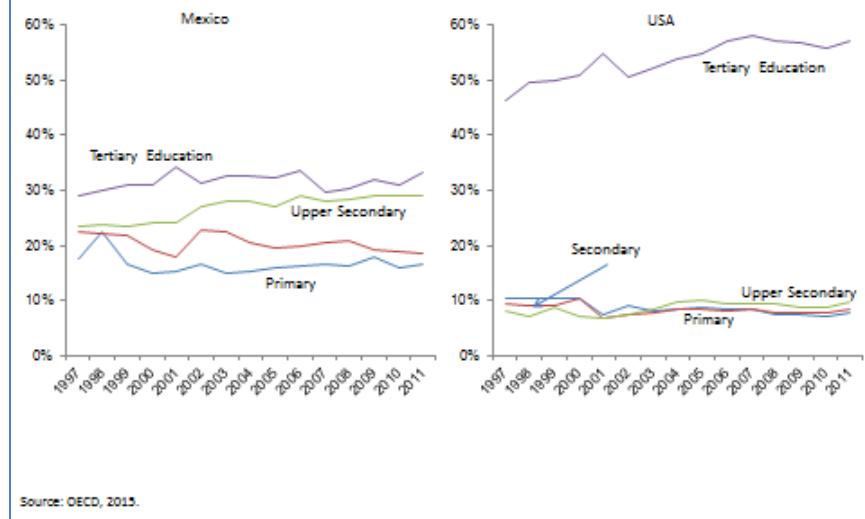


Interestingly, the smallest differences post-Primary, are observed in Tertiary education. This education level is beyond the compulsory education cycle in both countries and is characterized, especially in the US, by being financed directly by students rather than households as in the previous levels.

A complementary piece of evidence, suggesting a less compensatory role of private investments in education in the US, is that in this country, the vast majority of individuals enrolled in private institutions, at least up to 12<sup>th</sup> grade, attend a religious school, which is typically related with objectives such as reinforcing religious or cultural identities. Figure 3 plots the data separately for enrollment in private institutions from Pre-K to 8<sup>th</sup> grade for the 1995-2011 period, showing that in all years the share of private school enrollment in religious institutions is of about 80 per cent of the total enrollment in private institutions. The same is the case for grades 9-12 for the same time period (right panel of the figure).<sup>7</sup>

<sup>7</sup> The data are from the Digest of Education Statistics, 2013, National Center for Education Statistics, U.S. Department of Education, based on the Private School Universe Survey (PSS).

**Figure 4.**  
**Private expenditures as a % of total education expenditures in Mexico and the USA**



As for the composition of aggregate education expenditures, OECD (2015) data report that the importance of private investment in education is significantly greater as a source of total education investment in Mexico between Primary and Upper Secondary, than in the US. Figure 4 plots the share for all levels between 1997 and 2011 and shows, for instance, that at the High School level almost 30 per cent of all investments are originated from private resources, while these only account for about 10 per cent in the US. The private share oscillates around 20 per cent for Lower Secondary in Mexico, with shares below 10 per cent in the US. The difference is lower for Primary, but still apparent, with proportions around 17 per cent in Mexico and below 10 per cent in the US.

The notable exception is Tertiary education, for which more than half of total expenditures in the US are private, while they range about 30 per cent in Mexico. Important differences in access to finance in both countries, however, may account for a significant part of the discrepancy, since while the US has a well-established financial loan system for attending graduate and post-graduate studies, these mechanisms are incipient in Mexico, where private investments depend practically in their entirety on out-of-pocket resources.

## ***2.2 A Closer Look at the Evidence from Household Survey Micro Data***

The rest of this paper uses micro sources intensively for analyzing household expenditures in education. For Mexico we rely on the ENIGH, and for the US on the Consumer Expenditure Survey (CES), both of which include detailed consumption data, including education. The ENIGH is a nationally representative survey available for 1984, 1989, and biannually since 1992 through 2014—with 15 rounds—with a comparable design. The survey permits for a detailed account of all household income and expenditure items, with a breakdown of quarterly education expenses for every year. Actually, expenditures are registered at a considerable level of detail, and an important advantage is that the survey also includes the prices paid for different items as reported by the household informant.

The items included in this survey are the following:

1. Expenditures related to school fees: school fees and registration fees for pre-school, primary, lower secondary, upper secondary, tertiary education, and post graduate studies, identified individually. The survey also allows identifying the type of tertiary education classified as academic, and technical, respectively.
2. Education-related services: out-of-school teaching services, special needs, transport, extra day care, and food at school. These expenses are not classified by education level.
3. Educational articles and materials: books (text books and other books), materials, medical and life insurance required at school, examination fees, out of school-day courses provided by the school, educational equipment, and other fees.

The Consumer Expenditure Survey (henceforth CE) is the main source of data on household consumption in the US; it also includes data on income, as well as a range of household characteristics. The CE is nationally representative (with representativeness also for the Northeast, the Midwest, the South and the West regions). It has been held in 1996, and yearly since 2004, with 12 rounds altogether. The survey consists of two components, namely a quarterly Interview Survey and a Diary Survey. The Interview Survey tracks large expenditures,

such as those for property, automobiles, and major durable goods, as well as those that are performed on a regular basis, such as rent or utilities. Each consumer unit is interviewed once per quarter for five consecutive quarters. The Diary Survey tracks day-to-day expenditures including more frequently acquired smaller items, such as food and beverages, which are registered over two consecutive one-week periods.

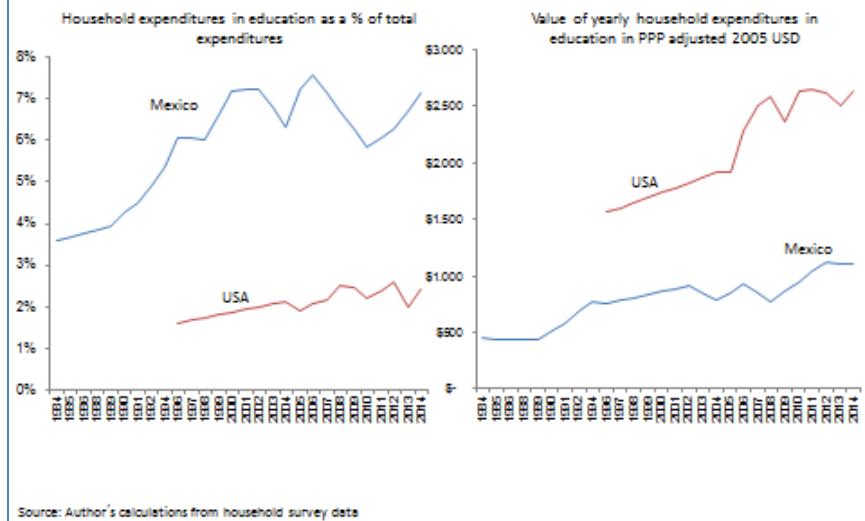
The education expenses that can be identified in this survey are the following:

1. Expenditures related to school fees: school fees that can be differentiated in pre-K to high school, and tertiary studies, respectively;
2. Education-related services: day care, special care, room and board expenses, and private transport;
3. Educational articles and materials: tutoring, books, educational materials and equipment, and other expenses.

Figure 5 plots education expenditures as a share of all household consumption expenses for both countries using those data, as well as the average value of the education expenditures in 2005 purchasing power parity (PPP) adjusted US dollars. The left panel shows that education expenditures account for a much more significant percentage of total consumption value in Mexico, around 7 percent in 2014, as compared to their relative importance in the US, which has oscillated around 2 percent during the past 10 years. Interestingly, in the case of Mexico, these expenditures have increased from less than 4 percent in 1984, to a peak of 7.6 percent in 2008, with two drops, in 2004 and 2010, which are years of economic contraction. A drop is also observed in the US in 2010 and in 2013, both years of low economic growth.

**Figure 5.**

### Private expenditures in Education in Mexico and the USA as measured by household survey data



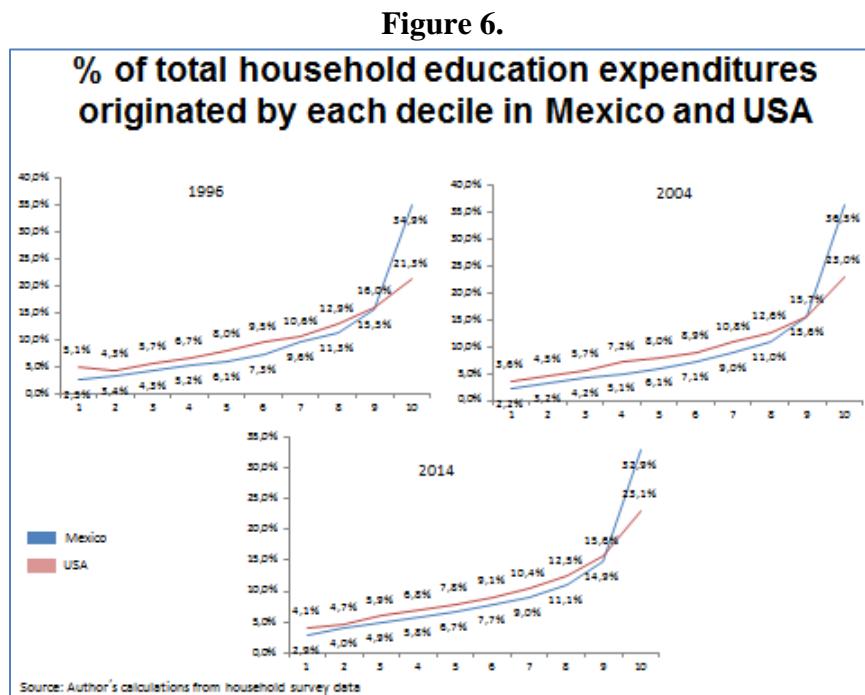
Source: Author's calculations from household survey data

The average value of education expenditures, as expected, is considerably higher in the US. According to our calculations (right panel of the Figure) in 1996, while in Mexico the average household devoted \$760 dollars a year to schooling expenses, the average for the US was \$1,561, roughly double. While the difference is considerable, it is still important to note that the US registers a level of GDP per capita more than five times higher than that observed in Mexico.<sup>8</sup> By 2014 the gap in education expenditures between the two countries expanded to about 2.4 times in favor of the US, where the average values grew somewhat faster, but the difference still remained at levels far below the gap in development levels.

Another relevant feature of the data is that household education investments are much more concentrated along the income distribution in Mexico. As shown in Figure 6, in 1996 more than 34 per cent of the total value of education expenditures in the country originated in the 10<sup>th</sup> decile, while only 21.3 per cent originated in the same sector in the US. The level of concentration reached a peak of almost 37 per cent in Mexico by 2004 and stabilized again at around 33 per cent in 2014. In the US there has been a slightly increasing concentration in the

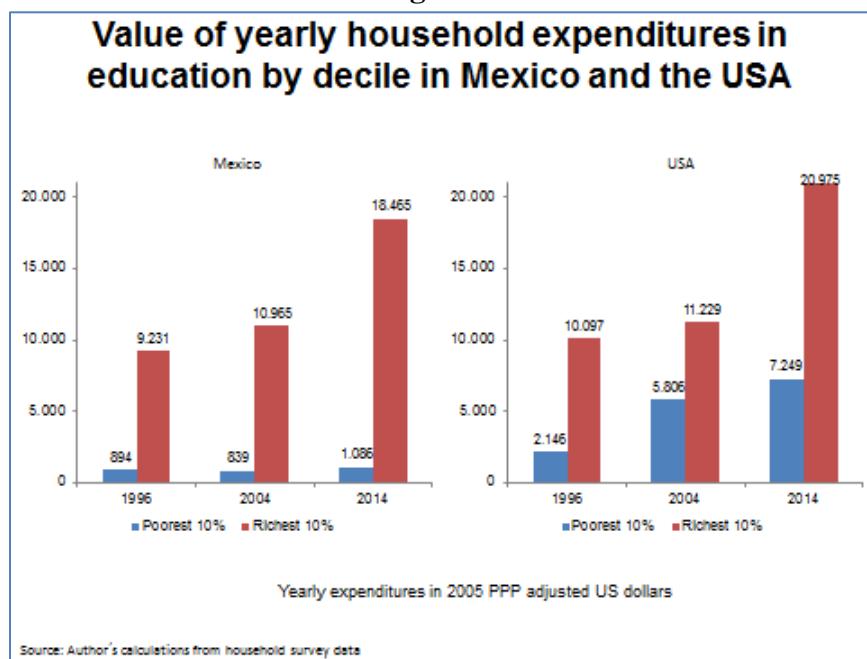
<sup>8</sup> GDP per capita figures are from the World Bank World Development Indicators, 2015. As mentioned, the education expenses are calculated from household survey data for both countries. The averages are obtained only for households that report education expenditures greater than zero.

richest 10 per cent over the years, reaching 23 per cent in the course of the two decades considered. A relevant feature to note is that the main gap between the two countries is observed in the richest decile of the population. For instance, for the 9<sup>th</sup> decile proportions are practically the same in both cases, and are higher in the US for all deciles below the 8<sup>th</sup>, with a gap of between 1 and 2 percentage points in all cases.



