IDB WORKING PAPER SERIES Nº IDB-WP-773

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Evidence from Income and Expenditure Surveys

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March 2017

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Cataloging-in-Publication data provided by the
Inter-American Development Bank
Felipe Herrera Library

Household education spending in Latin America and the Caribbean: evidence from income and expenditure surveys / Santiago Acerenza, Néstor Gandelman.
p. cm. — (IDB Working Paper Series ; 773)
Includes bibliographic references.
1. Education-Economic aspects-Latin America. 2. Education-Economic aspects-Caribbean Area. 3. Cost and standard of living-Latin America. 4. Cost and standard of living-Caribbean Area. 5. Household surveys-Latin America. 6. Household surveys-Caribbean Area. I. Gandelman, Néstor. II. Inter-American Development Bank. Department of Research and Chief Economist. III. Title. IV. Series.
IDB-WP-773

http://www.iadb.org

Abstract[1]

This paper characterizes household spending in education using microdata from income and expenditure surveys for 12 Latin American and Caribbean countries and the United States. Bahamas, Chile and Mexico have the highest household spending in education while Bolivia, Brazil and Paraguay have the lowest. Tertiary education is the most important form of spending, and most educational spending is performed for individuals 18-23 years old. More educated and richer household heads spend more in the education of household members. Households with both parents present and those with a female main income provider spend more than their counterparts. Urban households also spend more than rural households. On average, education in Latin America and the Caribbean is a luxury good, while it may be a necessity in the United States. No gender bias is found in primary education, but households invest more in females of secondary age and up than same-age males.

JEL classifications: E21, I2, D12
Keywords: Education, Income and expenditure surveys, Engel equations, Latin America

[1] The paper benefitted from comments from Matías Busso, Laura Rippani and Miguel Székely. We are indebted to Diether Beuermann, Javier Beverinotti, Carlos Gustavo Machicado, Marcelo Pérez, Eduardo Pontual Ribeiro, Rocío Portilla, José David Sierra, and Jorge Tovar for their help in gaining access to the databases used in this paper. This paper was undertaken as part of the Latin American and Caribbean Research Network project Private Spending on Skills Development in Latin America and the Caribbean.

1. Introduction

Governments in Latin American and the Caribbean (LAC) have developed large public education systems. In most countries, at primary and secondary levels public education has zero (or almost zero) tuition requirements, although this does not mean that education is free of any costs. Texts, notebooks, tutoring and transport are some of the expenses that are not always covered by the public system and must be privately provided. On the other hand, private educational institutions are probably the single most relevant category in household educational spending. Although there is great heterogeneity in educational spending, some forms of private spending are a widespread phenomenon in most households with children.

In this paper we aim at providing estimates of differences in private spending among various population groups. We use micro data from income and expenditure surveys in 12 LAC countries and the United States as a benchmark of comparison. The basic econometric step is the estimation of an Engel curve, and Engel curves have been estimated for a variety of consumption goods. The household budget share of a good or service (education in our case) is regressed on the log of per capital total expenditure, log of the household size, and other household characteristics.

The main focus of this paper is to answer questions such as those that follow. What is the income-expenditure elasticity of education demand? Is private spending in education a necessity or a luxury? Are there differences in this elasticity between the rich and the poor? Is education a necessity for the rich and a luxury for the poor? Is it important if the main income provider is the father or the mother? Does the providers' sex affect the total educational budget or the distribution between boys and girls? This framework allowed us to present the stylized facts regarding educational spending including total expenditures per child, differences in expenditures across households by age and gender of children, distribution of expenditure by educational level of the household head, differences in expenditure among urban and rural residents and scale effects associated with household size.

Economics has been long interested in education both in theoretical and empirical research. Seminal works include Mincer (1958), which has been at the center of the estimates of returns to education, and Becker (1964) human capital investment model. Hanushek (1979) provides and early review and discussion of concepts and estimation issues in educational production functions.

There is a specific literature in educational private spending that is in general based on single-country studies. The results suggest that household characteristics are important determinants of educational investments. Income elasticities are studied in Tansel and Bircan (2006) for Turkey, Hashimoto and Health (1995) for Japan, and Psacharopoulos and Papakonstantinou (2005) for Greece, Xiaolei and Smyth (2011) for China, Psacharopoulos, Ariera et al. (1997) for Bolivia and Omori (2010) for the United States. Gender differences in educational spending have been reported by Yueh (2006) for China, Maasterson (2012) for Paraguay, Carvalho and Kassouf (2009) for Brazil, Azam and Himaz (2010) for Sri Lanka, Aslam and Kingdon (2008) for Pakistan and Kingdon (2005), Zimmermann (2012), and Azam and Kingdon (2013) for India. The education level of the household head has an incremental effect on private spending as reported by Yueh (2006) for China and Omori (2010) for the United States. Emerson and Portela Souza (2007) reported higher impact of mother's education on daughters' school attendance and father's higher impact on sons' school attendance in Brazil. Masterson (2012) reports that asset ownership affects female bargaining power within households, which has an impact on gender bias in education spending in Paraguay.

As reviewed briefly in the last paragraph, there are some studies on private spending in education in LAC, but most of the literature based on developing countries has focused on Asia. Our contribution is not in the novelty of the methodology, but rather in our concentration in the LAC region, in the large set of stylized facts and in the systematic application of the same data homogenization and estimations to a wide range of countries. The replication of estimates to several countries has rarely been undertaken within this literature. The robustness of those estimates should also be of interest to researchers with regional interests beyond LAC.

2. Income and Expenditure Surveys

2.1 Data Sources and Coverage

Countries perform income and expenditure surveys at least every decade or so as an input for the Consumer Price Index. Since the objective of the surveys is the construction of an average consumption basket, data on consumption expenditure are thoroughly disaggregated, including all forms of consumption such as food, beverages, transportation, leisure, health and education expenditures.

Micro data come from 12 LAC countries and the United States. The LAC countries are: Bahamas, Bolivia, Brazil, Chile, Costa Rica, Ecuador, Mexico, Nicaragua, Panama, Paraguay, Peru and Uruguay. For the United States there are two microdata sets that contain detailed consumption information. Most previous research has used the Consumer Expenditures Survey (CES) of the Bureau of Labor Statistics (BLS). This database allows the construction of national averages for various forms of consumption. The sampling of the CES is based on a set of quarterly independent surveys. The BLS provides detailed information on how to reproduce average national statistics, but this procedure cannot be followed to obtain measures of annual consumption at the household level. We prefer to use the Panel Study of Income Dynamics (PSID), for which year 2013 information is the latest available. The sampling and data collection methods are more similar to those of LAC countries and allow us to compute household-level annual consumption. While the PSID historically only gathered housing and food-related expenditure, the consumption module of the survey was expanded in 1999 and again in 2005. Li et al. (2010) show that the consumption estimations of both surveys are consistent. According to Andreski et al. (2014), the ratio of the mean PSID consumption to the mean CE consumption ranges from 0.96 to 1.02 in survey years 1999 through 2009.

Survey coverage includes representative samples from both urban and rural settings in most countries. The surveys of Chile, Nicaragua and Panama cover only major urban areas. Surveys for Bahamas, Bolivia, Brazil, Costa Rica, Ecuador, Mexico, Paraguay, Peru, the United States and Uruguay cover both rural and urban areas. Table A1 in the Appendix presents the data sources.

The survey dates range from 2003-2004 (Bolivia) to 2014 (Mexico). Ideally, we would like to have information for all at the same moment in time and in the same phase of the business cycle. This is not possible, however, when working with a sample of countries as wide as in this paper. Therefore, one of the contributions of the paper is in itself a limitation that we acknowledge.

2.2 Recollection Mechanisms

In general terms, the surveys use two types of recollection mechanisms to gather expenditure information. The first is a diary given to households that is intended to be completed by an informed member. This diary recollects information on the household's most frequent small

expenses, generally in a seven-day period. In some cases, there are two diaries: one to compute household expenses and another given to all household members to compute their own expenses, as some kinds of expenses are better accounted for by the individual and not by the household member completing the general household diary. For example, spending on cigarettes by a 15-year-old boy is better documented by him than by his mother or the household head. Two different diaries (one for the entire household and another for individual members) are used in Chile, Costa Rica, Panama, Peru and Uruguay surveys. Only the household diary is used in Argentina, Mexico and Brazil. The other recollection mechanism is the interview itself. Here the interviewer asks about less frequent and high-amount expenses that are assumed to be correctly estimated by household members. This mechanism is in some cases a substitute for and in some cases a complement to the diary. Both mechanisms are used in surveys for Argentina, Brazil, Chile, Costa Rica, Mexico, Panama, Peru and Uruguay. The rest of the countries of LAC and the United States only use an interview to recollect expenses.

The diaries and interviews that are intended to gather information on household spending usually involve a reference member of the household. In Bahamas, Nicaragua, Panama, Paraguay and the United States this member is the household head. In Brazil, Chile, Costa Rica, Ecuador, Mexico and Uruguay, the household expenditure section is answered by the household member or members who reportedly have the most knowledge of household expenses.

The surveys request expenditures over various time frames, and there are differences in time frames both within and between surveys. Using the two data-gathering instruments discussed above, expenditures are usually gathered for the following periods of time prior to data recollection: i) seven days, ii) 30 days, iii) 90 days and iv) 12 months. Usually, the seven-day time frame is used for food and cleaning item expenses, and the 30-day time frame recollects information on expenses such as clothes and transportation. The 90-day time frame recollects information on expenses such as maintenance of household equipment, and the 12-month time frame usually gathers information on durable goods and on educational and housing expenses. For the purpose of this study it is important to note that education is always measured over the whole year to avoid seasonality problems. We convert all figures into annual data.

2.3 Definition of Income and Total and Educational Spending

We define expenditure in a broad sense and include all forms of consumption (either paid or home produced). We consider the following disaggregation of educational spending: direct spending in initial education (kindergarten, etc.); direct spending in primary education; direct spending in secondary education; direct spending in university and other tertiary education; other direct spending in education; and indirect educational spending (e.g., transport for schooling purposes.[2] In the econometric exercises we use household income as an instrument. Household income includes all forms of monetary and non-monetary income in all countries but Bahamas and Ecuador, where only monetary income was available. Financial capital gains (e.g., increases in asset values due to price changes in capital markets) are not commonly reported in the surveys, so we do not consider them. On the other hand, earned interest and dividends are regularly reported and are included in the working definition of current income.

Surveys for Bahamas, Brazil, Chile, Costa Rica, Nicaragua, Panama and Uruguay include information on whether consumption for each item was bought, home produced or obtained by other non-market means, but this estimation is performed by the national agencies. Ecuador, Mexico, Paraguay and Peru ask informants to estimate the cost at market prices for personal consumption. We include all categories in total consumption spending, whether bought, obtained as a gift or home produced. The PSID for the United States asks about broad expenditures categories without separating market value from personal consumption.