The disparities along the distribution are also clearly illustrated by the levels of expenditure in different segments in the two countries. In Mexico for instance, the poorest 10 percent of the population devoted on average \$494 PPP-adjusted 2005 dollars to education per year in 1996, compared with \$8,241 per year invested on average by the richest 10 percent of the population in the same year, a gap of slightly less than 17 times (Figure 7). In the US, yearly education expenditures reach \$2,146 and \$10,097 US in the same year, respectively, at the two extremes of the distribution, which represents a gap of 4.7 times across deciles. While the gap across deciles expanded to 17 times in Mexico by 2014, it declined from 4.7 to 2.89 times in the US.

**Figure 7.**



The most notable feature of our results, however, is that Mexican households in the richest 10 percent of the population register education expenditures similar to the value of those of their counterparts in the United States for all three years in the figure, with a difference of only 13 percent in 2014. This is a striking feature given the income and development differences—and therefore average purchasing potential—between the two countries. Combined with the distributional gaps just mentioned, the data suggest that in Mexico education expenditures are an (increasing) luxury of the rich, which again, is consistent with a pattern where private education expenditures are more of a compensatory nature. This argument is supported by the fact that, while for the richest Mexican households the value of annual education expenditures almost doubled between 1996 and 2014, these investments stagnated among the poorest households. This was not the case in the US, where average education expenditures among the poorest 10 per cent increased threefold during the same period, from \$2,146 to \$7,249 annually.

An additional element to note in this comparison is that for the US the patterns may be influenced by changes in household structure along the life cycle, specifically due to the fact that a higher share of students leave their parental household to attend college. When young individuals leave for this purpose and devote most of their time to unpaid education activities,

they are normally characterized by registering low incomes and might increase the ranks of the lower quintiles of the distribution. Table 1 plots the proportion of individuals in each income decile that attend Higher Education services and confirms the differences across countries, especially in the lower deciles. In Decile 1, for instance, the data show that 16.6 percent of all individuals attend Higher Education in the US, while the share is of only 0.4 per cent in Mexico. Interestingly, the share for the US declines up to Deciles 4 and 5, increases in the middle deciles, and drops again in the richest 10 per cent of the population. In contrast, in Mexico there is a direct positive correlation between the decile to which individuals belong and the probability of attending Higher Education.

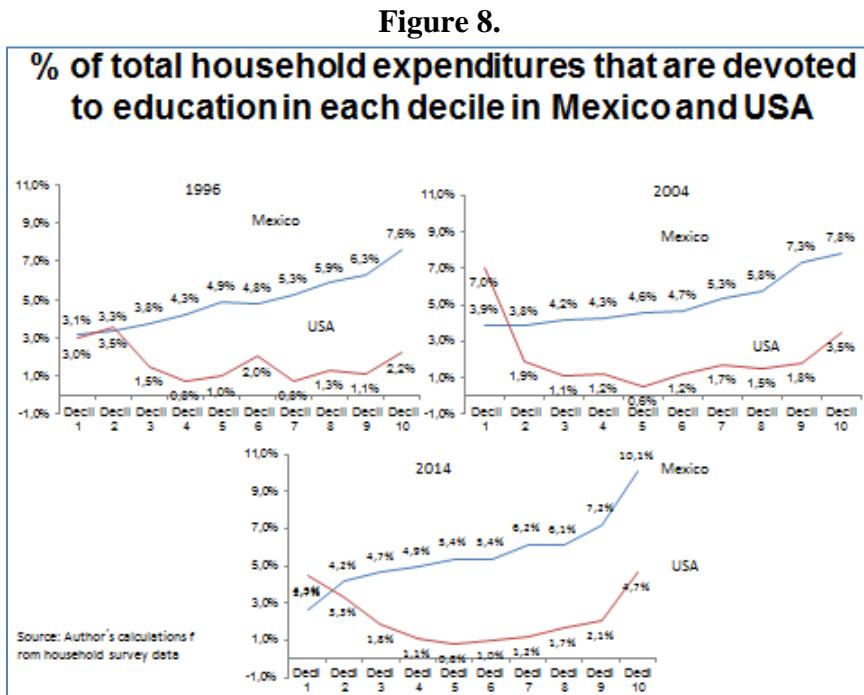
**Table 1. Proportion of Individuals in Each Decile Enrolled in Higher Education Studies, 2014**

Decile	United States	Mexico
Decile 1	16.6%	0.4%
Decile 2	9.8%	1.1%
Decile 3	8.2%	1.8%
Decile 4	5.9%	2.3%
Decile 5	6.9%	2.6%
Decile 6	6.1%	3.4%
Decile 7	6.8%	4.4%
Decile 8	6.6%	5.1%
Decile 9	7.4%	6.0%
Decile 10	5.3%	9.0%

*Source:* Authors' calculations based on household survey data

Another interesting feature from our exploration is that in Mexico, not only do the richest households account for the bulk of education expenditures, but they also tend to devote a larger share of their resources, as measured by their total consumption level, to education. This feature, however, is not present in the United States. This is shown in Figure 8, where it can be seen that, for instance, in 1996 the richest households in Mexico dedicated 7.6 percent of their consumption to education-related expenditures, while among the poorest 20 percent, on average the percentage was around 3.3 per cent. In contrast, in the same year, households in the poorest 20 per cent in the US distribution also dedicated around 3 percent of their consumption to private

education expenditures while households in the richest 10 per cent registered only 2.2 per cent. While in Mexico the line plotting the shares by decile is clearly upward-trending as income increases, in the US a “U” shape is observed, with relatively larger shares registered among the poor, the lowest rates observed in the middle segments of the distribution which presumably belong to the middle class, and a slight increase between deciles 9 and 10.



For the years 2004 and 2014 the patterns are similar in terms of the shape of the distribution curve, with two main differences. The first is that in Mexico deciles 1 to 9 show a slight increase in the relative share of their expenditure devoted to education, generally less than one percentage point, while the 10<sup>th</sup> decile increased its private educational investment from 7.8 percent of their income in 2004 to 10.1 percent in 2014, which is the most significant increase observed in all years in the two countries. In the US in contrast, there is a reduction in the relative educational expenditures at the bottom 10 per cent, there is relative stability up to decile 9, while the 10<sup>th</sup> decile increased its share by about 1 percentage point. The “U” shape pattern, however, remains in all years with proportions higher in the first than in the 10<sup>th</sup> decile.

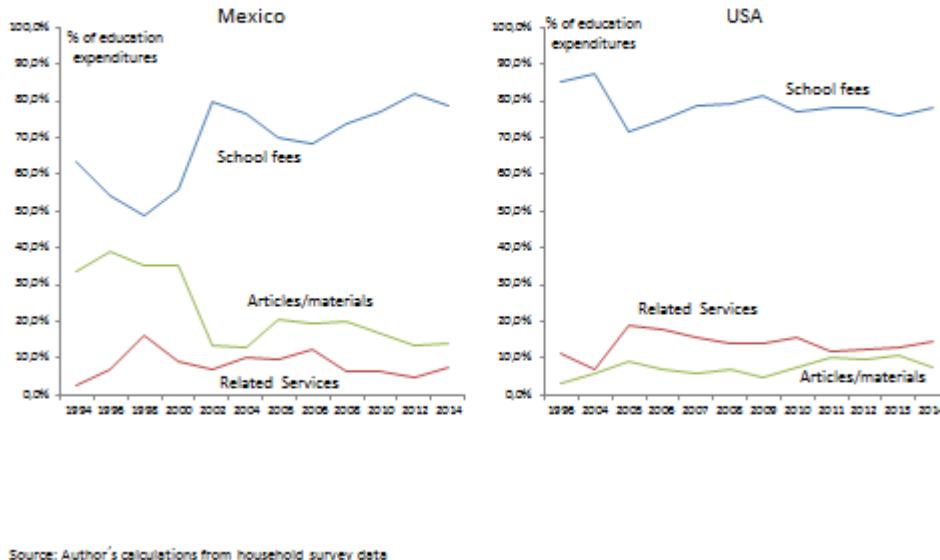
In order to explore further the influence of the changes in household structure along the life cycle in the United States—and in particular the effect of higher shares of students leaving

their parental household to attend college—we estimate household expenditures in education for this country by considering only households with a standard structure of 2 parents and 2 children. Appendix Figure A.1 illustrates the changes observed in the first decile of the income distribution. For instance, rather than generating 4.1 percent of all household expenditures, decile 1 only generates 1 percent when considering the more restricted household structure that is typical of pre-college school age in the USA. Rather than representing 4.5 percent of the overall value of household consumption, education expenditures account for only 0.4 per cent. As for the absolute value of expenditures, the difference is that when considering all households—including college students living on their own or with other students—the result is an expenditure of \$2,145 USD in education, while for a more restricted structure of 2 parents and 2 children the value is \$240 USD.

The differences in education expenditures observed along the income distribution are also likely to reflect disparities in the use of public and private services. This can actually be confirmed for Mexico, since the ENIGH data permit identifying the type of institution attended by each child. As shown in Appendix Table A.1, while about half of the students that inhabit households in the richest 10 percent of the population in 2014 attend private institutions, practically none of those in the first five deciles do so. The data also reveal that between 1996 and 2014 the disparities in this respect have grown.

**Figure 9.**

### Distribution of education expenditures by type in Mexico and the USA



By classifying education expenses by type, we find that the majority is dedicated to the payment of school fees, both in Mexico and the United States. In the US these type of expenses have represented around 80 percent of the total for the past decade, while in Mexico they accounted for around 60 percent in 1994 but have grown in importance steadily and now add up to around 80 percent also (see Figure 9). The main difference across countries is that in Mexico around 15 per cent of the total is dedicated to educational articles and materials, while only about 10 per cent is dedicated to related services. In the US the relative importance of these two items is reversed, with proportions similar to those observed in Mexico.

According to our calculations, while in Mexico there are some differences in the relative importance of these groups of items along the income distribution, in the US the share of each is very similar across income deciles. This is shown in Figure 10, where it can be seen that, while in the richest 10 percent in Mexico and in the top and bottom deciles in the US, around 80 percent of all education expenses are devoted to school fees, this item accounts for 70 percent among the bottom decile in Mexico. The main difference is that poor Mexican households spend more on educational articles and materials—27 percent in 2014—while the richest households in

the country spend only 6.6 percent in this item, and about 10 percent in related services. In the US, at both extremes of the distribution the second-most important item of expenditure is articles and materials, which absorb practically all resources remaining after paying school fees.

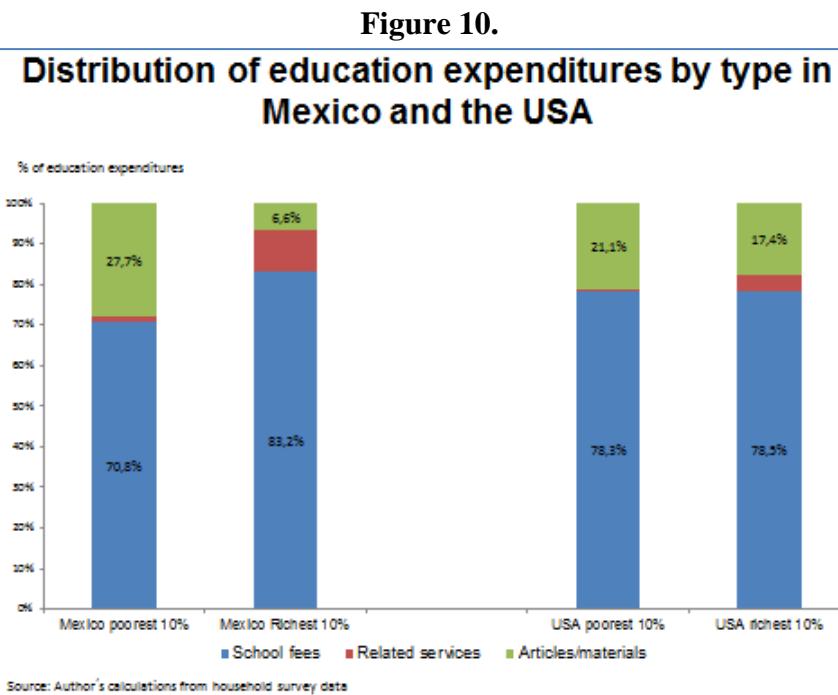
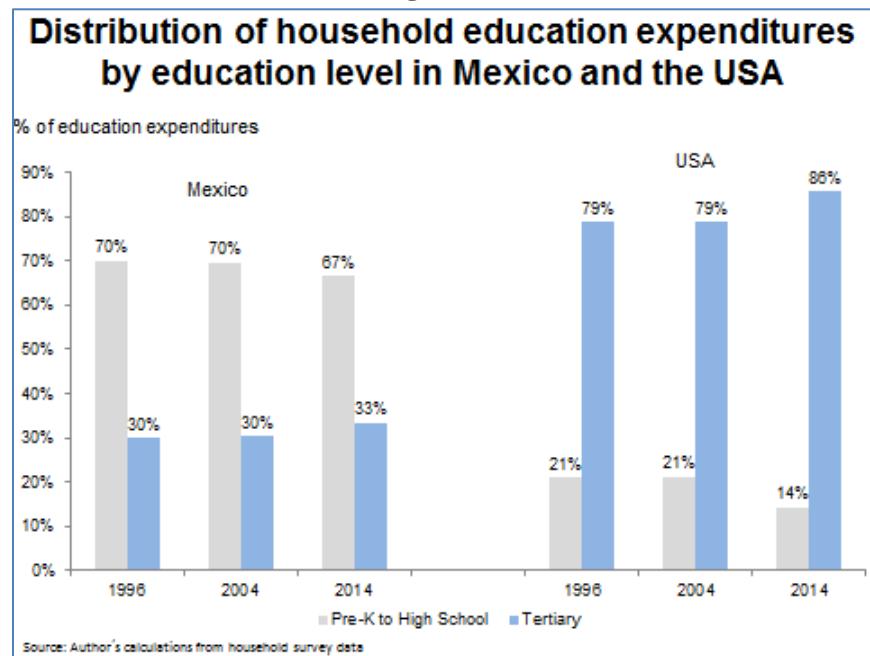


Figure 11 identifies the household education expenditures that are invested in different education levels in both countries in different years. It is important, however, to note two differences in the data sources between Mexico and the US in this respect. The first is that, while in the Mexico data some expenditure items such as school fees can be clearly linked to a specific individual in the household, for some other items, such as materials, transport costs and uniforms, only the global amount of expenditures is reported. Therefore, for our estimations we link expenditure items to specific individuals when possible, while for the remaining items reported aggregately we divide the value of the investment flow on a per capita basis among household members who are attending school. The US data does allow linking all reported school expenditures to specific individuals, so this type of adjustment is not necessary. The second difference is that, while for Mexico it is possible to separate expenditures for each education level, the US data are aggregated only in two broad groups, consisting of expenses for Pre-K to High School (added together), and Tertiary education, respectively.

**Figure 11.**



Our calculations, using the aggregation by levels in the US data for comparability, also show striking contrast in this respect (see Figure 11). While in Mexico between 67 and 70 percent of expenses are invested in Pre-K and up to High School and only around 30 per cent are invested in Tertiary schooling, in the US the pattern is exactly the opposite, with a minority of resources of 21, 21 and 14 percent being invested in Pre-K to High School for 1996, 2004 and 2014, respectively, and shares of between 79 and 86 percent accruing to Tertiary education in the same years.<sup>9</sup>

The differences in the share of expenditures devoted to Tertiary education in both countries seem to be apparent along the income distribution. As Table 2 shows, while in the US practically all expenditures among the poorest households are devoted to Tertiary schooling, with declining shares for the rich, for Mexico the opposite is the case. In this country, the vast majority of private investments in education by the poorest households accrue to pre-Tertiary levels, with less than a third going to the Tertiary level for the first four quintiles. Only in the

<sup>9</sup> To try to make the data as comparable as possible between the two countries, for Mexico the figure only includes the expenditure items, such as school fees, that are directly linked to specific individual. As can be seen in the following tables that report all expenditure items, this tends to overestimate the share of expenditures directed to Tertiary education. Once all expenditure items are considered (including those distributed on a per capita basis for our estimations), the share of Tertiary education expenditures oscillates around 15 percent.

richest quintile do investments at the Tertiary level reach 35 per cent of the total, but this is still far below what is observed in the US.

**Table 2.Distribution of Private Education Expenditures Across Education Levels by Quintile, Mexico and US**

Quintile	Mexico		United States	
	Elementary	Tertiary	Elementary	Tertiary
1	89%	11%	2%	98%
2	84%	16%	4%	96%
3	76%	24%	20%	80%
4	70%	30%	23%	77%
5	65%	35%	16%	84%

*Source:* Authors' calculations from household survey data.

For Mexico it is possible to break down expenditures to a finer extent by education level.<sup>10</sup> The results of doing so are presented in Table 3, where it can be seen that since 1996 the relative weight of education expenditures at the Pre School and Tertiary levels increased by about 5 percentage points, respectively; in the same period the share of investment accruing to Primary and Secondary schooling declined by a similar extent, while the share invested in Upper Secondary remained stable. This is an important result since it is precisely at the Upper Secondary level where the highest dropout is registered, and the lowest access to education services is observed in the country.<sup>11</sup> Since the year 2008 there has been a rather stable pattern, with around 14, 34, 19, 18 and 15 percent of all private education expenditures accruing to students attending Preschool, Primary, Lower Secondary, High School, and Tertiary Education, respectively.

Additionally, large differences remain in the absolute value of spending per level. According to the 2014 data in the right columns of Table 3, while households spend 2005 PPP-adjusted \$1,072 yearly per Preschool child, the value of per capita expenditures per Primary is 3.9 per cent above this value, while for Secondary, USE and Tertiary, expenditures reach values 11.7, 73.7 and 188 per cent more than what is observed in the lowest education level.

<sup>10</sup> For this disaggregation we use the information on all education expenditures and not only those that can be directly allocated to specific individuals. As mentioned before, for the items for which this cannot be done, we divide the aggregate amount of what is spent in the household among all school-attending members.

<sup>11</sup> See Bentaouet-Kattan and Székely (2015).

**Table 3. Distribution of Private Education Expenditures across Education Levels in Mexico, 1984-2014**

Year	Distribution of all household private expenditures in education by Education Level					Value of per capita household expenditures in education By Education level, in US ppp2005				
	Preschool	Primary	Lower Sec.	High School	Tertiary	Pre-school	Primary	Lower Sec.	High School	Tertiary
1996	10%	39%	24%	18%	10%	\$ 932	\$ 795	\$ 1,118	\$ 2,199	\$ 2,791
1998	10%	39%	23%	18%	10%	\$ 1,081	\$ 837	\$ 1,050	\$ 1,895	\$ 2,904
2000	9%	38%	22%	19%	11%	\$ 990	\$ 873	\$ 981	\$ 1,891	\$ 2,421
2002	7%	42%	22%	18%	11%	\$ 775	\$ 908	\$ 977	\$ 1,687	\$ 2,468
2004	8%	40%	21%	18%	13%	\$ 984	\$ 1,046	\$ 1,179	\$ 1,801	\$ 3,162
2005	8%	38%	21%	19%	14%	\$ 1,065	\$ 948	\$ 1,026	\$ 1,852	\$ 2,899
2006	8%	38%	21%	18%	14%	\$ 914	\$ 994	\$ 1,099	\$ 1,817	\$ 3,337
2008	14%	35%	20%	17%	14%	\$ 857	\$ 847	\$ 990	\$ 1,628	\$ 2,692
2010	14%	34%	19%	18%	15%	\$ 959	\$ 920	\$ 1,130	\$ 1,742	\$ 2,873
2012	15%	35%	19%	18%	13%	\$ 909	\$ 945	\$ 1,054	\$ 1,822	\$ 3,567
2014	14%	34%	19%	18%	15%	\$ 1,072	\$ 1,114	\$ 1,198	\$ 1,862	\$ 3,090

*Source:* Authors' calculations based on household survey data.

**Table 4. Distribution of Private Education Expenditures across Quintiles by Education levels in Mexico, 2014**

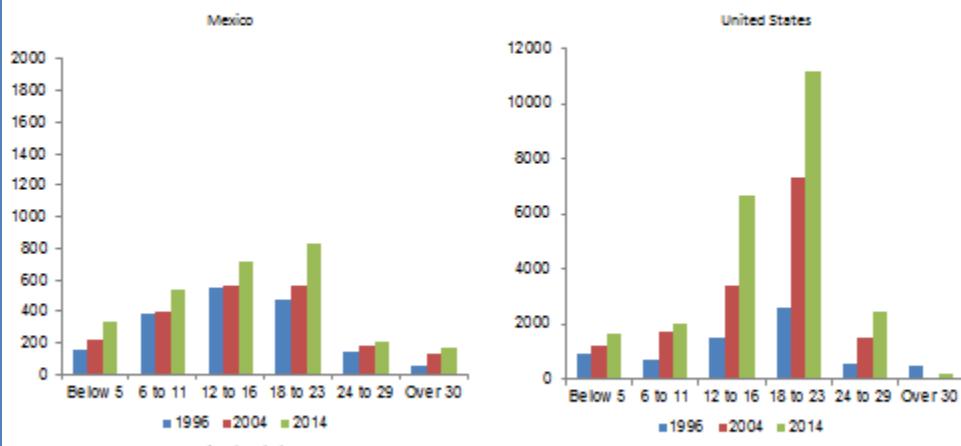
Quintile	Pre-school	Primary	Lower Sec.	High School	Tertiary
1	6%	5%	5%	5%	2%
2	9%	11%	11%	10%	5%
3	13%	13%	14%	16%	10%
4	21%	19%	18%	22%	20%
5	51%	52%	51%	48%	63%
Total	100%	100%	100%	100%	100%

Source: Authors' calculations based on household survey data

Interestingly, for all education levels the same feature that the bulk of private investments in education originate in the richest households is observed. As shown in Table 4, while half of all household private expenditures in education are concentrated in the richest quintile of the income distribution between Preschool and the Upper Secondary level, for Tertiary education the concentration reaches 63 per cent of the total.

**Figure 12.**

**Age pattern of private expenditures in education in Mexico and the United States 1996-2014**



Source: Author's calculations from household survey data.

Finally, education expenditures can also be classified by the age bracket of the school age population. Figure 12 shows that for both countries there is an inverted “U” pattern indicating that expenditures per child increase with age up to the 18 to 23 bracket, reflecting that education costs increase with the education level (note that the scale of the two panels differs due to the much larger values in absolute terms for the US). The drop after age 23 is presumably associated with exit from the education cycle. An interesting difference between Mexico and the United States is that, while in Mexico there is a steady marginal increase from the first group to the 18-23 age bracket, in the United States there is practically no change between the first two groups, and large increases are observed when transiting between the 6-11 to 12-16 brackets, and the 12-16 and 18-23 ranges.