Most national statistics agencies impute homeowners' rental value as a form of consumption, either estimating or directly asking homeowners how much they would have to pay in rent to live where they do. We excluded this value for the total consumption measure in all surveys. In Bahamas and the United States this imputation is not made by the corresponding institutions, so no rental value correction was needed.

We checked the databases especially for imputations in educational expenses and asked national statistics institutions how they proceed. This happens only in Uruguay, where the national agency imputes a value of educational spending to those attending public educational institutions free of charge. We do not consider this a form of private spending, since it is publicly provided and does not involve any financial effort for households.

[2] For Panama and the United States we cannot compute this disaggregation.

3 Results

3.1 Averages by Country

We start reporting national averages in Figure 1. Private household investment in education can be measured as the amount of money spent or as the share of total consumption represented by educational spending. At the national level we compute mean spending in 2014 PPP adjusted dollars (Panel A), the average of the ratios of educational spending to total spending (Panel B) and the ratio of national educational spending to national total spending (Panel C). Some of the variation across countries might be due to differences in household composition, such as the number of children by household. Therefore, we report in Panels D, E and F the same statistics but for a "typical" household of two adults and two children.

Direct forms of spending have the highest degree of between-country comparability, since some forms of indirect spending might be differently classified. In Appendix Figure A1 we present a version where only direct forms of spending are included, with the exceptions of Panama and the United States, where we only have total spending in education but not its disaggregation.

At this point it is worthwhile to note the difference between the average of ratios and the ratio of averages. While they are in the same line, they do not report exactly the same information. The average of ratios gives the same weight to each household, while in the ratio of national averages the rich account for a larger part of the denominator. If they spend a higher share of their budget on education than the poor, then, the ratio of the average educational spending to the average total spending will be higher than the average of household ratios. This is the case in all countries, as can be seen in Panels B and C (or E and F).

In the United States, households' average spending in education was $1,539, while the average in LAC countries was $883 (a 74 percent difference).[3] The magnitudes of the differences between the United States and LAC are much higher, however, in the exercises focusing only on two-parent, two-child households. In those exercises, U.S. spending is about three times the average LAC level. The difference between panel A and D are due to LAC's higher household fecundity (more household members) than the United States.

Bahamas and Chile are the countries with the largest private investment in education, with annual spending levels of $2,388 and $2,194, respectively. Households in those countries

[3] The BLS estimate of educational spending based on CE is 25 percent lower than our estimation based on the PSID.

allocate 4.6 percent and 6.4 percent of their respective total consumption to education. Mexico also allocates an important share, 5.2 percent, while U.S. households allocate 2 percent. The top countries' classification is robust to the "standard" estimates using only direct spending in education and to estimates based on two-adult, two-child households. As expected, the exercise for typical households reports higher levels of educational expenditure.

Bolivia is the country with the lowest private spending in education in absolute terms ($471). On the other hand, Brazil has the lowest average ratio (1.6 percent) and the lowest ratio of the total (2.7 percent). Paraguay's private spending in education is also among the lowest in the region (2.2 percent or 3.2 percent, according to panels B and C, respectively).

Table 1 reports some descriptive statistics. We start by showing a huge difference between the mean and median values for all countries in the estimations using all households. The country medians are more than 90 percent lower than the averages of educational expenditure. This suggests a highly right-skewed expenditure distribution. Restricting the analysis to two-adult, two-child households, the difference between the mean and the median is lower but still of significant magnitude. A similar picture emerges from the statistics computed using the share of educational spending on total spending. The medians are well below the averages, and the mean-median difference is smaller for two-adult, two-child households.

In the last columns of table 1 we report Gini indexes of income, educational spending and total spending. To have a benchmark we also include in the table the WDI reported income-based Gini.

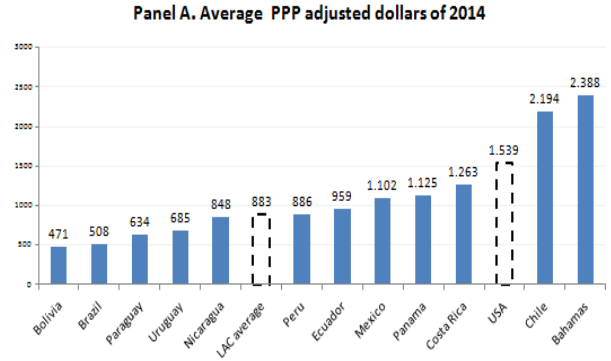
Our estimates of Gini based on total expenditure show lower levels of inequality than the income-based Gini coefficients. This is consistent with evidence that saving rates are higher in the top of the income distribution (see Gandelman, 2015). In addition, our estimates of Gini of income are consistent with those of WDI, which is a check of the reasonability of the results reported and the quality of the data. Consistently with WDI data, our estimates of Gini of income and consumption show that LAC is more unequal than the United States. Nevertheless, this pattern reverses when we look at educational spending. Although both LAC and the United States are unequal, in educational expenditure the Unite States shows even more inequality.

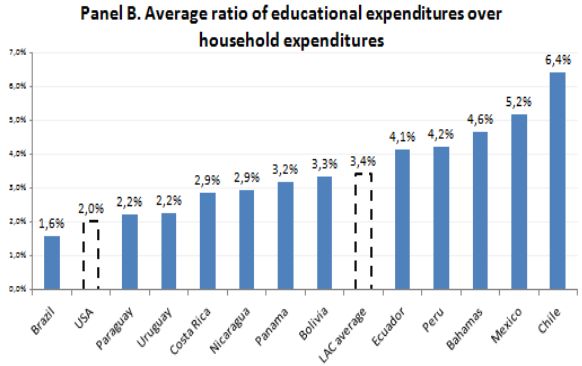
We find that the inequality in educational spending is huge. Using all the observations, the figure of the country Gini coefficients is up to two times the traditional Gini based on income. Naturally, due to life-cycle phases some households may have invested in education in

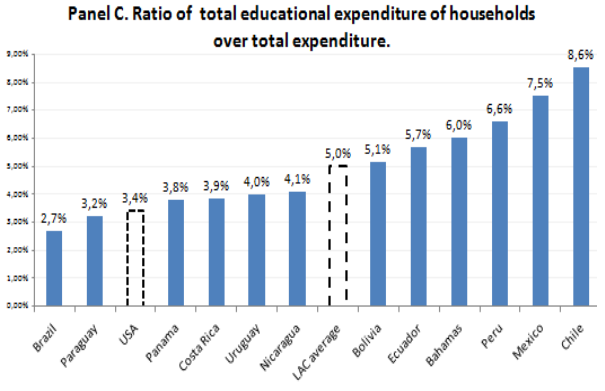
the past but not anymore. The Gini using only two-parent, two-child households shows substantially lower inequality but still much higher than income-based Gini indicators.

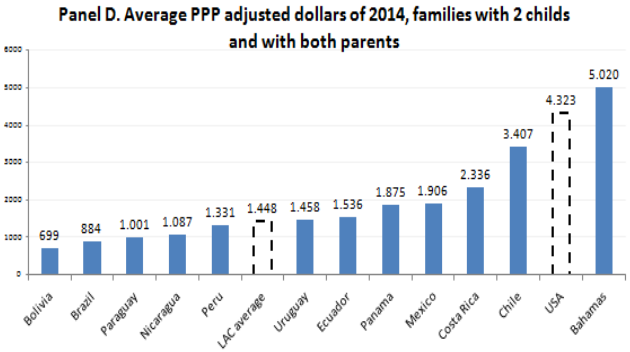
Table 2 presents a disaggregation of the average educational spending (all observations) on its main components. Tertiary education is the most important form of spending, accounting on average for 36 percent of total expenses in education. Indirect spending is also a relevant form of spending, with an average of 16 percent of total expenses in education (more than the average of secondary education, 14 percent) but, as previously mentioned, strict comparability of this item is more problematic. Appendix Table A2 disaggregates other indirect spending in clothing, materials, housing, food and other education-related expenses.

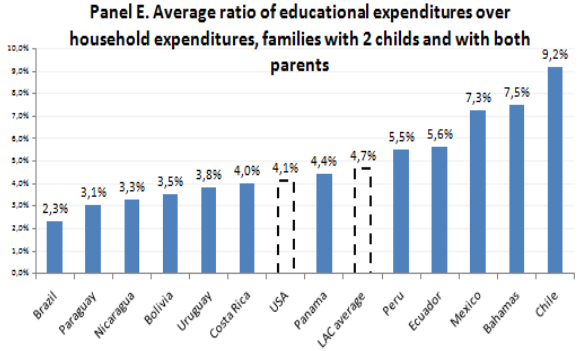
Figure 1. Household Educational expenses by Country











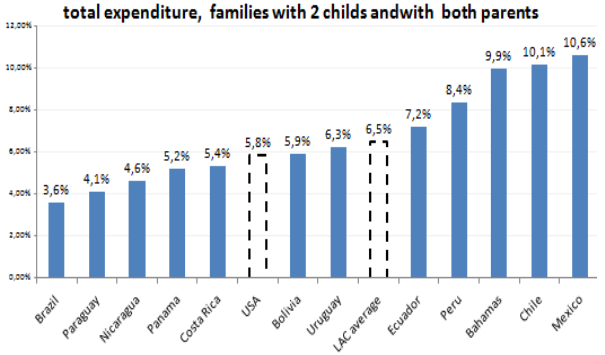


Table 1. Educational expenses stats and inequality measures																	
	Household educational expenditure in PPP adjusted annual dollars						Household educational expenditure as % of total household expenditure						GINI indexes				
	All households			2 adults 2 children			All households			2 adults 2 children			All hh 2ads 2ch.				
	mean	median	percentile 90	mean	median	percentile 90	mean	median	percentile 90	mean	median	percentile 90	GINI index of Household expenditure in education		GINI index of total household expenditure	GINI index of income from WDI	GINI index of income from our estimates
Bahamas	2388	303	5628	5020	1684	9409	4.6%	1.1%	13.9%	7.5%	5.1%	15.6%	0.806	0.557	0.382	-	0.470
Bolivia	471	57	737	699	86	1166	3.3%	1.0%	8.8%	3.5%	1.1%	9.4%	0.862	0.867	0.493	0.550	0.512
Brazil	508	0	1185	884	0	2528	1.6%	0.0%	4.9%	2.3%	0.0%	8.2%	0.910	0.820	0.549	0.541	0.528
Chile	2194	106	6932	3407	1394	9795	6.4%	0.8%	21.0%	9.2%	5.7%	23.7%	0.800	0.562	0.480	0.505	0.488
Costa Rica	1263	70	3469	2336	267	6570	2.9%	0.4%	9.3%	4.0%	1.3%	11.7%	0.846	0.802	0.521	0.492	0.513
Ecuador	959	163	2615	1536	343	4197	4.1%	1.4%	12.4%	5.6%	2.5%	15.6%	0.800	0.623	0.416	0.464	0.450
Mexico	1102	0	2730	1906	325	4224	5.2%	0.0%	17.6%	7.3%	2.8%	20.9%	0.856	0.679	0.457	0.481	0.457
Nicaragua	848	72	1966	1087	182	2629	2.9%	0.6%	9.0%	3.3%	1.2%	9.3%	0.819	0.675	0.464	0.457	0.481
Panama	1125	188	3143	1875	508	5485	3.2%	1.0%	9.5%	4.4%	2.1%	11.3%	0.782	0.611	0.428	0.528	0.450
Paraguay	634	66	1889	1001	184	2646	2.2%	0.5%	7.3%	3.1%	1.1%	8.9%	0.816	0.748	0.383	0.526	0.517
Peru	886	61	2477	1331	176	3306	4.2%	0.7%	13.7%	5.5%	1.8%	15.9%	0.832	0.666	0.428	0.483	0.467
Uruguay	685	0	1567	1,458	0	4359	2.2%	0.0%	7.1%	3.8%	0.0%	12.8%	0.916	0.850	0.464	0.465	0.437
LAC average	883	66	2342	1448	255	3816	3.4%	0.6%	10.7%	4.7%	1.6%	13.5%	0.849	0.714	0.470	0.501	0.484
USA	1539	0	2,032	4,323	0	13,211	2.0%	0%	4.3%	4.1%	0	15.8%	0.941	0.855	0.388	0.411	0.489