In sum, the evidence shown in this subsection regarding the concentration of education expenditures in each country, supports the view that while in Mexico these types of private investments would conform to the pattern of a compensatory motive for addressing access and quality deficiencies in the public system, in the US, for High School and lower levels, private investments are relatively minor and could be more of a complementary nature, particularly when combined with an overwhelming high share of private school attendance in religious schools, as discussed above.

### **3. Cohort Analysis of Private Expenditures in Education**

So far we have provided a picture of private household expenditures in education by taking each household survey as a snapshot of data. In a 10-year period of analysis such as the one provided in this paper these snapshots reflect i) new households entering the group with school-age children and ii) households exiting that group because their children are no longer of school age.

When looking at comparisons between two periods of time, the averages actually hide at least three different effects that are of interest in our examination, especially due to the various disparities between Mexico and the US that might be influencing the results reported in the previous section. Perhaps the most evident is that both countries are at different stages of their demographic transition, which implies that there are more households in Mexico—which is a country with a younger population—that are in an education investments state due to their demographics, while in the US there are relatively fewer households with children at ages 3 to

24, which could be characterized as the typical age for attending school. Both the levels and the changes over time documented could in fact include a demographic composition effect that blurs the pure education expenditure choice.

Another source might be that generations can react differently to changes in the environment. For instance, as shown in Figure 1, average schooling in the US has already been much higher than that in Mexico for at least the last 50 years and has increased only modestly, precisely due to the already high levels achieved. In Mexico, although averages are still below those of the US, average years of schooling have grown steadily, which suggests that the “average parent” has been increasingly more educated. If greater education is associated with preferences for investing more in formal schooling, it would be expected that while generational increases in the US would be relatively low, in Mexico they would be potentially higher, and this could also be influencing the findings discussed above.

A third difference might be that households react differently regarding education investments when exposed to economic shocks. Moreover, shocks may leave “scars” in the future when they affect school attendance, which might make it more difficult for certain individuals to re-engage in the education system—i.e., individuals closer to working age. As shown in the previous section, there seems to be a drop in private investments in skills formation through the schooling system in both countries, particularly after the 2008-2009 world recession, although the longer-term effects of this and other economic contractions could also be underlying factors behind the differences in trends and levels, at least to some extent.

In order to assess the magnitude of these differences it would be necessary to go beyond the snapshots of data and perform a dynamic analysis. To do so empirically, ideally it would be desirable to have access to panel data following specific households during the years of their life cycle when school attendance decisions are being taken, but unfortunately these types of data are not available for a sufficient number of years for both countries.

An alternative in the literature of life cycle choices has been to use repeated cross-sections of data, typically drawn from household surveys that allow tracking the life cycle path of representative groups of individuals or households belonging to a birth cohort. This approach, proposed initially by Browning, Deaton, and Irish (1985) for analyzing other outcomes that are

expected to vary throughout the life cycle, such as savings—and that has been used widely in other contexts due to their richness—implies the construction of pseudo panels.<sup>12</sup>

As noted by Verbeek (2008), in general terms, perhaps the main limitation of these types of data is that they do not follow the same individual or household over time, but rather groups of representative agents. When the within-cohort variance of the variable under analysis is low, this may be of less concern since the average will be close to what is observed in actual individual observations. However, when high degrees of variability are observed, the cohort average will reflect individual cases to a much lower extent. On the other hand, two important advantages of using repeated cross-sections are that they minimize attrition biases and problems of non-response that are common in true panels, and that when household surveys are nationally representative, averaging across cohorts likely reduces idiosyncratic measurement error and heterogeneity (as discussed in Attanasio and Banks, 1998).

In the context of the present analysis the use of repeated cross-sections seems attractive given the availability of data for Mexico and the US for following the transition of households from the time when they would be expected to have children entering Primary school at ages 5-6, until they exit Tertiary age at around 24—households’ typical investment history.<sup>13</sup>

One important aspect to bear in mind, however, is that household structures in both countries are quite different, especially regarding youth turning 18 years of age. While in the US it is quite common for this age group to emigrate from the parental household, in Mexico the tendency is to stay in the nuclear group well beyond age 20. Furthermore, the emigration decision is intimately linked to schooling decisions. On the one hand, in the US enrolling in college is even a decision closely related to migrating geographically, which implies that under a

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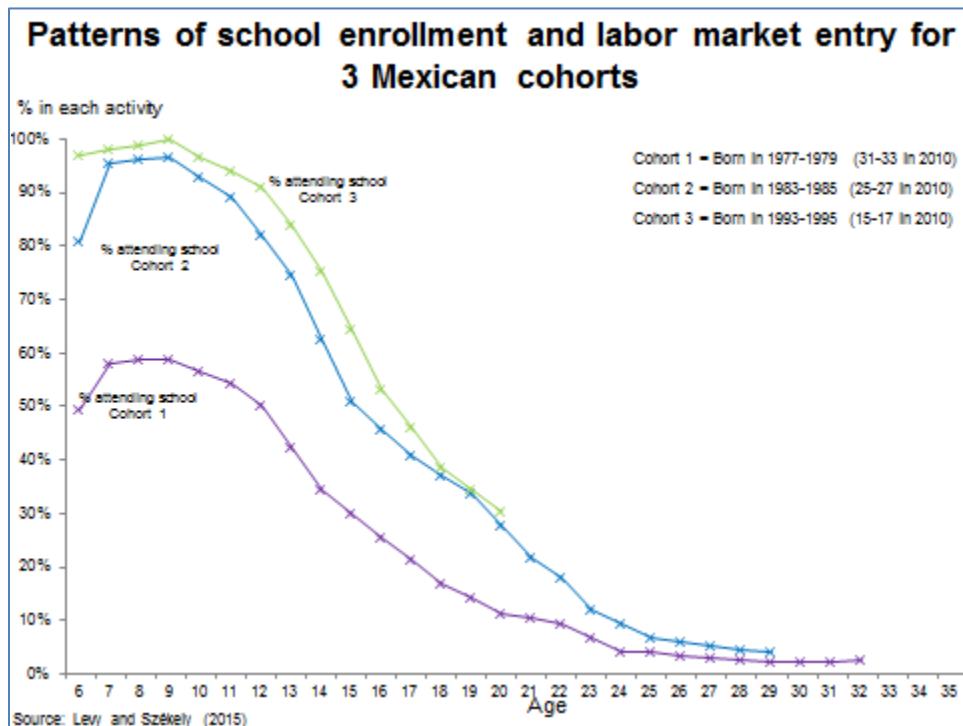
<sup>12</sup> Shorrocks (1975), Moffit (1993), Deaton (1997), and Attanasio and Banks (1998) are some of the first to use this technique in the context of the analysis of savings. Recent applications to other areas include Dang et al. (2014) in the context of poverty analysis, Cruces, Fields and Viollaz (2013) who use the cohort approach for examining income mobility. In a series of studies, Székely and Karver (2014), Bentataouet-Kattan and Székely (2015), Székely, Mendoza and Karver (2015), and Levy and Székely (2016) have used a similar approach for analyzing the phenomena of youth out of school and out, school attendance, household savings, and the relation between schooling and formality, respectively. These analyses have included data for Mexico and for other Latin American counties, but not the US.

<sup>13</sup> It should be mentioned that cohort analysis is not free from some potential problems. Two of the most common are differential mortality and migration, which may alter the composition of some cohorts over time. Deaton and Paxson (1999) and Attanasio and Hoynes (2000) attempt some corrections to household survey data in the context of savings decisions and argue that these effects can be significant. Since the window of the life cycle of our interest is relatively short and focused at early ages, we would expect the effects to be rather small.

traditional definition of a household—which normally refers to a group of individuals living in the same physical unit and sharing a common budget—those leaving the parental unit and attending Tertiary education might be considered as a household on their own. The data presented in Table 1 above indicate that this is an important element to consider in the case of this country.

On the other hand, Mexico displays different dynamics of household structure. Tertiary education attendance does not necessarily imply geographic migration and heavily relies on household resources, so that those engaged in those studies are more likely to be financed by the parental unit. This can influence particularly the (household head's) pattern of education investments in education.

**Figure 13.**



For illustration of the cohort technique, we use the synthetic panel constructed by Levy and Székely (2015) for Mexico by using the full series of household surveys between 1984 and 2014, which presents the average evolution of school enrollment patterns for three different generations over time, spanning a period of more than 20, and up to more than 30 years for the

oldest cohort (see Figure 13). Since the generations are observed for the time span for which household surveys are available, some of them are seen during their full schooling trajectory and entry into labor market age—such as the bottom two lines in the figure—while some are observed during the first and last segments, respectively. It is important to note that these are individual trajectories rather than household units as will be the case for the analysis of household expenditures.

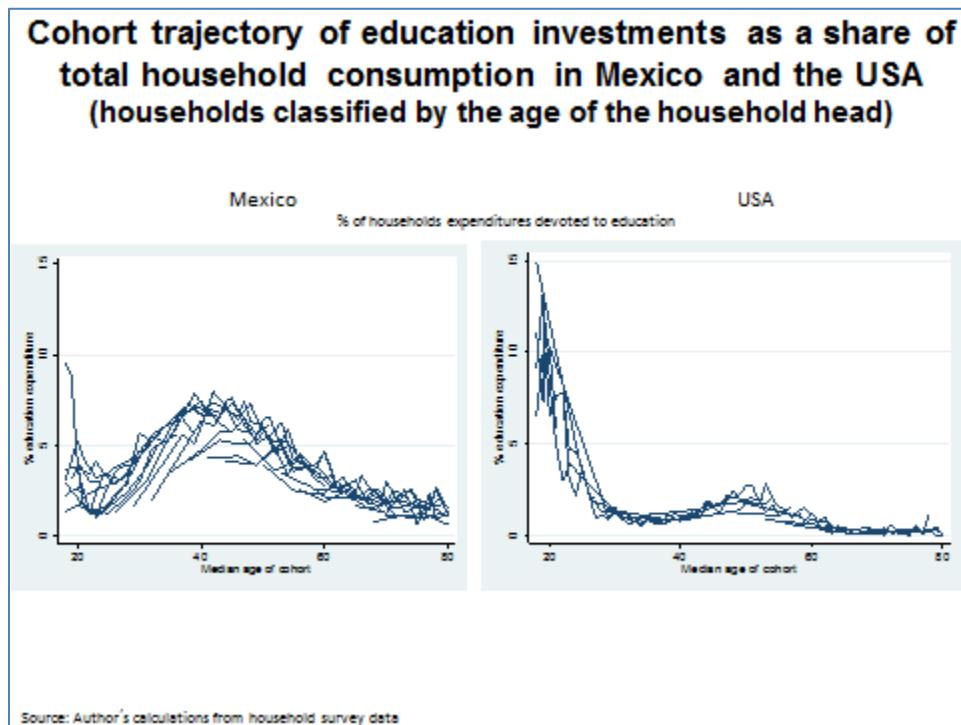
The share of individuals in each cohort attending school—and presumably investing resources in doing so—is presented from the bottom up. The first generation included (labelled Cohort 1 in the figure) is the one born between 1977 and 1979, which reached Primary age at around 1983-1985 and the average Upper Secondary Education (USE) age between 1992 and 1994. Cohort 2 was born between 1983 and 1985 and is observed at USE age several years after Cohort 1 between 1998 and 2000, while Cohort 3, born between 1993 and 1995 is observed at USE age during 2008-2010. For the three cases we can follow individuals in practically the entirety of their education cycle beyond Tertiary school age.

Presenting the data in this way helps illustrate the difference between focusing on snapshots of data as is traditional, and a dynamic synthetic panel approach. For instance, one comparison of interest is across generations (the vertical distance between the curves), where according to the data 30 percent of individuals in Cohort 1 were enrolled in school at age 15, while the rate is of 54 percent for Cohort 2 and 66 percent for Cohort 3 at the same age. We would expect greater private investments in schooling across younger generations in line with the increase in attendance. The same applies at all ages, with the exception of the trajectories after about age 20 for Cohorts 2 and 3, which tend to converge in the final stage of school age.

Additionally, when following each trajectory individually through the slope of the curves, the age pattern of attendance—and presumably of educational investments—is apparent. The main feature in this respect is that in all cases enrollment increases between ages 6 and 7 up to around age 10, and then declines steadily. One relevant comparison in this case, is the rate of exit from the schooling system across different ages for each generation. For Cohort 1, attendance declines by about 40 percentage points—from almost 60 to less than 20 per cent—between ages 10 and 18, and it is reduced from about 95 to 40 per cent in Cohort 2 during the same stage.

Cohort 3, which registers the highest enrollment at all ages, shows a decline from almost 100 per cent at age 10 to slightly less than 50 per cent at age 17-18 at the verge of entering College age.

**Figure 14.**



For our analysis we construct similar trajectories for all the cohorts observed in Mexico that can be traced through school age from 1984 to 2014, while for the US we identify the same demographic cycle for generations observed between 1996 and 2014. In all cases, we focus on the household as unit of observation and take the age of the household head as reference for tracking the evolution of each household over time. Our variable of interest is the percentage of all household consumption that is devoted to education investments as categorized in Section 1 above. Household expenditures are presented on a per capita basis to control for household size—that is, all education expenses are divided over the number of individuals in school ages 4 to 24.

The trajectory of all cohorts for each country is presented in Figure 14, which shows a quite distinctive evolution in both cases. While in Mexico—with the exception of one cohort—there is a relatively low start in terms of educational investments that grows continuously

thereafter until a turning point when the household head's age reaches the mid-40s, in the US there is an early start, with the highest investments when household heads are younger and presumably have younger children in their initial years of the school trajectory. Investments plunge rapidly, though, to the extent that when the head reaches about age 30 investments are low and only present a slight hump during ages 45-55.

The inclusion of the series of trajectories in the figure permits observing the different sources of variation discussed above. The first, which is more evident in Mexico, is that there are differences across generations, which are normally referred to as a “cohort effects,” reflecting the variety of structural conditions for different generations. These are not apparent for the US, which is in line with the hypothesis that after education rates have reached high levels, there are only slight cohort differentials. The distance of the attendance trajectories in Cohorts 1, 2 and 3 in Figure 13 would belong to these types of “cohort” effects, which tend to apply to all individuals in each generation.

The second is that there are variations along the life cycle of each cohort, which are especially apparent for Mexico, and that apparently correspond to the dynamics of household size and structure. The inverted “&” pattern that increases until the household head's mid-40s and declines thereafter is similar to what is normally classified as an “age effect” in the literature.

A third source of variation is “time effects”, which correspond to shocks that occur in a particular year, and that can affect school investment choices irrespective of the age or cohort effects. Economic crisis or natural disasters that alter the expected age pattern of investment and affect all cohorts in a country would be good examples of this. These effects, however, are not immediately apparent in the data.

In the context of the analysis of the dynamics of savings over the life cycle, several authors have attempted the identification of the aforementioned age, cohort, and time effects separately.<sup>14</sup> Following Székely, Mendoza and Karver (2015) we adapt this approach to identify the patterns of household expenditure in education. Similarly to the literature on household saving, the logic behind the model for estimating age, cohort, and time effects refers to the evolution of a continuous variable that may follow a complex underlying investment model

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<sup>14</sup> Some examples are Attanasio (1993), Attanasio and Banks (1998), Attanasio (1998), and Attanasio and Székely (2001).

similarly to savings and which may fluctuate quite a bit throughout the life cycle—whether whether to react to exogenous shocks or to change in investment strategies.<sup>15</sup>

The estimated age, cohort and time effects for both countries are presented in Figures 15a, 15b and 15c, and confirm the previously noted trends. For Mexico there is a clear inverted “u” shape pattern corresponding to the demographic cycle of households, while in the US initial levels are high but drop considerably early on in the household evolution process. Interestingly, cohort effects are positive in Mexico –with the only exceptions of the first cohort- indicating that over time, independently of the age effects identified, each generation in the country has tended to invest more in schooling as a share of household total consumption. This is not observed in the US where the cohort effects are quite flat and even negative for the most recent generations. Finally, time effects are somewhat similar in both cases with a negative influence up to the year 2000, and slight positive effects thereafter, with a blip in 2010 presumably related to the economic contraction experienced during that year.

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<sup>15</sup> Following Székely, Karver and Mendoza (2015), for implementing the procedure we compute the median age of the household head, which will always be the same in a given survey year. Since we are interested in cell means we first consider our indicator of interest as a function of cohort tendencies and an error term, which allows us to decompose the variability of a given indicator for each household in a given year-cohort. Following Attanasio (1993) for each household  $i$  with a median age of the household head  $a$  in cohort  $c$  in time  $t$ , we consider the following:  $X_t^{aci} = \delta_t^c + \varepsilon_t^{aci}$ , where  $\delta$  represents cell means (in our case, the proportion of total household expenditures devoted to education), and  $\varepsilon$  is a random error (deviations from  $\delta$ ) with the assumption that  $E[\varepsilon] = 0$ . Cell means are adjusted by cell size so that cohorts with more households are weighted accordingly, and  $\delta$  is estimated as a simple weighted proportion of household expenditures in education. Having postulated a typical age profile of education investment, we can consider any deviations of these indicators in the aggregate as cohort effects, since they capture differences across cohorts that cannot be accounted for by differences in age—under the assumption of equivalent time effects across cohorts. These deviations could also be considered a combination of age and time effects, since what makes a group of households different, other than their age, is the time period in which they are being observed. Under the assumption that the  $\delta_t^c$  represent cohort means for enrollment they can be expressed as polynomials in age, year of birth of the household head (cohort) and survey year (with constant  $\alpha_0$ ). By taking the first differences of the polynomial we arrive at an equation that can be estimated to determine the shape of the age profile. Following Attanasio (1993), rather than estimating the equation directly, we smooth the cell means (that are essentially line plots per cohort) by regressing these cell means on a fifth order polynomial in age,  $c-1$  dummies for each cohort, and  $t-1$  dummies for each survey year, the latter constrained to sum up to zero and to be orthogonal to a linear (time) trend. The smoothed profiles, assume that year effects are identical across cohorts. This would imply that all trends in the means can be interpreted as being the result of age and cohort effects.

Figure 15a.

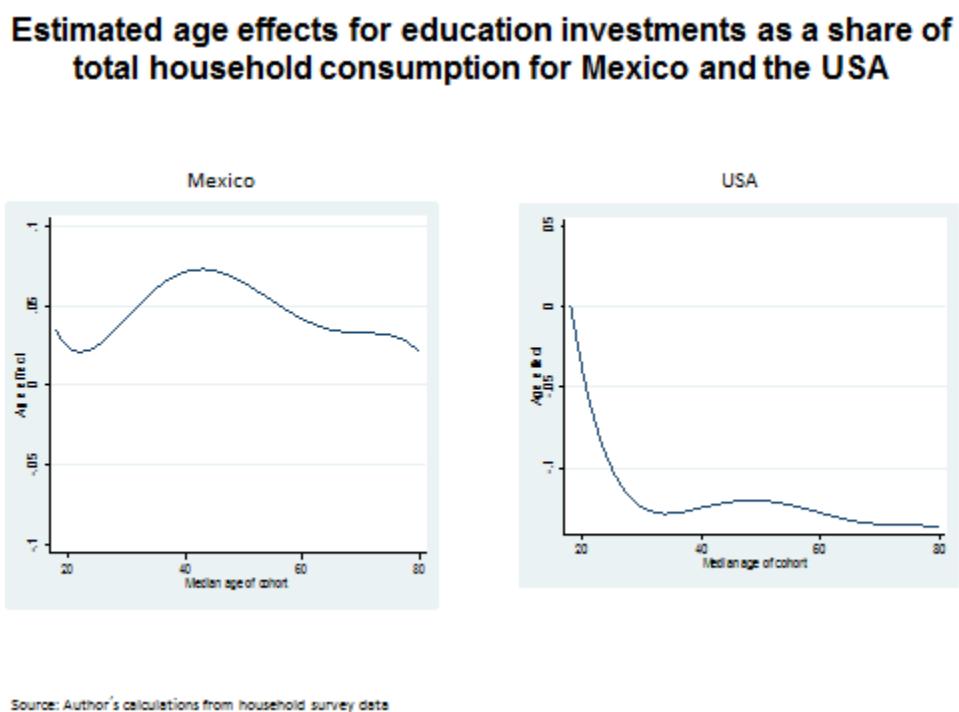
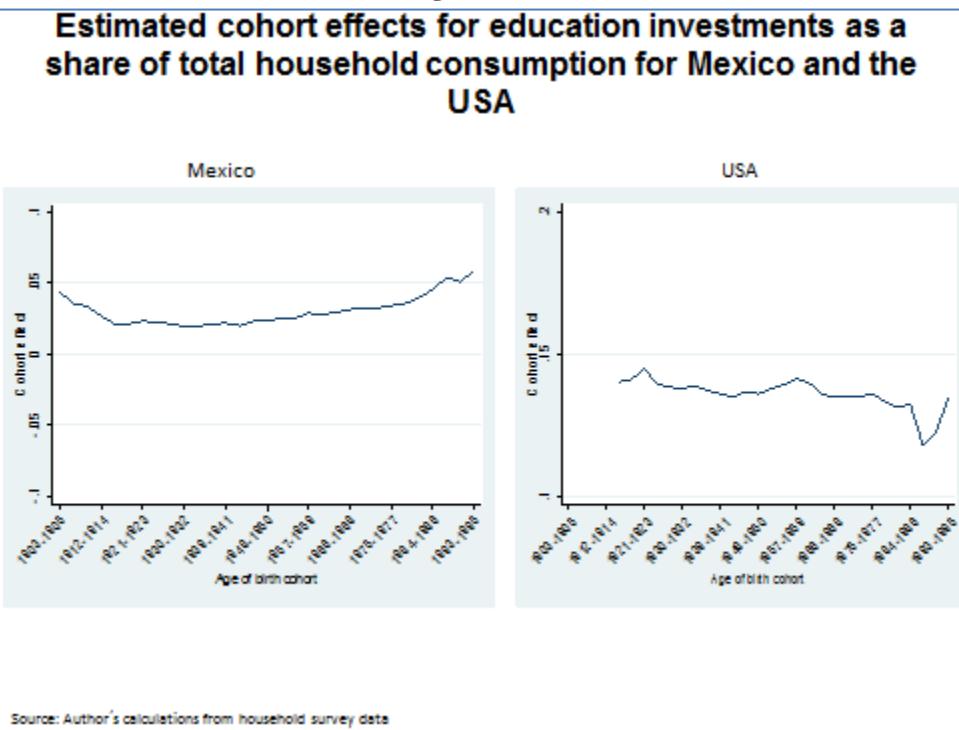
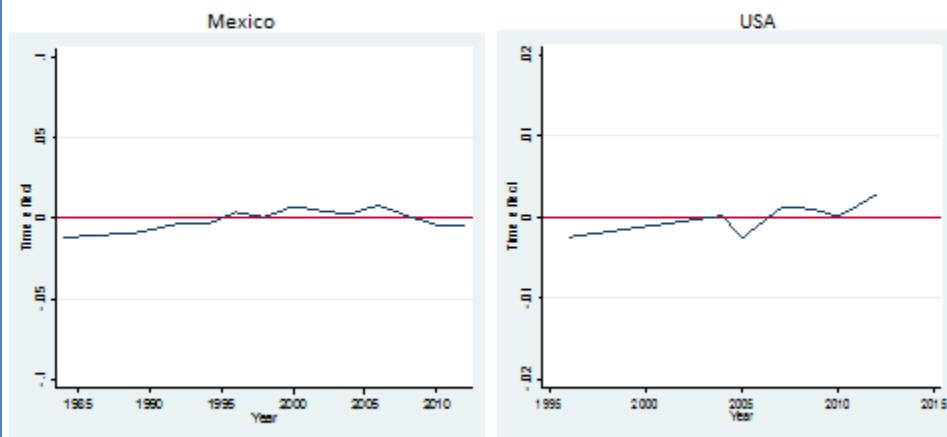


Figure 15b.