Note: On the WDI Gini is for the same year as our microdata. They are the following: Bolivia (2004), Brazil (average 2008-2009), Chile (2013), Costa Rica (2013), Ecuador (average 2011-2012), Mexico (2012), Nicaragua (2009), Panama (average 2007-2008), Paraguay (2011), Peru (average 2008-2009) and Uruguay (average 2005-2006).

Table 2. Disaggregation of educational expenses by country								
	Total educational expenses	Initial education expenses	Primary education expenses	Secondary education expenses	Tertiary education expenses	Other direct expenses	Indirect expenses	Number of households
Annual average, PPP adjusted dollars of 2014								
Bahamas	2,388	209	310	298	838	56	677	1,545
Bolivia	471	9	81	51	154	39	137	9,135
Brazil	508	27	87	47	209	85	52	56,091
Chile	2,194	125	405	220	1,235	91	118	10,528
Costa Rica	1,263	97	195	159	458	155	199	5,705
Ecuador	959	42	130	153	239	114	280	39,617
Mexico	1,102	79	233	285	283	48	174	19,479
Nicaragua	848	-	201	153	378	116	-	6912
Panama	1,125	-	-	-	-	-	-	8895
Paraguay	634	24	101	46	271	102	91	5,417
Peru	886	43	120	111	393	130	89	35,161
Uruguay	685	58	148	173	73	161	72	7,033
USA	1,539	-	-	-	-	-	-	9,064
LAC average	883	48	144	126	323	100	138	
Structure in percentage terms (%)								
Bahamas	100	9	13	12	35	2	28	
Bolivia	100	2	17	11	33	8	29	
Brazil	100	5	17	9	41	17	10	
Chile	100	6	18	10	56	4	5	
Costa Rica	100	8	15	13	36	12	16	
Ecuador	100	4	14	16	25	12	29	
Mexico	100	7	21	26	26	4	16	
Nicaragua	100	-	24	18	45	14	-	
Panama	100	-	-	-	-	-	-	
Paraguay	100	4	16	7	43	16	14	
Peru	100	5	14	13	44	15	10	
Uruguay	100	8	22	25	11	24	10	
USA	100	-	-	-	-	-	-	
LAC average	100	5	17	14	36	13	16	

3.2 Public-Private Spending and Its Impact on Inequality

In this section we compare the pattern of public and private spending in education. To this end, we compare total public expenditure on educational institutions with families' expenditures on education. We find that LAC households tend to spend more in tertiary education, as opposed to LAC governments that tend to spend more in secondary education. For a more detailed analysis of the decompositions of public-private spending see Appendix Table A3.

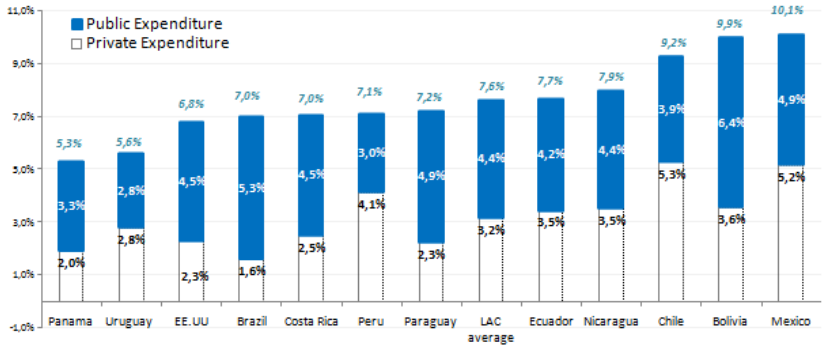
When comparing total expenditures on education we see that public expenditure is higher than private spending (Figure 2). Taking the sum of both public and private spending we find that Mexico spends the largest share of its GDP on education, while Panama spends the least. In private educations, Chile spends the highest percentage of its GDP, while private Brazil spends the lowest. Although we have showed that in PPP terms Bolivia has the lowest investment in education, as percentage of GDP it is the country that the most on public education.

Public and private spending in education can be substitutes or complementary. In countries with lower-quality public educational systems, households may spend more on private institutions. On the other hand, public institutions may crowd in household education investment, for instance due to a higher general educational level that forces individuals to increase human capital investment. A simple Pearson correlation based on the 12 LAC countries in this study shows a negative but non-significant correlation between public and private spending as percentage of GDP. This smooth negative relationship can be observed at the slope of the tendency line in the scatter plot in Figure 2, Panel B.

Figure 2. Public-Private Educational expenditure decomposition

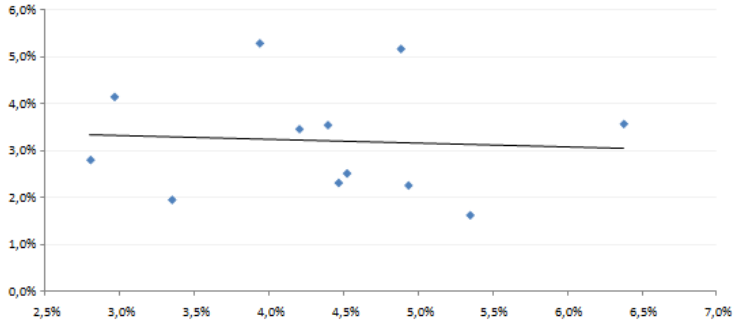
Panel A. Total educational expenses by country

(Public Expenditure over GDP of the year from which the expenditure is refered to plus Private expenditures from our estimates over GDP of the period of the survey)



Panel B. Scatter Plot Between Public and Private expenditurse as percentages of GDP.

(x axis public expenditure, y axis private expenditure)



Note: In some countries the years of the statistics for public spending (source: WDI) and private spending (authors' estimations based on income and expenditure surveys of Table A1) do not coincide. They are: Bolivia (2003 public and private 2003-2004), Costa Rica (2004 public spending in primary, the rest of public spending is from 2007 and private spending is from 2013), Mexico (2011 public spending and 2014 private), Nicaragua (2010 for total public spending and tertiary public spending, 2005 for the rest of public spending and 2006-2007 for private spending), Panama (2008 for total public spending, 2011 for total tertiary public spending, 2007 for the rest of public spending and 2007-2008 for private spending) and the United States (2011 for public spending and 2013 for private spending). The rest of the figures are from the year(s) of the surveys. Estimates of private consumption from income and expenditure surveys tend to be below national accounts consumption estimates. We adjust our estimates by the proportional factor needed to make both sources coincide.

We have shown above that there is substantial inequality in household spending in education. Public spending can compensate for this difference if it is more concentrated on sectors that spend less in education. To address this issue we compute a simple exercise. We start by assuming that public spending in public institutions benefits only those attending a public institution. This is a simplifying assumption that does not need to completely hold in reality, since there are publicly financed activities (like coordination of syllabuses, generation of books and study materials) that also benefit those attending private institutions. Then, we obtain the per

child public investment in education as the ratio of total public educational spending over the number of children attending public institutions, and this is done by education levels. Finally, we proceed to impute average public spending to all children who, according to our surveys, attend a public institution.[4]

In Table 3 we report the adjustment made to the educational spending of those attending public schools and then the effects of this adjustment on median educational spending and the Gini. We find a substantial increase in median educational spending and a large decrease in the inequality indicator. On average (for those LAC countries for which we perform this exercise), the median including public investment shows an increase from $62 to $2,170. This is another way of saying that for at least half of the population in LAC private education investment is almost null. Imputing public education also shows a high decrease in the Gini from 0.859 to 0.606. Even with this adjustment, educational inequality remains higher than consumption inequality and income inequality.

[4] For these computations we can only use surveys where we have information on the type of institution (public or private) that students attend.

Table 3. Inequality exercise					
	Public Spending Adjustment (public spending per student in the public educational system in PPP adjusted 2014 dollars)	**Median in annually PPP adjusted dollars of 2014**		**Gini of educational expenditure**	
		Before adjustment	Adjusted	Before adjustment	Adjusted
Bolivia	993	57	1155	0.862	0.581
Ecuador	1970	163	2111	0.800	0.571
Mexico	2887	0	2887	0.856	0.598
Panama	2226	188	2354	0.782	0.581
Paraguay	1348	66	1391	0.816	0.594
Uruguay	1577	0	131	0.916	0.703
Brazil	2664	0	2432	0.910	0.630
LAC average	2272	62	2170	0.859	0.606

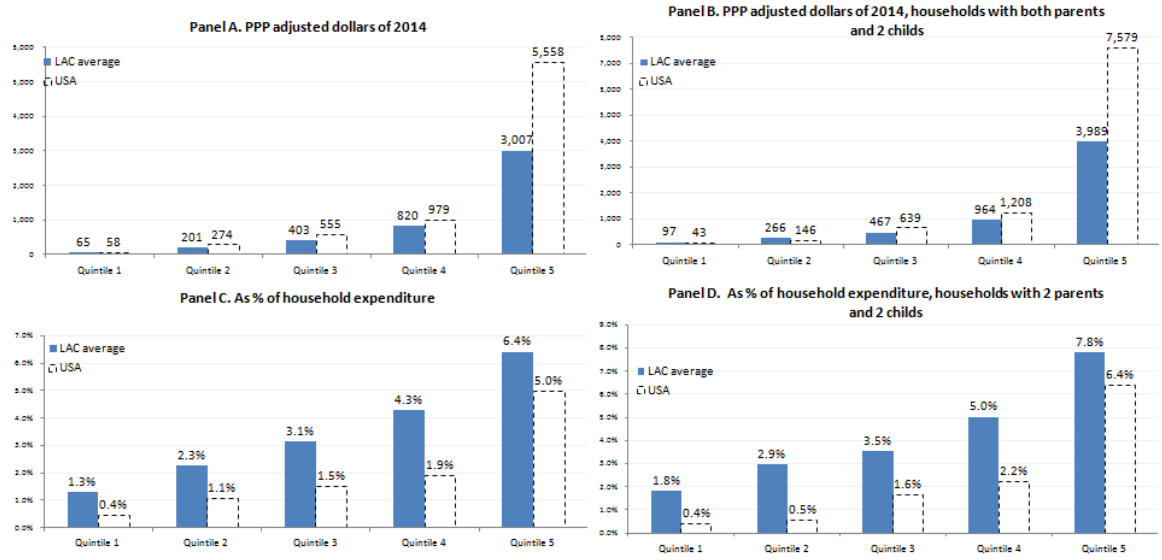
Note 1: For all countries but Brazil, enrollment and public spending data are from WDI. The WDI reports private and public enrollment up to secondary education. For tertiary education, it reports total enrollment. Our micro data include the percentage of tertiary education students in public and private institutions. We estimate public enrollment in tertiary education applying the ratio of our surveys to the WDI data on total tertiary enrollment.
Note 2: Public expenditures data used for this exercise for Bolivia, Ecuador, Mexico, Panama and Paraguay are from years 2003, 2012, 2011, 2008 and 2010, respectively. For Uruguay, data are constructed using the average public expenditure for 2005-2006. Finally, for Brazil the data are constructed using the public expenditure average of 2008-2009
Note 3: For Brazil, the data source for enrollment is the INEP, while the source for public expenditures is WDI as in the rest of the countries.

3.3 Educational Spending by Total Expenditure Level

It is natural to think that the rich spend more in education in absolute levels, but whether they spend a larger proportion of their budget on education is less obvious. Figure 3 shows that the differences between the rich and the poor are at both the absolute and relative levels. Those at the top quintile of expenditure annually $3,007 in education, compared to $403 for the median group and $65 for the poorest quintile in LAC. The corresponding figures for the United States are $5,558, $555 and $58, respectively. This shows that the difference in educational spending between LAC and the United States is most pronounced among higher-income families. Restricting our comparison to two-parent, two-child households we find quantitatively similar differences between expenditure groups. This result, presented here in averages, is also found in every one of the countries analyzed (see Appendix Figure A2).

If the expenditure elasticity of education is 1, this implies that an increase of *x* percent in total expenditure translates into an increase of *x* percent in educational expenditure. If this is the case, the ratio of educational expenditure to total expenditure would be constant. Therefore, our evidence (panels B and D) suggests that expenditure elasticity is above 1 and education responds like a luxury good. This is formally tested in the next section.

Figure 3. Average household educational expenses by expenditure quintile



3.4 Educational Spending by Number of Children

The household education production function is likely to have economies of scale. Private schools offer tuition discounts for families with more than one child in school, and some materials and clothing can be passed from an older sibling to a younger one. Figure 4 reports that, while households in LAC with on child spend on average $754, households with two children spend $675 per child (1,353$/2) and those with three children spend $468 ($1,405/3). Thus, while the number of children increases, expenditure per child decreases, consistent with economies of scale.[5] The same happens in the United States. Families with one child spend $2,274 per child, families with two children spend on average $1,846 per child and those with three children spend $1,682.

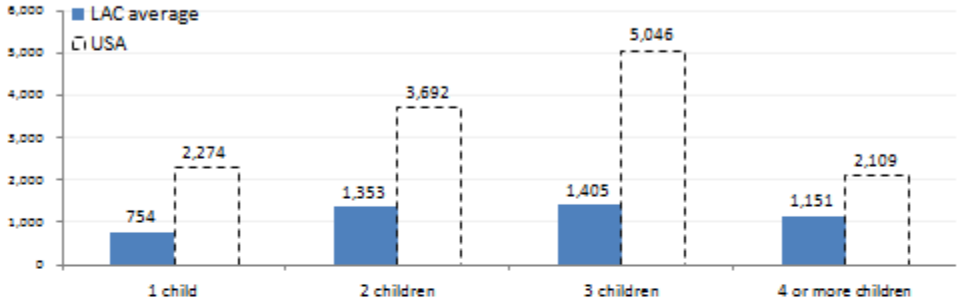
[5] In Appendix Figures A4 and A5 we present these statistics at the country level.

Note, however, that in both LAC and the United States the total educational spending of households of four and more children households is $1,151, lower than the total household educational spending of households with two or three children. This suggests that there must be something else going on and that the differences cannot be completely attributed to economies of scale. First, fecundity rates are endogenous. On theoretical grounds, a rational couple may decide to have more children if they have the material means to properly provide for them. Second, contrary to the rational previous argument, empirically, poorer families tend to have more children. This could produce the type of result presented in panels A and B of Figure 4 just because those with more children are simply poorer than those with smaller families and they spend less. Indeed, note that for LAC the $1,151 educational spending of households of four and more children represents 4.2 percent of their budget, implying an average total spending of $27,405. The implied budget for those with three children is $28,673.

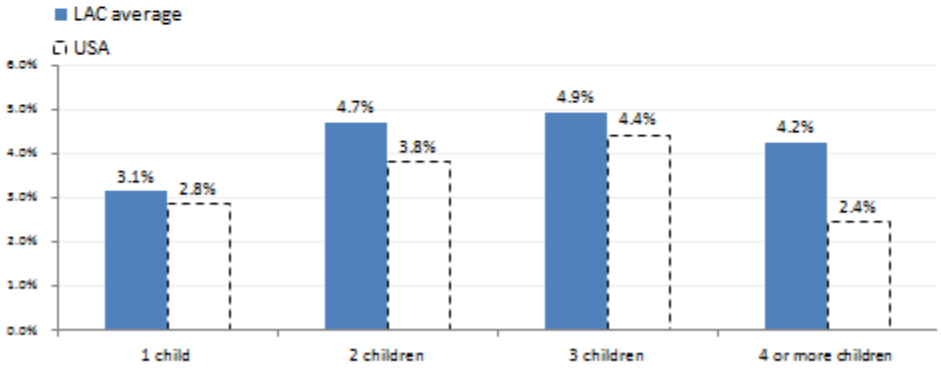
In Appendix Figure A4 we report educational spending by number of children and quintile groups. Although this is an initial control to address the endogeneity of the fecundity rate, there are still sizeable differences in budgets within quintiles that are correlated with the number of children. It is interesting that once the exercise of the previous paragraph is repeated for each quintile, we see this pattern is mostly due to the fourth and fifth quintile groups. Thus, the reported graphical evidence of economies of scale is mixed. In the next section we test this formally.

Figure 4. Average household educational expenses by number of children in the household

Panel A. PPP adjusted dollars of 2011



Panel B. As % of household expenditure



3.5 Educational Spending by Other Socio-Demographic Characteristics

In this section, we analyze further characteristics that may be important for understanding differences in educational spending. Table 4 presents average spending for LAC and the United States in various dimensions.

On average, in both LAC and the United States households in urban areas spend more in absolute and relative terms in education (see Appendix Table A4 for results by country). A part of this may be associated with the higher income of inhabitants of urban areas, but it is also a matter of income allocation since the difference is present in relative terms as well. Private schools are an almost exclusively urban phenomenon, and spending in private institutions is one of the main forms of household spending in education.

Considering the gender of the main income provider shows an interesting pattern. In LAC, households where the main income provider is a female spend more in education, both in absolute and relative terms, than households where the main income provider is a male. In the United, male main income providers spend more on education, but as a share of their total consumption they are largely similar (2.6 percent vs. 2.1 percent). See Appendix Table A5 for results by country.

Family structure also affects total spending and allocation within households. Females-solo households tend to be poorer than male-solo and two-parent households. In LAC, households with both parents spend about 1.5 times more in absolute terms than only-female households and only-male households. In the United States, two-parent households spend four times as much in education as single-father households and about 2.5 times as much as single-mother families (see Appendix Table A6 for results by country).

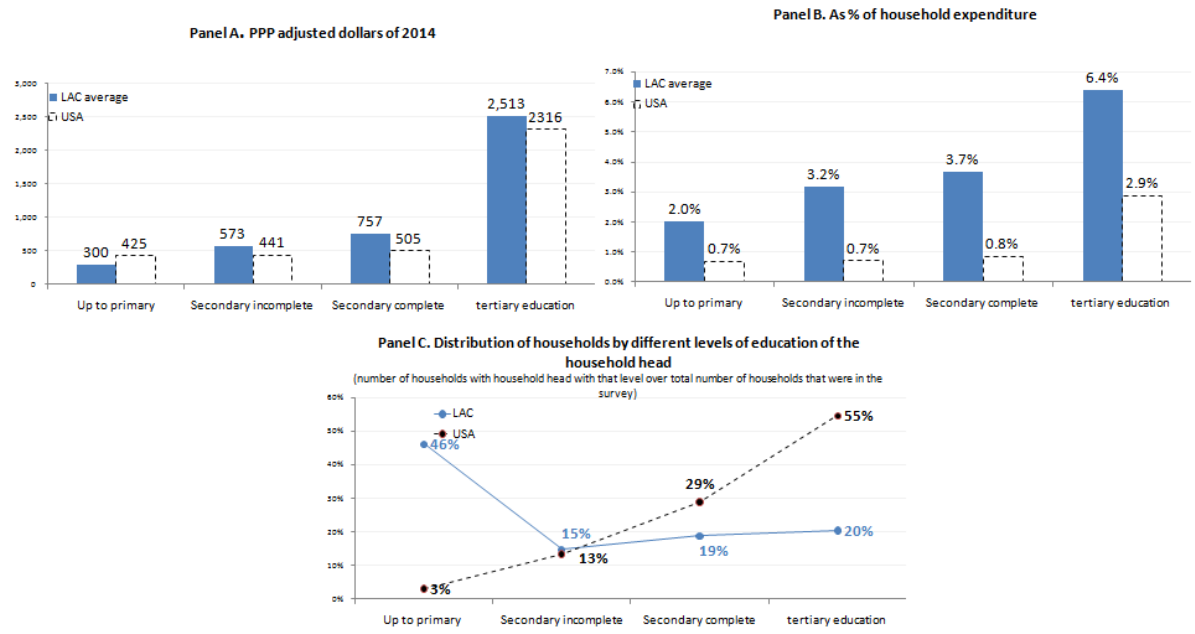
Finally, panels A and B of Figure 4 show a positive correlation between educational spending and education of the household head in both LAC and the United States (Appendix Figure A5 show this pattern by country). The average spending for most educational levels in the United States is below the LAC average. In principle this seems puzzling, given that average U.S. spending is higher than average LAC spending in education. Panel C explains why this happens. Although those with tertiary education in the USA spend less than those in LAC, they represent a much larger proportion of the population, and average national spending is a weighted average of the average spending of each group. In LAC household heads with lower

education represent a substantially larger proportion of the population and therefore are weighted more in the regional average.