**Figure 15c.**

**Estimated time effects for education investments as a share of total household consumption for Mexico and the USA**



#### **4. Income and Price Elasticities of Private Expenditures in Education**

In order to provide further evidence of the nature of household education expenditures in Mexico and the United States, which is necessary for identifying the most adequate policy interventions for enhancing human capital formation, in this section we estimate a series of elasticities. The first, which we are able to calculate for both countries, is income elasticity, which is an indicator of the strength of the income-education relation. The second is the price elasticity of education expenditures, which is possible in the case of Mexico due to the inclusion of detailed prices for all consumption items registered in the household survey. This also allows for the estimation of some cross elasticities with the objective of identifying goods that are complementary or substitutes to educational investments.

**Table 5. Income Elasticity of Private Expenditures  
in Education in Mexico and the US**

Year	Mexico	USA
1992	1.10	
1994	1.15	
1996	1.12	0.50
1998	1.18	
2000	1.16	
2002	1.13	
2004	1.18	0.41
2005	1.14	0.48
2006	1.19	0.47
2007		0.35
2008	1.18	0.46
2009		0.41
2010	1.20	0.48
2011		0.40
2012	1.22	0.29
2013		0.41
2014	1.19	0.54

*Source:* Authors' calculations based on the ENIGH and the CPE.

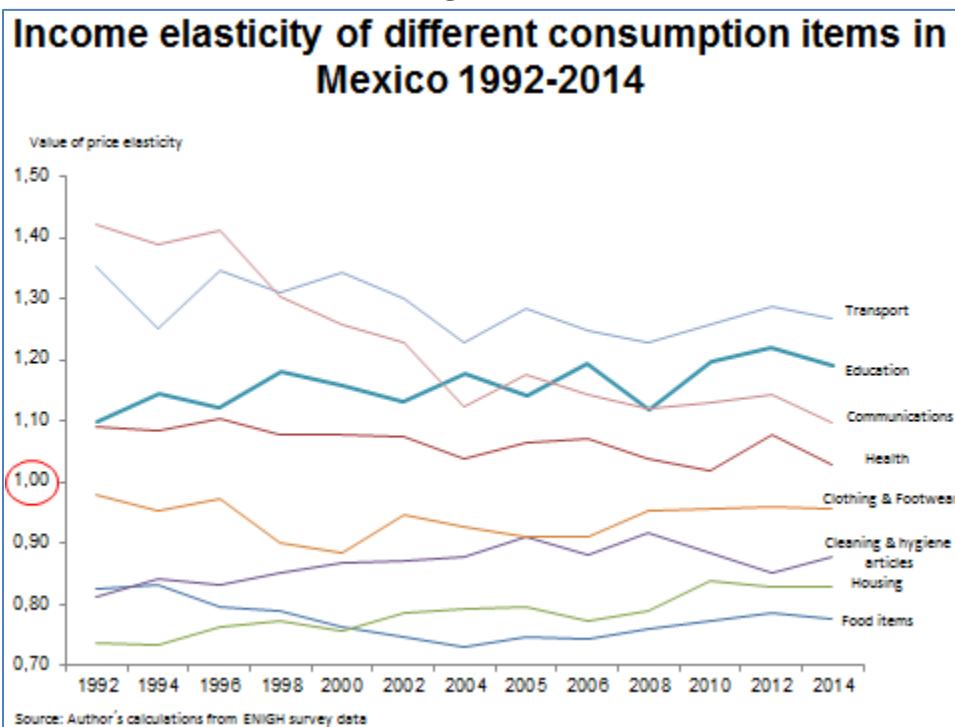
In order to estimate the income elasticities, for each household in the ENIGH and the CES we identify all education expenditures and allocate to each school age child those items that are clearly age-specific (i.e., we allocate the value of primary school fees to children attending primary school, and so on), and distribute on a per capita basis the value of the expenditures items that cannot be directly linked to particular individuals in the household (i.e., school materials in Mexico). After considering all education expenditures we divide the value of the education expenditure per child over the value of the per capita total household expenditures and interpret this as a measure of household “effort” in financing schooling through its resources.

We estimate the elasticity of this variable with respect to household per capita income, and find that as expected, the sensitivity of household private investments in education per child is much higher in Mexico than in the US. In fact, as shown in Table 5, household education expenditures are highly income-elastic in Mexico, while they are inelastic in the US—which is consistent with the “u” shape observed in Figure 8. This suggests that investing in education in Mexico is mostly a privilege of the rich (or even a luxury), while it is a more much generalized

phenomenon not as closely related to household positions in the income distribution in the US. In the context of low average quality and restricted access at the USE level, this in turn is consistent with a compensatory motive of investment in Mexico.

The data show that in Mexico there is a slightly increasing trend in the value of the elasticity since 1992, which can be interpreted as a sign of further concentration of human capital formation efforts along the income distribution. In the US the trend is more stable, with the exception of the year 2014, where an increase of about 20 per cent is observed.

**Figure 16.**

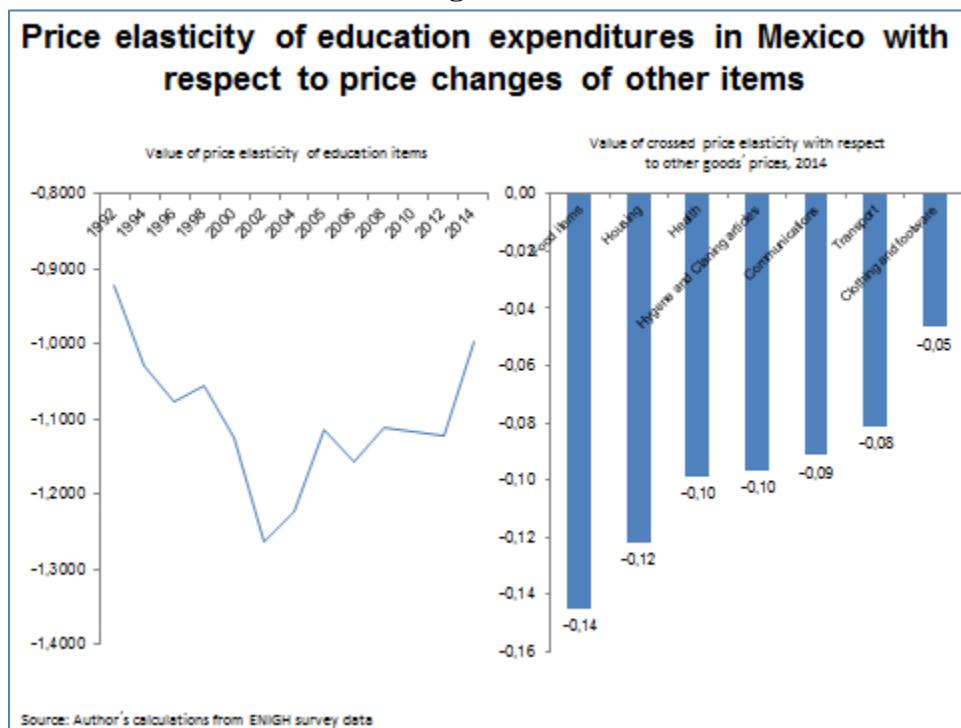


In order to place the apparently high income elasticities of education expenditures in Mexico in perspective, in Figure 16 we include the estimation of similar income elasticities for a range of goods and services that are also included in the ENIGH data. As can be seen, with the sole exception of expenditures in transport, expenditures in education show the highest income elasticities although, for the initial years in the figure, the income elasticity of expenditures in communications was higher but declines considerably since 1998. At the other extreme, we find that expenditures in food items, housing, and cleaning and hygiene articles are all inelastic with

respect to income. The other expenditure item that shows a high elasticity, as would also be expected, is health goods and services.

As mentioned above, an additional advantage of the ENIGH series is that this survey also registers the prices of the goods and services acquired by each household, which allows for estimating price elasticities. For instance, in the left panel of Figure 17 we plot the value of the price elasticity of household expenditures in education for the 1992-2014 period and find that household education expenditures are also highly elastic to changes in the price of educational goods and services. With the sole exception of the year 1992, where the price elasticity is below a value of -1, in all the other years the evidence suggests that Mexican households react importantly to price shifts in education, with a considerably decreasing trend since 2004.

**Figure 17.**



The right panel of the figure plots the cross elasticities of household education expenditures with respect to the prices of other goods and services; non-compensated price elasticities are shown here, although we also compute compensated elasticities, with similar results. The estimation departs from the demand system proposed by Deaton and Muellbauer

(1980) and corrects for the quadratic term used by Poi (2012).<sup>16</sup> We follow the method in Banks, Blundell and Lewbel (1997) that is based on the indirect utility function in (1):

$$\ln V(p, m) = \left\{ \left[ \frac{\ln(m) - \ln(a(p))}{b(p)} \right]^{-1} + \lambda(p) \right\}^{-1} \quad (1)$$

where  $p_i$  is the price of good  $i$  for  $i = 0, 1, \dots, 22$  (we are able to identify 22 different kinds of goods and services for which prices are clearly identified),  $b(p)$  is the function that aggregates prices  $b(p) = \prod_{i=0}^{22} p_i^{\beta_i}$ ,  $\lambda(p) = \sum_{i=0}^{22} \lambda_i \ln p_i$  and  $\ln(a(p))$  is the logarithmic function that is defined as:

$$\ln(a(p)) = \alpha_0 + \sum_{i=0}^{22} \alpha_i \ln(p_i) + \frac{1}{2} \sum_{i=0}^{22} \sum_{j=0}^{22} \gamma_{ij} \ln(p_i) \ln(p_j) \quad (2)$$

subject to the following homogeneity and (Slutsky's) symmetry restrictions:

$$\sum_{i=0}^{22} \beta_i = 0, \sum_{i=0}^{22} \lambda_i = 0, \sum_{j=0}^{22} \gamma_{ij} = 0, \gamma_{ij} = \gamma_{ji}, \text{ and } \sum_{i=0}^{22} \alpha_i = 1$$

The prices for the food items in the survey are complemented by the data from the food poverty basket calculated by the National Evaluation Council (CONEVAL), while we take the general price data from INEGI for the rest of the goods.<sup>17</sup> In our notation,  $q_i$  denotes the quantity of each good consumed, so the proportion of household expenditures devoted to each consumption category is  $w_i = \frac{p_i q_i}{m}$  and  $\sum_{i=0}^{22} w_i = 1$ . By taking equation (1) and applying Roy's identity the proportion of each consumption item is obtained by:

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<sup>16</sup> To our knowledge these are the first private education elasticities reported for Mexico. In the literature on demand systems for the country there are some recent articles calculating food consumption elasticities for a limited number of products and years, such as Chávez et al. (2009), who calculates a demand system for the ENIGH 2006 using 5 groups of goods; Valero (2006), who uses a demand system for calculating the price elasticity of 11 goods for 1992 and 2002; Chávez and Terrazas (2011), who estimate a demand system for eight goods with the ENIGH 2008 data; and Székely and Ortega (2014), who estimate a full consumption model with a variety of price and cross-price elasticities for food items.

<sup>17</sup> It should be noted that we were not always able to identify the prices of all goods and services consumed by all households due to missing data in the ENIGH, so we take averages by state when the number of price-observations is too low. For the next revision of the paper we intend to incorporate complementary data on prices from other sources of data, in order to refine the estimation of the cross-price elasticities.

$$w_i = \alpha_i + \sum_{j=0}^{22} \gamma_{ij} \ln(p_j) + \beta_i \ln\left(\frac{m}{a(p)}\right) + \frac{\lambda_i}{b(p)} \left[ \ln\left(\frac{m}{a(p)}\right) \right]^2 \quad (3)$$

where  $w_i$  is the proportion of expenditures devoted to category  $i$ ,  $p_i$  is the price of item  $i$ , and  $m$  represents the value of total household expenditures.