Table 4. Annual average of educational expenses by other socio-demographic characteristics of the households				
	LAC		USA	
Characteristics	PPP adjusted 2014 dollars	As % of household expenditure	PPP adjusted 2014 dollars	As % of household expenditure
Urban areas	962	3.7%	1560	2.0%
Rural areas	231	1.7%	729	1.2%
Female Main Income Provider	1253	4.3%	1817	2.1%
Male Main Income Provider	1061	3.7%	2626	2.6%
Families with both parents	1211	4.2%	3940	3.8%
Families with Only the father	838	3.2%	864	2.0%
Families with Only the Mother	862	4.2%	1563	2.6%

Note: Main income providers are calculated using only families with both parents. Family structure data are calculated using only families with children.

Figure 5. Average household educational expenses by educational level of household head



3.6 Life Cycle

Human capital theory specifies differences in educational investment over the life cycle. Ideally, to obtain an estimation of this sort it would be necessary to use panel data to follow the same sets of households over time. As such data do not exist for LAC; an alternative could be the use of cross-section data and computing differences in education spending by age at one point in time. Unfortunately, there are also problems with this approach. In almost all countries, spending is reported at the household level. Therefore, it is not possible to know which household member is being spent on and therefore to compute average spending by age. The exception is the Peruvian survey, which specifies the household member for whom the most important forms of direct spending in education occur.

In this section we follow an assignment procedure and test it using Peruvian survey data. The assignment is based on three facts that we know for all countries, with the exception of Panama: i) the age of each household member, ii) whether each family member attends an educational institution and iii) whether household direct spending was in initial pre-primary school, primary school, secondary school or tertiary education.

The first step of our procedure is to equally divide the education spending at each educational level into the household members of the corresponding age that attend an educational institution. The second step is to consider other direct educational spending and equally divide by all household members. The third step is to consider other indirect educational expenses and divide this into five categories: clothing, materials, food, housing and others. The first four categories are equally divided among the members of the household that attend an educational institution, regardless of their age. The last category (others within indirect spending) is equally divided among all household members, regardless of whether they attend an educational institution.

The data for Peru are useful for providing idea of how well this procedure replicates spending over the life cycle. We compute average spending in Peru using actual spending on each household member, and we also implement the assignment method (assuming we do not know to whom it refers).

Panels A and B (PPP-adjusted dollars and percentage of total spending, respectively) of Figure 6 suggest the assignment is reasonably accurate. We therefore proceed to report (Panels C and D) the average results for LAC. Consistent with Table 2, we find that in PPP terms the

largest spending is for students 18-23 years old (about 9 percent larger than for those of secondary school age). Moreover, households with older children tend to have older parents with higher income and total expenditure. As a result, in percentage terms spending on children in primary, secondary and tertiary age represents a similar share of total household spending (1.8 percent, 1.9 percent and 1.9 percent, respectively). In both PPP and percentage terms, average spending shows a clearly defined inverted-U shape.

In Appendix Figures A6 we present results by country. Although the inverted-U shape is a common characteristic of all countries, the years of maximum educational investment vary within the region. In fact, in terms of PPP-adjusted dollars Bahamas, Bolivia, Brazil Nicaragua, Paraguay and Peru are the countries that clearly present a maximum at tertiary-age education.

Panels A to F of Figure 7 present life cycle averages by three household classifications. Households with only one parent invest less in the early stages of education but more in university age; this is probably due to individuals living alone**.** Households where the main income provider is a female invest more in education in both absolute and relative terms, and the magnitude of the difference is economically significant. Finally, as expected there are important differences in educational spending between poor and rich households. Nevertheless, we show that the inverted-U shape is common to all expenditure quintiles.

Figure 6. Average individual educational expenses by age

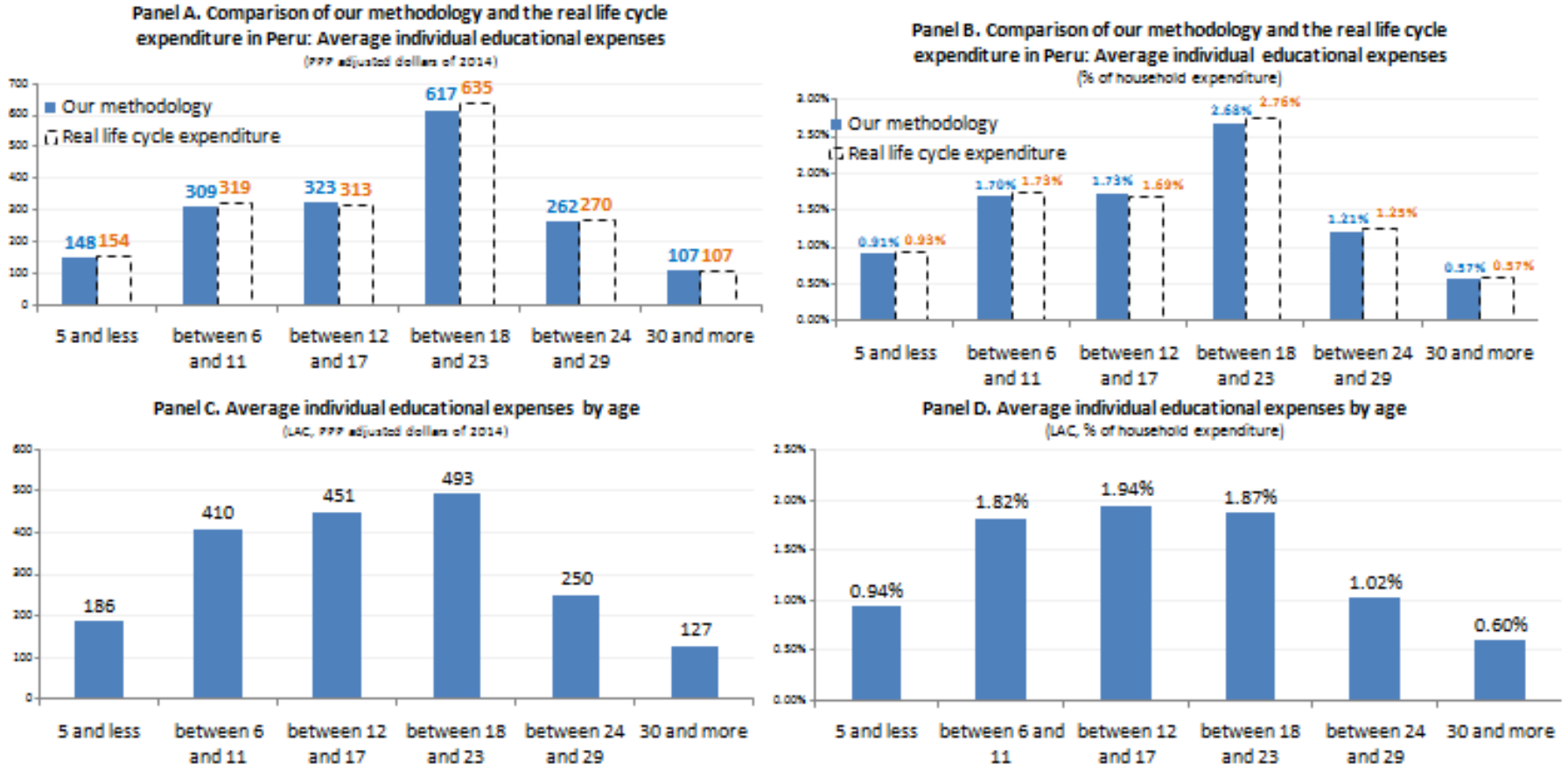
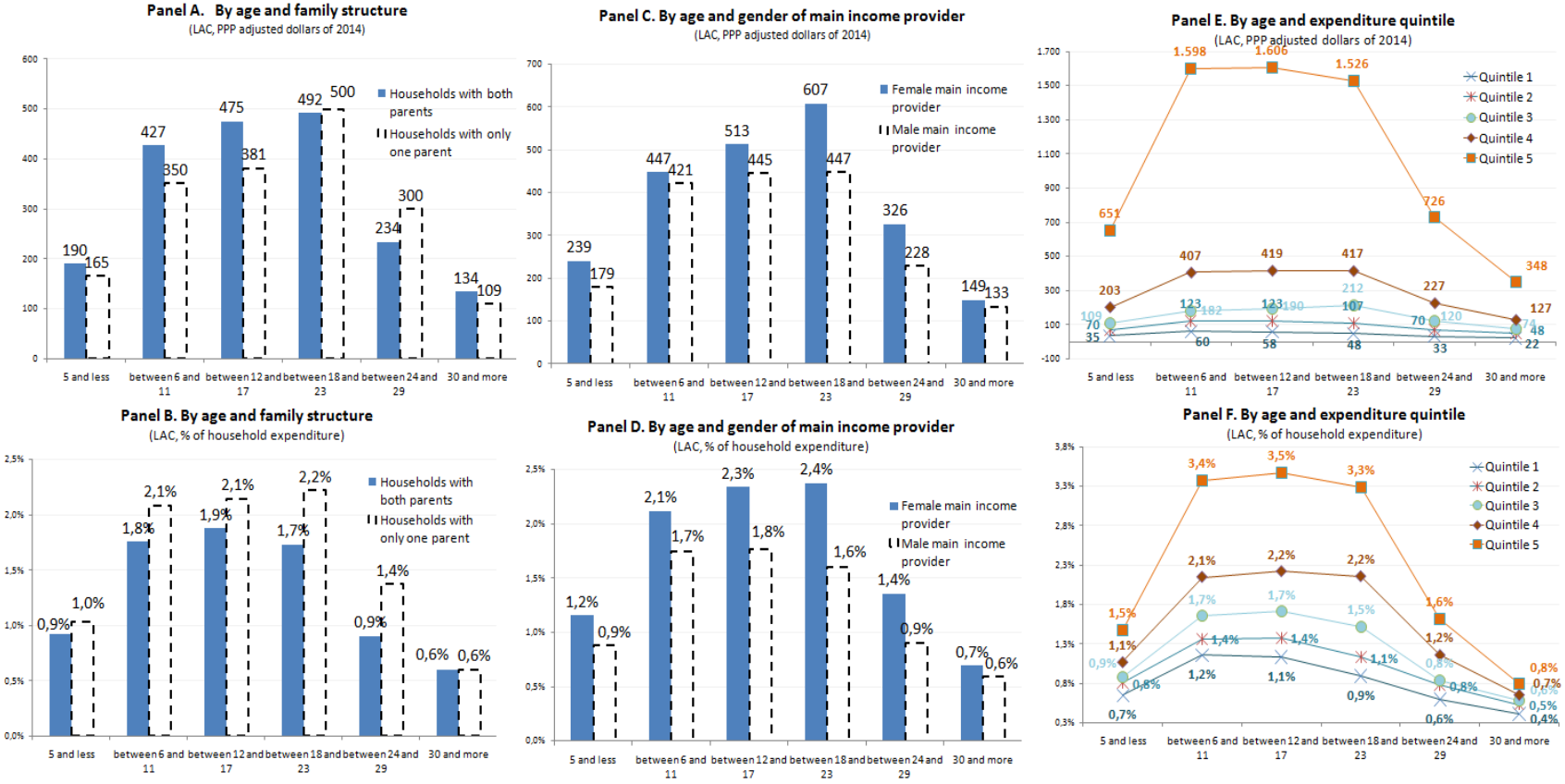


Figure 7. Average individual educational expenses by age



4 Engel Curves

4.1 Methodology

Estimations of Engel curves for several goods and services have been intensively performed in microeconomic applied research since Working (1943) and Leser (1963) uncovered the stability of the relationship between the expenditure share of food consumption and the logarithm of income. Later research has allowed functional forms beyond the linear specification that allowed for more curvature than the Working-Leser model. The basic analysis of Engel curves starts from the definition of relatively homogeneous demographic groups to which various estimations techniques can be applied (e.g., kernel regressions, point wise confidence intervals). See Blundell (1998) for a nice review of the development of the literature on consumer demand and household intertemporal allocation.

The standard Working-Leser specification is:

$$w_i = \alpha + \beta ln\left(\frac{x_i}{n_i}\right) + \gamma lnn_i + \varphi z_i + \mu_i \qquad (1)$$

where w_i is the budget share of education of the i[th] household, x_i is the total expenditure of the household, n_i is the household size z_i is a vector of other household socio-demographic characteristics as education and gender of the household head and dummies for urban or rural residence. μ_i is the error term.

The expenditure elasticity of educational spending is $= 1 + \frac{\beta}{w_i}$. This functional form allows the elasticity to vary by the share of educational expenditure but does not allow the good to be a necessity ($\beta < 0$) for some and a luxury ($\beta > 0$)for others.

To address scale effects we can estimate how expenditure is affected by changes in household size. If the age and gender composition of the household remain constant, the household size expenditure elasticity is $\frac{\gamma}{w_i}$. Valuating this expression at the mean education budget share provides an estimate of scale effects. If this figure is below 1 it means that a certain proportional increase in household size increases educational spending by a lower proportion. This would provide evidence of economies of scale.

Equation (1) can be expanded to include age-gender household controls

$$w_i = \alpha + \beta ln\left(\frac{x_i}{n_i}\right) + \gamma lnn_i + \sum \theta_k \left(\frac{n_{ki}}{n_i}\right) + \varphi z_i + \mu_i \qquad (2)$$

where $\frac{n_{ki}}{n_i}$ is the fraction of the household members in the k^{th} age-gender class. We define the fraction terms, $\left(\frac{n_{ki}}{n_i}\right)$, for age groups that correspond to primary education (5-11 years old), secondary education (12-17) and tertiary education (18-23). In addition to the age groups we will include the fractions between age (24-29) and (30 and more). For LAC, these dummies are defined separately for males and females. The omitted category is the female oldest. These θ_k coefficients report the effect of changing household composition conditional on household size (n_i). Differences across gender can be tested comparing for each age bracket θ_{kf} and θ_{km} where f stands for females and m for males. This is an indirect way of testing for gender discrimination in educational spending, i.e., we try to detect gender biases in education spending testing how the presence of children of similar age but different sex affects household spending in education. Since the PSID survey does not present a gender variable for each member of the household this extension is only estimated for LAC.

In the older literature, the first estimations of Engel equations were performed for food expenditure simply using OLS. For other types of expenditure, like education, there is the problem of a substantial number of zero expenditure entries. The traditional solution for this censoring problem is the estimation of a Tobit model

A concern is that missed measurement of individual goods is accumulated into total spending, inducing correlation between the measurement error captured in the residual and observed total expenditure. As in Aguiar and Bils (2015), we instrument total expenditure with income and report instrumental variables Tobit regressions. Also following Aguiar and Bils we restrict the Engel equation estimations to urban households whose household head is between 25 and 64 years old, and we trim households in the bottom and top 5 percent of total household expenditures.

4.2 Econometric Results

Table 5 presents the regressions for LAC and the United States. Per capita expenditure presents a positive and significant coefficient only in LAC. The fact that the natural logarithm of per capita expenditure is not significantly different from 0 for the United States implies that we cannot reject the null hypothesis of educational elasticity equal to 1 (as elasticity is defined as $\varepsilon = 1 + \frac{\beta}{w_i}$, if β shows no significance this implies that we cannot reject $\beta = 0$, then we cannot reject

$\varepsilon = 1$). The coefficient of age turns out to be negative and statistically significant for LAC and the United. Additionally, in LAC education variables show significant and expected values. The omitted educational category corresponds to household heads whose maximum educational level is primary school. Tertiary-educated household heads allocate a statistically significant higher share of their budgets (not only absolute levels) to the educational spending of household members. The natural logarithm of the number of members on the household shows significance and positive intercepts in both specifications. In order to address the existence of economies of scale this coefficient should be compared with the share of expenditure on education. The estimated coefficient of the log of household members is about 10 percent for LAC. This figure is larger than the average educational share for the region. This implies that the household size expenditure elasticity is above 1. The same happens for the United States. This evidence is against economies of scale. Female-headed households do not have a statistically significant different share of educational spending in the United States. The dummy of households with both parents is negative and significant for LAC.

Table 5. Engel Curves
(Instrumental Variables Tobit regressions)

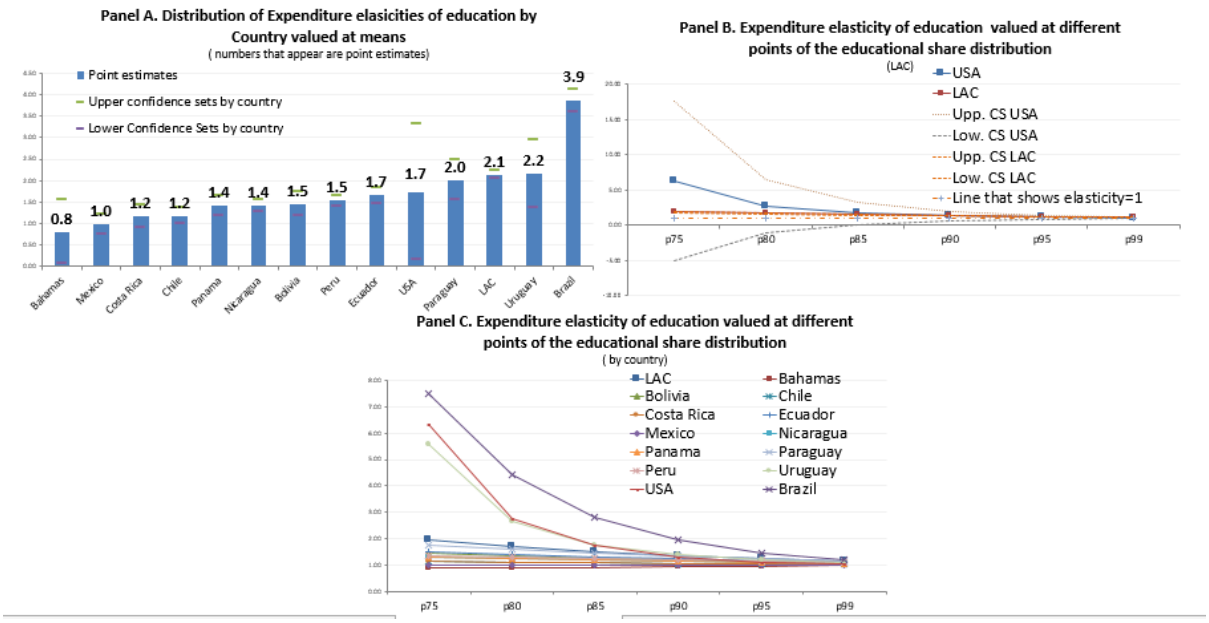
	LAC	USA
Per capita expenditure (in logs)	0.04587***	0.01411
	(0.00186)	(0.01536)
Age of the household head	-0.00064***	-0.00153***
	(0.00007)	(0.00038)
Female household head	0.00823***	0.02029
	(0.00218)	(0.01567)
Household head education=secondary incomplete	0.02396***	-0.03457
	(0.00256)	(0.02203)
Household head education=secondary complete	0.01679***	-0.00456
	(0.00195)	(0.02065)
Household head education=tertiary	0.04449***	0.06425***
	(0.00273)	(0.02153)
Dummy for family with both parents	-0.01067***	-0.00721
	(0.00243)	(0.01518)
Household members (in logs)	0.10426***	0.11493***
	(0.00244)	(0.01421)
Constant	-0.42485***	-0.30140***
	(0.01308)	(0.11521)
Observations	113,229	6,172

Note: The instrument for per capita consumption is per capita income. Robust standard errors in parentheses. *** statistically significant at 1%, ** statistically significant at 5%, * statistically significant at 10%

Panel A of Figure 8 presents the expenditure elasticities valued at the mean of the educational share. In the estimations using all LAC countries we find an expenditure elasticity of 2.1. At the country level, in LAC the point estimates of the elasticities valued at the means of the educational expenditure share range from 0.8 (Bahamas) to 3.9 (Brazil). The estimated expenditure elasticity for the United States is 1.7. Using CES, Aguiar and Bils (2015) report an elasticity for the United States of 1.63 or 1.88 depending on the subsamples used.

Nevertheless, taking into account the confidence interval we cannot reject the null hypothesis of elasticities of 1 or below for Bahamas, Chile, Costa Rica and the United States. In those countries education behaves like a necessity good. The rest of the LAC countries have consistently and statistically significant elasticities above 1, suggesting educational expenditure is a luxury.

Figure 8. Expenditure Elasticities at different points of the distribution



Panel B of Figure 8 uses the same regressions but evaluates the elasticity at different points of the educational expenditure distribution. As expected, it shows a decreasing pattern that converges to 1 (elasticity equal to 1 is represented by the orange dotted line). More interestingly, the confidence intervals show that differences over the educational share distribution are statistically significant for LAC. Panel B shows that when we move towards richer households educational expenses are less luxurious. Panel C reports the same pattern by countries.

Estimation for all countries and all points of the distributions are above 1 (taking into account the confidence sets), with the previously mentioned exceptions of Bahamas, Chile, Costa Rica, Mexico and the United States. At all points of the expenditure distribution for these countries we cannot reject that the elasticity equals 1. Appendix Table A7 shows the disaggregation by country used to construct the figure of panel C.

Table 6 presents t-test of differences in the gender coefficients for groups of age based on equation (2). We find no evidence of differences for younger household members. When looking at the ranges of 12 years old and more we can see that the estimated coefficients of the share of females are statistically larger than the coefficients for males of the same age group. This suggests that LAC households spend more in the secondary and tertiary education of their females than of their males. This evidence shows a completely different pattern than that reported by Kindgom (2005) for India and Aslam and Kingdon (2008) for Pakistan. The gender estimation by country can be found in Appendix Table A8.