As can be seen in the right panel of Figure 17, which groups expenditure items in seven categories, the cross-price elasticity in all cases is negative, indicating that education and the groups of goods included have a substitution relationship. The strongest relation is observed between household expenditures in education and the price of food items, followed by housing and health. The results imply that relative increases in the prices of these goods inhibit private investments in human capital. At the other extreme, the sensitivity of education expenditures is much lower with respect to changes in prices of clothing and footwear and transport.

In sum, the high income elasticity of household education investments in Mexico leads us to conclude, on the one hand, that incentives for enhancing them might be highly regressive, and thus devoting resources for improving public services might have a stronger impact on human capital formation for lower-income households in this country. On the other hand, interventions that positively impact household incomes and that are targeted to the poor (e.g., cash transfer programs) can be an effective option for promoting greater private investments in schooling at lower incomes. However, for this alternative also, it is not clear whether devoting the same resources for improving the public education system would have greater impact on the human capital accumulation process, especially among the poor.

As for the relation with the price of other goods and services, it seems that “protecting” consumption items such as food, housing and health from price increases also implies protecting the investments that households devote to education from their private resources.

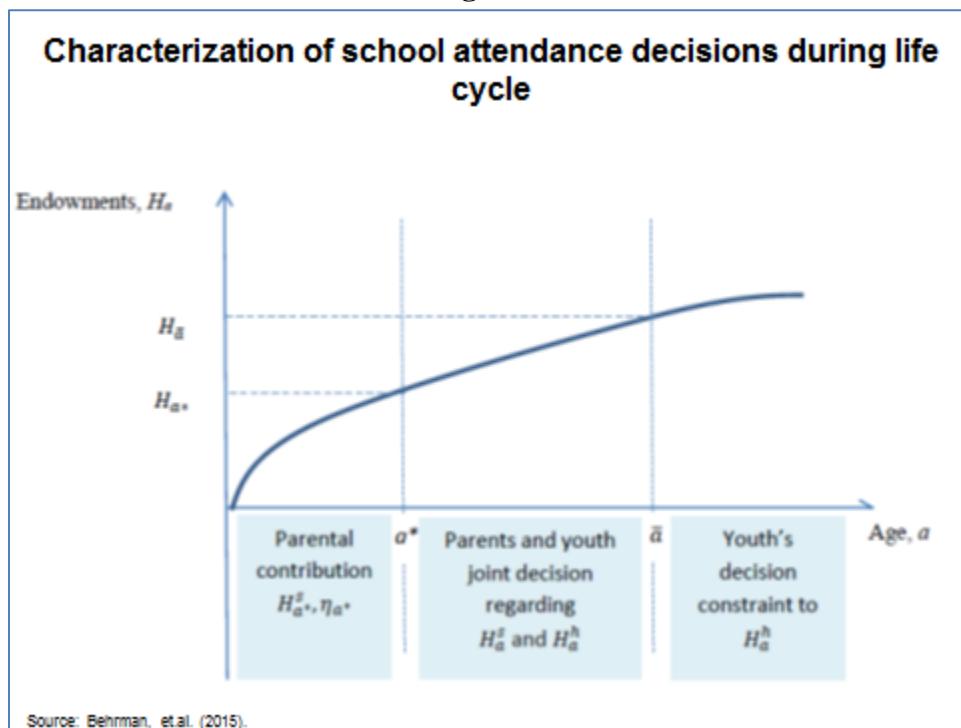
## 5. Private Expenditures in Education and Context Variables

So far we have presented some evidence on the dynamics of household expenditures in education in Mexico and the US, as well as measures of the link between such expenditures and income and with the prices of related goods and services. In this section we explore in more detail the potential motives and underlying factors influencing education expenditures in the case of Mexico, since for this country we are able to link the micro data used so far with context

variables that allow for a more complete picture of the different forces that, at least in theory, could modify household behavior.

As conceptual guidance, we use the recent work by Behrman, de Hoyos and Székely (2014) who follow the original development of human capital accumulation theory by Becker (1967) to explain human capital investment decisions as a balance between the marginal expected cost of continuing investment in education, and the marginal expected benefits of acquiring more years of schooling, where costs and benefits are shaped by a series of individual-family, community, and macro-aggregate variables that change along the life cycle and determine the resource use decisions of individuals and households.

**Diagram 1.**



The idea is illustrated in Diagram 1, borrowed from the authors, where an important distinction is made regarding who has greater weight inn school enrollment decisions along a typical household life cycle trajectory. The characterization implies that during pre-Primary and Primary education ages, parents usually make the relevant school enrollment and investment decision for their children. Thus, family resources would be expected to be a key variable

determining such decisions at this stage, and the interaction with each child's personal characteristics would also be thought to be critical. For instance, if resources are limited, parents might choose to invest in family members with a higher expected future economic return to education, determined for instance by cognitive abilities, gender (when gender is related to labor market opportunities), personality, and similar factors.

Along the same lines, family and personal characteristics can interact with community and macro-aggregate circumstances that can lead to a variety of enrollment and education investment decision. For example, when the context where the school operates is characterized by insecurity, lack of basic services or other problems (which would be community variables), the marginal expected cost of attendance of females may be perceived to be higher, and this could lead to premature truncation of the formal schooling investment process. Similarly, in a context where the labor market is perceived to be generating increasing returns to schooling and opportunities for a particular profile—for instance, females in specific jobs—this may alter the current family investment decision due to perceived higher expected returns to schooling in the future.

A critical change that implies a shift in the decision-making process in the diagram towards the center of the figure is when individuals enter an age where labor market options start to be a relevant alternative for time use. Although in Mexico the official working age is 15, it is possible that working options become more attractive earlier, especially in rural settings where agricultural family activities predominate. It would be expected that when individuals enter Lower Secondary age, this would already be an option, which implies an important change in the equation of marginal costs and benefits of attending school. At this point it would also be expected that youth influence the decision of their time use actively to some extent, although family resources and influence would remain relevant.

Perhaps the most crucial change from this stage onward is that the value of the opportunity cost of school attendance starts increasing with employment options. At the family level, when the budget constraint is binding to a greater extent there may be incentives to shift the time use of youth toward a paid activity in the labor market, which, rather than requiring the investment of household resources, yields income to the household. A key variable would be the expectation of which family member in the relevant age group is expected to receive higher

economic rewards, since this implicitly increases the cost for this member of staying in school. If the opportunity cost increases with age, there will be incentives for shifting into the labor market.

The interactions with community variables are multiple, since the opportunity cost will also be determined by the local labor market dynamics that determine job creation, wage levels, the quality of employment, and other elements such as the future rewards to experience. Similarly, the nature of interactions with the macro environment will be increasingly influential with age. In the context for instance, of an external economic shock that affects household income negatively the family might decide to continue investment in human capital for family members that have lower opportunity costs due to more limited labor market opportunities.

After age 15, when individuals enter what is usually USE age, the balance between the individual's and the family's influence on time-use and investment choices would be expected to start shifting towards the latter, and this should have implications for the interactions with family-personal, community and macro variables.

A critical variable that interacts with community characteristics is that adolescence is a stage of increasing exposure to risks, which can also change the balance between the marginal costs and benefits from being enrolled in school, especially at the Lower and Upper Secondary levels. Environments with more prevalent crime, violence, insecurity, and addictions, can have consequences not only for accessing education services, but also for labor market opportunities and job quality, among other considerations.

Interaction with the labor market will also create new scenarios. In particular, if better employment opportunities exist currently, this may imply higher household incomes and thus, greater resources for investing in the human capital of its members. This is characterized in the literature as a positive *income* effect. However, the same opportunities might generate the additional effect of "pulling" youth out of school by increasing the opportunity cost of remaining enrolled and losing out income generation possibilities, especially after legal working age. This is normally called a *substitution* effect that goes in the opposite direction. The final result from improved labor opportunities is an empirical matter that needs to be verified for each particular case.

Due to the achievement of legal working age since Lower Secondary schooling the interaction with the macro environment might also be more sensitive from this stage onward. In

particular, the opportunity cost of attending school in interaction with attitudes toward education, expected future income gains, and the social context will be expected to shape time use and education investment decisions more strongly, and perhaps in an increasingly different way for the individual than for the household.

In this context, it becomes clear that better understanding the process by which households decide on their human capital investments is critical to being able to influence the process at the aggregate level through public policy.

The ENIGH data for Mexico allow for a general exploration along these lines, since for every household in the survey it is possible to construct an indicator of geographic location with which information on community and economic context variables can be linked. Specifically, we are able to identify the geographic coordinates of the block where each household is located and associate such geographic coordinates, on the one hand, with georeferenced data on the availability of schools, the characteristics of the schools surrounding the household's location, and the availability of credit market services—which could be relevant as a source of finance for investment.<sup>18</sup> On the other hand, we are able to calculate from the same survey and from the National Employment Survey (ENOE) information on wages, employment and even the returns to education within certain area of influence of the same geographic area (identified by its coordinates). Along the lines of the previous sections, the main hypothesis of interest is whether private education expenditures in Mexico are of a compensatory nature in terms of playing a role of substituting for the deficiencies of the public education system—as measured by school access and proxies of education quality—since this has a direct link with policy implications.

To explore the hypothesis we regress the value of the education expenditures per child as a share of total household consumption per capita (defined as dependent variable),<sup>19</sup> as a function of(i) a series of household characteristics including the household head's education level, gender and age—which we introduce as a quadratic term in order to control for the dynamic age patterns

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<sup>18</sup> The procedure for identifying the location of the household departs from finding the coordinates of each AGEB (Área Geoestadística Básica) which a basic georeferenced location pertaining to the specific block where the household is located. The coordinates of each AGEB were obtained directly from the statistical office of INEGI (Instituto Nacional de Estadística y Geografía). Once the coordinates for the location of each household have been identified, it is possible to associate any georeferenced data set with each household record in the ENIGH.

<sup>19</sup> As in Section 3 above, for each household in the ENIGH we identify all (personalized and non-personalized) education expenditures, and divide them over the value of per capita household total expenditures, and interpret the indicator as a measure of household "effort" in financing schooling.

shown in Section 2 above—household size, and gender of each school age child; ii) municipality-level variables including poverty rates and access to financial services; iii) a characterization of the labor market through average wages, employment levels, relative returns to schooling, and employment formality in the municipality of residence; and iv) number of schools, coverage of the education system, average test scores in the national proficiency test ENLACE (which is performed in all schools of the country), and other indicators of academic performance such as dropout rates and over age rates, all at the municipality level, which are introduced to capture information on the quality and accessibility of the local education system. We estimate the regressions for Primary, Lower Secondary and Upper Secondary age students separately since, as noted above, the nature of education investment is highly dependent on age.

Since the dependent variable is the per capita share of private schooling investments relative to per capita total consumption, we interpret this measure as a sign of the effort that the household undertakes for investing in human capital through the schooling of each of its individual members in Primary, Lower Secondary, and Upper Secondary school age, respectively.

Our results, presented in Table 6, correspond to Huber-corrected OLS cross-section estimations with municipality fixed effects by using the ENIGH 2012 as a database for obtaining all household variables. We use the 2012 data since this is the year for which other databases with useful information for our purposes—namely access to financial services, and the school variables—are available. We interpret our results as associations in the data mainly because of potential endogeneity between labor market conditions and the education environment, and the household's location decisions.

The first set of variables referring to personal and household characteristics yields somewhat expected results. On the one hand, the gender of each child does not seem to have a statistically significant association with the relative education investment per child, which is in line with the well-known fact that the gender schooling gap is no longer existent in the country; in fact, it has reversed in favor of females at some levels. Interestingly, the gender of the household head does not appear to have a significant relation with schooling investments either. Household size, however, does have a positive and significant association, suggesting that there are few economies of scale in schooling investments.