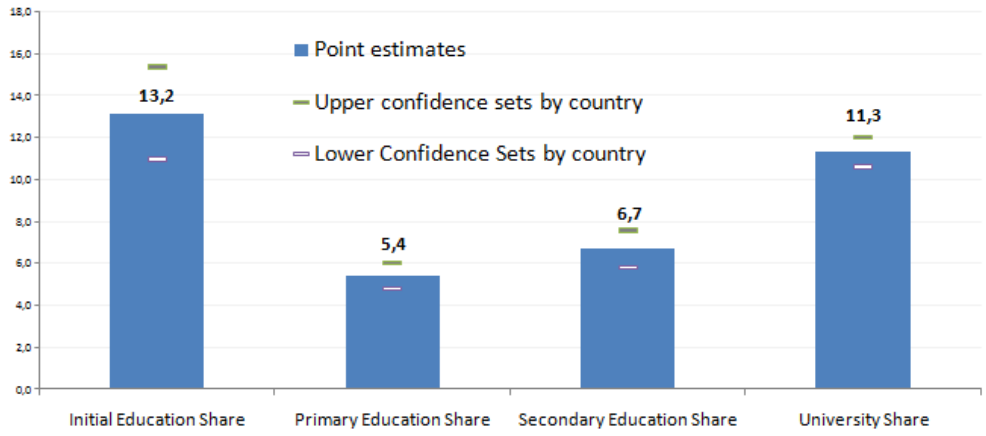
Table 6. Gender differences in educational allocation (LAC)

	Coefficients (standard errors in brackets)		Difference between coefficients (Male-Female)	Chi Squared statistic
	Male	Female		
less than 6 years old	0.025	0.027	-0.002	0.03
	(0.010)	(0.009)		
between 6 and 11	0.119	0.125	-0.006	0.52
	(0.009)	(0.009)		
between 12 and 17	0.108	0.126	-0.018	5.50**
	(0.008)	(0.008)		
between 18 and 23	0.073	0.097	-0.024	6.140**
	(0.009)	(0.008)		
between 24 and 29	-0.028	0.029	-0.057	30.89***
	(0.008)	(0.007)		
more than 29 years old	-0.038	-	-0.038	30.43***
	(0.007)	-		

*** statistically significant at 1%, ** statistically significant at 5%, * statistically significant at 10%

Finally, Figure 9 repeats the estimation of equation (1) but for the share of initial, primary, secondary and tertiary educational expenses.[6] This is only computed for countries (all but Panama and the United States) where we can decompose educational expenses among different kind of estimations. We can consistently see, as intuition would suggest, that initial education expenses tend to be more luxurious than other kinds of educational expenses. We can see a U-shape curve in the luxurious condition of educational expenses. This way, the less luxurious kind of spending is primary education, and university and initial education are the more luxurious.

Figure 9. Expenditure elasticity of education for different kind of educational expenses
(LAC)



5 Conclusions

In this paper, we characterized private spending in education in 12 LAC countries. We also report similar statistics for the United States as a benchmark economy and present detailed stylized facts. The region shows a heterogeneous picture, with some countries displaying relatively high average annual private spending and others displaying very low spending in education in terms of both absolute levels and in relation to total expenditure. Average household spending in education in the USA is $1,539, almost twice the LAC level of $883. Nevertheless,

[6] Due to convergence problems these estimations are performed using a Tobit model without instrumenting expenditure with income.

this figures implies an average budget allocation to education of 2 percent for the United States and a higher share of 3.4 percent for LAC. Bahamas, Chile and Mexico have in relative terms the largest household investments in education (4.6 percent, 5.2 percent and 6.4 percent, respectively, of the household consumption budget). Bolivia, Brazil and Paraguay have the lowest investment ($471, $508 and $634 PPP-adjusted dollars per year).

More educated and richer household heads spend more in household education in both absolute levels and as percentage of total household consumption. This result contributes to perpetuating educational differences over time.

Educational spending is highly unequal. The country Gini estimates of educational spending are about two times the Gini estimates for total expenditure. While the median household in most countries has almost insignificant spending in education, we show that public spending has the potential to balance some of this inequality. In our estimates including public education we report a reduction of the Gini in education spending (whether private or publicly financed) of a high magnitude.

We find that tertiary education is the most important form of spending, accounting for about a third of average household educational spending. Consistently, over the life cycle most educational spending is performed for individuals 18-23 years of age. We report a clear inverted-U pattern of household investment in LAC across age brackets.

The gender of the main income provider also has an effect on household allocation decisions. Households whose main income provider is a female spend more than households with a male main income provider. Family composition also has an impact on budget allocations. Two-parent households spend more than only parent households in absolute terms. Nevertheless, single mothers spend about the same ratio as two-parent households, as females seem to be more sensitive to family education issues than males. Finally, urban households spend more in education than rural households.

We estimate Engel equations and find that the education expenditure elasticity (valuated at the mean of educational spending) is above 1 for 8 out of the 12 LAC countries and in the estimations for LAC as a whole. We cannot reject the null of unitary elasticity in Bahamas, Chile, Costa Rica, Mexico and the United States. Thus, on average education in LAC is a luxury good while we cannot reject that it is a necessity in the United States.

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Appendix. Table A1. Data

	Years	Observations (households)	Survey	Source
Bahamas	2013	1544	Bahamas Household Expenditure Survey	Department of Statistics, Ministry of Finance
Bolivia	2003-2004	9.149	Encuesta Continua de los Hogares	Instituto Nacional de Estadística
Brazil	2008-2009	55.702	Pesquisa de Orçamentos Familiares	Instituto Brasileiro de Geografia e Estatística
Chile	2011-2012	10.518	VII Encuesta de Presupuestos Familiares	Instituto Nacional de Estadísticas
Costa Rica	2013	5.705	Encuesta Nacional de Ingresos y Gastos de los Hogares	Instituto Nacional de Estadística y Censos
Ecuador	2011-2012	39.617	Encuesta Nacional de Ingresos y Gastos de los Hogares Urbanos	Instituto Nacional de Estadística y Censos
Mexico	2014	19.479	Encuesta Nacional de Ingresos y Gastos de los Hogares	Instituto Nacional de Estadística y Geografía
Nicaragua	2006-2007	6.912		
Panama	2007-2008	8.895	Encuesta Ingresos y Gastos de los Hogares	Banco Central de Nicaragua
Paraguay	2011-2012	5.417	Encuesta de Ingresos y Gastos de los Hogares Encuesta de Ingresos y Gastos y de Condiciones de Vida	Instituto Nacional de Estadística y Censo Dirección General de Estadísticas, Encuestas y Censos
Peru	2008-2009	35.161	Encuesta Nacional de Presupuestos Familiares	Instituto Nacional de Estadística e Informática
USA	2013	9064	Panel Study of Income Dynamics	Institute of Social Research
Uruguay	2005-2006	7.043	Encuesta Nacional de Gastos e Ingresos de los Hogares	Instituto Nacional de Estadística

Table A2. Disaggregation of household other indirect expenses

	Total "Other Indirect Spending"	Clothes	Materials	Housing	Food	Others
			(in PPP adjusted annual dollars of 2014)			
Bahamas	677	138	136	-	162	241
Bolivia	137	20	102	-	-	15
Brazil	52	5	26	1	0	20
Chile	118	41	9	-	-	68
Costa Rica	199	34	76	-	0	89
Ecuador	280	67	145	-	8	61
Mexico	174	-	85	14	-	75
Nicaragua	-	-	-	-	-	-
Panama	-	-	-	-	-	-
Paraguay	91	59	3	-	-	28
Peru	89	39	23	0	4	24
Uruguay	72	7	48	2	-	15
			(% of total household expenditure)			
Bahamas	1.6%	0.4%	0.3%	-	0.4%	0.4%
Bolivia	1.8%	0.2%	1.4%	-	-	0.1%
Brazil	0.2%	0.0%	0.1%	0.0%	0.0%	0.1%
Chile	0.5%	0.2%	0.0%	-	-	0.3%
Costa Rica	0.7%	0.1%	0.3%	-	0.0%	0.3%
Ecuador	1.7%	0.4%	1.0%	-	0.0%	0.3%
Mexico	1.1%	-	0.5%	0.0%	-	0.5%
Nicaragua	-	-	-	-	-	-
Panama	-	-	-	-	-	-
Paraguay	0.4%	0.3%	0.0%	-	-	0.1%
Peru	0.7%	0.4%	0.1%	0.0%	0.0%	0.1%
Uruguay	0.4%	0.0%	0.3%	0.0%	-	0.1%

Table A3. Expenditures as a percentage of GDP of the period of the survey										
	Government	pre primary	primary	secondary	tertiary	**Families expenditure in education**	pre primary	primary	secondary	tertiary
Bahamas	-	-	-	-	-	*3,2%*	*0,3%*	*0,4%*	*0,4%*	*1,1%*
Bolivia	*6,4%*	0,2%	2,8%	1,6%	1,4%	*2,6%*	*0,1%*	*0,5%*	*0,3%*	*0,9%*
Brazil	*5,3%*	0,4%	1,7%	2,4%	0,8%	*1,3%*	*0,1%*	*0,2%*	*0,1%*	*0,5%*
Chile	*3,9%*	0,6%	1,4%	1,4%	0,6%	*2,0%*	*0,1%*	*0,4%*	*0,2%*	*1,1%*
Costa Rica	*4,5%*	0,3%	2,1%	1,0%	1,0%	*3,6%*	*0,3%*	*0,6%*	*0,5%*	*1,3%*
Ecuador	*4,2%*	0,2%	1,1%	1,7%	1,1%	*2,4%*	*0,1%*	*0,3%*	*0,4%*	*0,6%*
Mexico	*4,9%*	0,5%	1,8%	1,5%	0,8%	*1,9%*	*0,1%*	*0,4%*	*0,5%*	*0,5%*
Nicaragua	*4,4%*	0,0%	1,3%	0,2%	1,1%	*1,5%*	-	*0,3%*	*0,3%*	*0,7%*
Panama	*3,3%*	0,1%	1,6%	1,1%	0,7%	*1,1%*	-	-	-	-
Paraguay	*4,9%*	0,3%	1,7%	1,6%	1,4%	*2,2%*	*0,1%*	*0,3%*	*0,2%*	*0,9%*
Peru	*3,0%*	0,3%	1,2%	1,0%	0,4%	*2,4%*	*0,1%*	*0,3%*	*0,3%*	*1,1%*
Uruguay	*2,8%*	0,2%	0,9%	1,0%	0,6%	*1,6%*	*0,1%*	*0,3%*	*0,4%*	*0,2%*
U.S.A.	*4,5%*	0,3%	1,5%	1,7%	0,9%	0,0%	-	-	-	-
LAC average	***4,4%***	0,3%	1,5%	1,6%	0,8%	***1,9%***	0,1%	0,3%	0,3%	0,7%

Note: In some countries the years for the statistics of public spending (source: WDI) and private spending (authors' estimations based on income and expenditure surveys of Table A1) do not coincide. They are: Bolivia (2003 public and private 2003-2004), Costa Rica (2004 public spending in primary, the rest of public spending is from 2007 and private spending is from 2013), Mexico (2011 public spending and 2014 private), Nicaragua (2010 for total public spending and tertiary public spending, 2005 for the rest of public spending and 2006-2007 for private spending), Panama (2008 for total public spending, 2011 for total tertiary public spending, 2007 for the rest of public spending and 2007-2008 for private spending) and the United States (2011 for public spending and 2013 for private spending). The rest of the figures are from the year(s) of the surveys.