According to our estimations, there is a positive and quite strong association between household education investments—as measured here—and the level of education of the household head, which is open to at least two interpretations. One is that higher education changes preferences in favor of human capital investments, so the positive association might be a sign that parents that have reached higher levels realize the advantages of this asset and place additional effort for opening the same possibilities for their children. Another is that the education variable is capturing to a large extent the socioeconomic level of the household due to the positive relation between schooling and income, so the coefficient would be indicating simply the already illustrated high elasticity of education expenditures to incomes. The age of the household head (and its squared value), however, do not seem to have a statistically significant association with education expenditures.

As for the community variables accounted for by municipality, poverty and access to financial services, the results are in line with what one would expect, although only for the estimates focusing on Lower and Upper Secondary levels, respectively; the associations with primary education investments are not significant. In the case of poverty an expected negative association is observed, which presumably captures similar income effect as the elasticities in the previous section, although in this case, at the municipality level. It should be noted, however, that if since this variable is in some sense controlling for socioeconomic levels—although at the municipality and not the household level—perhaps the education spending-education of the household head relation mentioned before might be net (at least to some extent) of socioeconomic influences, leaving some merit to the interpretation that the aforementioned result might be indicating preferences of more educated parents for investing more in the human capital of their children, irrespective of their income level.

The positive association between household per capita education spending and the presence of financial institutions in the locality of residence, especially at the Upper Secondary Level, suggests that credit constraints (access) might be a factor undermining (promoting) USE investments in Mexico, which would be in line with the results of investment models for items with attractive future returns.<sup>20</sup> A direct policy implication would be that increasing access to

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<sup>20</sup> A detailed description of the type of financial services merged with the ENIGH data and their distribution in the country and along the income distribution can be found in Powell and Székely (2015).

financing education might be a relevant instrument for enhancing household human capital investment capacities for complementing public investments in education.

The following variables in Table 6 characterize the prevalent labor market conditions. The main result in this respect is that while spending in Primary and Lower Secondary schooling seem to be only weakly associated with future income employment and income opportunities—perhaps due to their legal and compulsory nature since 1992—Upper Secondary education investments do seem to have a strong and significant association with local returns to schooling, local employment opportunities, and the quality of jobs available in the municipality of residence. This is indicated by the positive association with the returns to USE relative to Primary, with the level of employment and job formality observed for the 35 to 45 age group, respectively. These results support the view that the *income* effect of improved labor market conditions may be dominating the potential *substitution* effect of a higher opportunity cost for remaining in school at working ages.

Finally, we include four variables directly related to education availability and quality. The first measures the number of schools of each education level—in the Primary school regression we incorporate only the number of Primary institutions, and so on—and yields a first important element for the discussion of our hypothesis. Our results indicate a positive association with respect to the number of schools available at the Primary and Lower Secondary level, suggesting a complementary motive at these levels. However, the sign of the association is negative for USE, indicating that fewer schools available lead to greater household investments, which is in line with a compensatory role where households have to spend more when the supply of services is only readily available to a limited extent. The interpretation is supported by the related result that the rate of gross education coverage is not statistically significantly related to education expenses in Primary and Lower Secondary, but it is significant for USE; that is, when a larger share of students are enrolled with respect to USE age, households tend to spend more, presumably due to more limited *effective* supply capacity of the schooling system at this level.

**Table 6. Association between Spending in Primary and Lower Secondary Education and Different Variables**

Independent variable	Schooling Level		
	Primary	Lower Sec.	Upper Sec.
Child's Gender (male=1)	<b>0.011</b> 0.014	<b>-0.010</b> 0.007	<b>0.010</b> 0.018
Household Size	<b>0.011</b> 0.005	<b>0.008</b> 0.002	<b>0.014</b> 0.004
Gender of Household Head (male=1)	<b>-0.021</b> 0.016	<b>-0.009</b> 0.009	<b>0.016</b> 0.022
Years of Schooling of Household Head	<b>0.005</b> 0.002	<b>0.004</b> 0.001	<b>0.008</b> 0.002
Age of Household Head	<b>0.004</b> 0.003	<b>0.000</b> 0.002	<b>0.006</b> 0.005
Age of Household Head Squared value	<b>0.000</b> 0.000	<b>0.000</b> 0.000	<b>0.000</b> 0.000
Poverty at the Municipality level	<b>-0.008</b> 0.053	<b>-0.040</b> 0.016	<b>-0.217</b> 0.066
Number of financial institutions available in the Locality	<b>-0.027</b> 0.019	<b>0.038</b> 0.022	<b>0.029</b> 0.009
USE/Lower Secondary returns to schooling	<b>-0.181</b> 0.185	<b>0.054</b> 0.051	<b>0.212</b> 0.100
Secondary/Primary returns to schooling	<b>-0.006</b> 0.004	<b>0.012</b> 0.023	<b>0.003</b> 0.009
Employment rate for population 35-45 years of age	<b>0.062</b> 0.265	<b>-0.182</b> 0.158	<b>0.985</b> 0.402
Formality rate for population 35-45 years of age	<b>0.071</b> 0.098	<b>0.075</b> 0.053	<b>0.327</b> 0.131
Number of schools available in the Locality (Primary, Secondary and Upper Secondary respectively)	<b>0.089</b> 0.033	<b>0.015</b> 0.008	<b>-0.105</b> 0.023
Average ENLACE test scores in the Locality (Primary, Secondary and Upper Secondary, respectively)	<b>0.336</b> 0.269	<b>0.061</b> 0.031	<b>0.186</b> 0.087
School coverage rate in the locality (Primary, Secondary and Upper Secondary, respectively)	<b>0.462</b> 0.981	<b>0.364</b> 0.278	<b>0.465</b> 0.203
Overage and repetition rates in the locality (Primary, Secondary and Upper Secondary, respectively)	<b>0.802</b> 0.479	<b>0.235</b> 0.190	<b>0.661</b> 0.335
Constant	<b>0.084</b> 0.971	<b>-0.027</b> 0.210	<b>-0.275</b> 0.274
Number of obs.	2,839	2,056	1,718
F( 16, 2822)	2.59	6.14	5.28
Prob > F	0.0005	0	0
R-squared	0.1562	0.146	0.2273
Root MSE	0.28719	0.28719	0.28719

Source: Authors' calculations based on 2012 ENIGH data.

As for the variables representing education quality, we find that higher ENLACE test scores in the schools located in the same locality as the household are associated with higher education spending for Lower and Upper Secondary schooling.<sup>21</sup> Given the positive association between academic achievement (as measured by ENLACE) and socioeconomic status, however, this result may also be capturing an income effect of the type illustrated in the previous section. Municipality level poverty rates capture part of the income effect since they are truncated above the poverty cutoff.

The second quality-related variable, which measures the percentage of enrolled students that are either over-age or repeating a grade, also offers an interesting picture, although in this case the association is only statistically significant for USE. The fact that the coefficient is of positive sign suggests that greater household spending at this level is observed when the schools in the locality of reference have poorer academic results. That is, lower quality leads to greater investments after controlling for the average academic scores through the ENLACE tests, and effective school supply as characterized by the other variables already commented. This result also supports the view that Mexican household spending in education at the USE level could entail an important compensatory component.

## 6. Conclusions

This paper uses intensive household survey income and consumption data for Mexico and the United States to analyze private household expenditures in education in both countries. The comparison is of interest since Mexico is a country characterized by relatively low education quality and relatively low schooling coverage especially at the Upper Secondary Education level, and a highly unequal income distribution, while the United States has much higher quality and coverage rates. Additionally, although the United States is a country with a relatively unequal distribution of income by developed country standards, income concentration is much lower than in Mexico. The hypothesis is that in these two different contexts, private household expenditures in education respond to different motives, and have different effects on the human capital formation processes of school age individuals, which means that the public policy response for enhancing education investments should also be different.

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<sup>21</sup> ENLACE refers to the national standardized test Examen Nacional de Logro Académico applied to Mexican schools between 2006 and 2014.

The evidence presented here suggests that private expenditures in education in Mexico are actually more of a compensatory nature, while they are more in line with a complementary role in the United States. In Mexico, private education spending is high relative to household consumption and it is concentrated among the richest households. In fact, it is of similar value among the richest households in the country when compared to the richest households in the United States, spite of the income and development differences between these countries. The bulk of the private education expenditures are concentrated in the Primary, Lower Secondary and Upper Secondary levels, which are all compulsory and supposed to be guaranteed by the State. In the United States, in contrast, most expenditures are concentrated at the Tertiary education level where individuals have financing options, and which is not a compulsory level to start with. Furthermore, a large part of private education enrollment in the United States pre-Tertiary levels is in religious schools, which suggests that investments respond to a large extent to preferences related to specific cultural and religious identities rather than to a need to substitute for poor public education.

Our dynamic cohort analysis reveals that, while education expenditures show a clear age pattern aligned to the demographics of households in Mexico, in the United States they are concentrated at the extreme, at the Pre-K school level. We also find that, while in Mexico there are apparent positive cohort effects (i.e., new generations tend to spend more in education from private resources), generational differences are practically nonexistent in the United States.

One central result is that, while in the United States the income-elasticity of household education expenditures is below a value of 1 (i.e., expenditures are inelastic), in Mexico education expenditures are highly sensitive to increases in household income and display a slightly increasing trend over time. Moreover, of the seven groups of consumption items that we are able to characterize through the household survey data, private education expenditures are among the most income-elastic, suggesting that private education investments are a privilege—and luxury—of the rich.

Additionally, we find that Mexican households do respond importantly to price increases in education-related goods by reducing their education investments considerably. These investments are also sensitive to increases in the prices of food items, housing and health, so

“protecting” households from price shifts in these categories can indirectly enhance private household investments in education.

For Mexico we perform additional estimations by linking household survey data with variables characterizing household and personal features, access to financial services, labor market characteristics and some variables that account for access to and quality of schooling services. Our results are particularly interesting for household expenditures in Upper Secondary Education, since this is the level with the highest dropout rates and the lowest coverage among the compulsory stages.

We find a positive and significant association between household USE expenditures and access to the financial system, which suggests that credit mechanisms may play a relevant role in permitting households to expand their human capital investments. We also find a similar positive and statistically significant association between USE expenditures and labor market conditions—that is, greater household education investments per USE age child are observed when employment rates, formality, and returns to schooling are higher in the locality and municipality of residence. Most importantly, our estimates reveal that when there are fewer USE schools available in the locality of residence, households tend to spend more in education, presumably to compensate for the lack of immediate access, which is in line with a compensatory motive. Also, households spend more in USE when the rate of USE coverage is higher, which can be taken as indication of greater investment efforts in environments where there is lower effective school supply. Interestingly, we also find that households tend to spend more privately in education at the USE level where there is higher dropout and over age, which we interpret as a sign of compensation for relatively low quality.

The main conclusion derived from our analysis is that, while in Mexico promoting more private expenditures in education through increasing the income of poorer households, and through improving the access and quality of the public education system may be the best way of accelerating human capital formation in an egalitarian way, in the United States other policy options, such as providing incentives to all households for facilitating their private education investments, might be a preferred alternative.

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## Appendix

**Table A.1. Percentage of Students Enrolled in Public and Private Institutions in Each Decile in Mexico**

Decile	1996		2004		2014	
	Public	Private	Public	Private	Public	Private
1	99%	1%	100%	0%	99%	1%
2	99%	1%	99%	1%	99%	1%
3	99%	1%	98%	2%	98%	2%
4	99%	1%	97%	3%	97%	3%
5	98%	2%	96%	4%	96%	4%
6	97%	3%	95%	5%	94%	6%
7	94%	6%	92%	8%	92%	8%
8	93%	7%	87%	13%	87%	13%
9	84%	16%	75%	25%	76%	24%
10	57%	43%	45%	55%	48%	52%

Source: Authors' calculations based on household survey data.

**Figure A.1**