Table A4. Annual average of educational expenses by area of residence						
	2014 PPP adjusted dollars		% of household expenditure		Number of cases	
	Urban areas	Rural areas	Urban areas	Rural areas	Urban areas	Rural areas
Bahamas	2695	1673	5.1%	3.6%	974	570
Bolivia	683	133	3.9%	2.5%	7213	1922
Brazil	582	102	1.8%	0.6%	43050	13041
Chile	-	-	-	-	-	-
Costa Rica	1526	541	3.1%	2.1%	3764	1941
Ecuador	1245	353	4.9%	2.4%	29303	10314
Mexico	1300	402	5.6%	3.6%	14228	5251
Nicaragua	-	-	-	-	-	-
Panama	-	-	-	-	-	-
Paraguay	852	293	2.8%	1.4%	3231	1845
Peru	1113	105	5.0%	1.4%	33952	1209
Uruguay	310	253	1.4%	0.9%	2789	1162
United States	1560	729	2.0%	1.2%	8775	237
LAC Average	962	231	3.7%	1.7%		

Note: In Chile, Nicaragua and Panama all households in the surveys are urban.

Table A5. Educational expenses by gender of the main income provider

	Annually In PPP adjusted 2014 dollars		As % of household expenditure		Number of cases	
	Female	Male	Female	Male	Female	Male
Bahamas	3132	3640	5.0%	5.5%	276	427
Bolivia	670	459	4.2%	3.1%	940	4891
Brazil	863	567	2.4%	1.7%	6419	27982
Chile	2931	2949	7.2%	7.0%	1062	3909
Costa Rica	2196	1425	4.0%	2.9%	621	2980
Ecuador	1030	1150	4.2%	4.5%	13122	13438
Mexico	1224	1286	5.7%	5.7%	2618	10831
Nicaragua	831	970	2.9%	2.9%	899	3156
Panama	1506	1218	3.7%	3.2%	1096	4172
Paraguay	649	751	2.4%	2.4%	872	2136
Peru	1691	1124	6.6%	4.8%	3972	12512
Uruguay	1140	772	3.4%	2.2%	875	3442
United States	1817	2626	2.1%	2.6%	1659	3048
LAC Average	1,253	1,061	4.3%	3.7%		

Note: Only for two-parent families.

Table A6. Educational expenses by type of family structure									
	Annually in PPP adjusted 2014 dollars			As % of household expenditure			Number of cases		
	Both parents	Only Father	Only Mother	Both parents	Only Father	Only Mother	Both parents	Only Father	Only Mother
Bahamas	4301	1592	2456	6.60%	4.20%	6.50%	534	67	395
Bolivia	545	460	570	3.60%	3.95%	4.23%	5144	319	1528
Brazil	686	693	433	1.96%	1.81%	1.91%	28906	1177	8286
Chile	3658	1784	1847	8.65%	6.11%	7.68%	3883	978	2343
Costa Rica	1837	962	938	3.62%	2.12%	3.15%	2840	104	1099
Ecuador	1246	879	993	4.98%	3.96%	5.24%	22362	1070	6346
Mexico	1519	1159	1041	6.77%	4.99%	6.22%	11124	463	2859
Nicaragua	1008	638	842	3.11%	2.46%	3.62%	3445	192	1858
Panama	1470	598	1330	3.71%	2.42%	4.22%	4224	234	1835
Paraguay	798	616	688	2.57%	1.99%	2.60%	2425	318	818
Peru	1088	871	938	4.87%	3.83%	5.12%	21221	1198	5997
Uruguay	1,159	188	726	3.28%	1.05%	2.95%	2829	9	63
EE.UU	3940	864	1563	3.8%	2.0%	2.6%	2821	211	1474
LAC Average	1,211	838	862	4.2%	3.2%	4.2%			

Note: Only households with at least one child.

Table A7. Expenditure elasticity of education valued at different points of the educational share distribution												
Percentiles	p75	p80	p85	p90	p95	p99	p75	p80	p85	p90	p95	p99
	Bahamas						Bolivia					
Point estimate	0.87	0.90	0.92	0.93	0.95	0.97	1.43	1.34	1.26	1.18	1.10	1.05
Lower Confidence set	0.38	0.52	0.60	0.67	0.75	0.87	1.16	1.13	1.10	1.07	1.04	1.02
Upper confidence set	1.36	1.28	1.23	1.19	1.15	1.08	1.69	1.56	1.43	1.29	1.17	1.08
p-value	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Brazil						Chile					
Point estimate	7.5	4.4	2.8	1.9	1.5	1.2	1.12	1.10	1.08	1.06	1.04	1.03
Lower Confidence set	6.9	4.1	2.6	1.9	1.4	1.2	1.00	1.00	1.00	1.00	1.00	1.00
Upper confidence set	8.1	4.7	3.0	2.0	1.5	1.2	1.25	1.20	1.15	1.12	1.09	1.06
p-value	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Costa Rica						Ecuador					
Point estimate	1.16	1.11	1.08	1.06	1.04	1.02	1.48	1.39	1.30	1.23	1.17	1.10
Lower Confidence set	0.92	0.95	0.96	0.97	0.98	0.99	1.34	1.27	1.22	1.17	1.12	1.07
Upper confidence set	1.40	1.27	1.20	1.14	1.09	1.05	1.62	1.50	1.39	1.30	1.21	1.13
p-value	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Mexico						Nicaragua					
Point estimate	0.99	0.99	0.99	0.99	1.00	1.00	1.31	1.24	1.19	1.15	1.10	1.06
Lower Confidence set	0.83	0.87	0.90	0.93	0.95	0.97	1.21	1.17	1.13	1.10	1.07	1.04
Upper confidence set	1.14	1.11	1.08	1.06	1.05	1.03	1.40	1.31	1.25	1.19	1.14	1.08
p-value	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Panama						Paraguay					
Point estimate	1.32	1.25	1.19	1.15	1.10	1.06	1.73	1.58	1.43	1.33	1.23	1.15
Lower Confidence set	1.15	1.11	1.09	1.07	1.05	1.03	1.39	1.31	1.23	1.17	1.12	1.08
Upper confidence set	1.49	1.38	1.30	1.23	1.16	1.09	2.07	1.84	1.63	1.48	1.33	1.22
p-value	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Peru						Uruguay					
Point estimate	1.37	1.29	1.23	1.18	1.14	1.09	5.59	2.66	1.75	1.40	1.19	1.07
Lower Confidence set	1.28	1.22	1.18	1.14	1.10	1.07	2.49	1.54	1.24	1.13	1.06	1.02
Upper confidence set	1.45	1.36	1.28	1.22	1.17	1.10	8.69	3.78	2.25	1.66	1.32	1.12
p-value	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	USA						LAC total					
Point estimate	6.33	2.76	1.75	1.31	1.12	1.04	1.93	1.68	1.50	1.36	1.24	1.14
Lower Confidence set	-5.04	-0.99	0.15	0.65	0.87	0.95	1.85	1.62	1.46	1.33	1.22	1.13
Upper confidence set	17.69	6.51	3.36	1.97	1.36	1.13	2.00	1.73	1.54	1.39	1.26	1.15
p-value	28%	15%	3%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table A8. Gender Differences in educational allocation by country

test of differences between male and female coefficients

	Coefficients			Coefficients			Coefficients		
	male	female	Chi Square	male	female	Chi Square	male	female	Chi Square
	Bahamas			Bolivia			Brazil		
less than 6 years old	0.176	0.176	0.00	-0.022	0.002	1.96	0.023	0.02	0.20
between 6 and 11	0.255	0.263	0.04	0.112	0.116	0.09	0.086	0.085	0.00
between 12 and 17	0.254	0.268	0.11	0.121	0.102	1.11	0.069	0.084	2.52
between 18 and 23	0.135	0.174	0.43	0.075	0.024	3.67*	0.041	0.068	4.78**
between 24 and 29	-0.041	0.116	5.63**	0.014	0.007	0.07	-0.018	0.027	14.07
more than 29 years old	-0.037	-	1.19	-0.008	-	0.19	-0.023	-	9.54***
	Chile			Costa Rica			Ecuador		
less than 6 years old	-0.005	0.012	0.50	-0.016	-0.006	0.15	0.049	0.021	5.82**
between 6 and 11	0.232	0.232	0.00	0.087	0.095	0.19	0.180	0.165	2.13
between 12 and 17	0.227	0.271	5.43**	0.087	0.091	0.06	0.132	0.158	5.19**
between 18 and 23	0.328	0.368	1.93	0.091	0.125	1.65	0.042	0.052	0.47
between 24 and 29	0.098	0.210	6.24**	-0.015	0.023	3.48*	-0.043	0.012	14.25***
more than 29 years old	-0.022	-	1.22	-0.031	-	3.81*	-0.031	-	9.05***
	Mexico			Nicaragua			Panama		
less than 6 years old	0.126	0.161	1.79	-0.032	-0.019	0.95	0.007	-0.02	3.75*
between 6 and 11	0.287	0.313	1.26	0.060	0.054	0.39	0.133	0.147	1.02
between 12 and 17	0.305	0.335	1.44	0.051	0.065	2.00	0.119	0.143	2.26
between 18 and 23	0.210	0.212	0.01	0.055	0.064	0.39	0.039	0.064	2.71
between 24 and 29	-0.055	0.01	3.78*	-0.02	0.024	5.92***	-0.027	0.025	10.33***
more than 29 years old	-0.080	-	15.29***	-0.055	-	32.04***	-0.017	-	2.55
	Paraguay			Peru			Uruguay		
less than 6 years old	-0.011	-0.046	4.38**	0.007	0.008	0.01	0.084	0.125	0.40
between 6 and 11	0.061	0.061	0.00	0.122	0.126	0.13	0.245	0.309	2.11
between 12 and 17	0.050	0.059	0.39	0.107	0.103	0.14	0.171	0.192	0.21
between 18 and 23	0.057	0.099	3.08*	0.112	0.144	4.24**	0.127	0.047	1.81
between 24 and 29	0.006	0.016	0.34	-0.030	0.041	20.92***	0.015	0.061	0.49
more than 29 years old	-0.021	-	3.23*	-0.063	-	37.77***	-0.047	-	2.57

*** statistically significant at 1%, ** statistically significant at 5%, * statistically significant at 10%.

Figure A1. "Standard" household Educational expenses by country
(educational expenses in kindergarden, primary, secondary and terciary school)

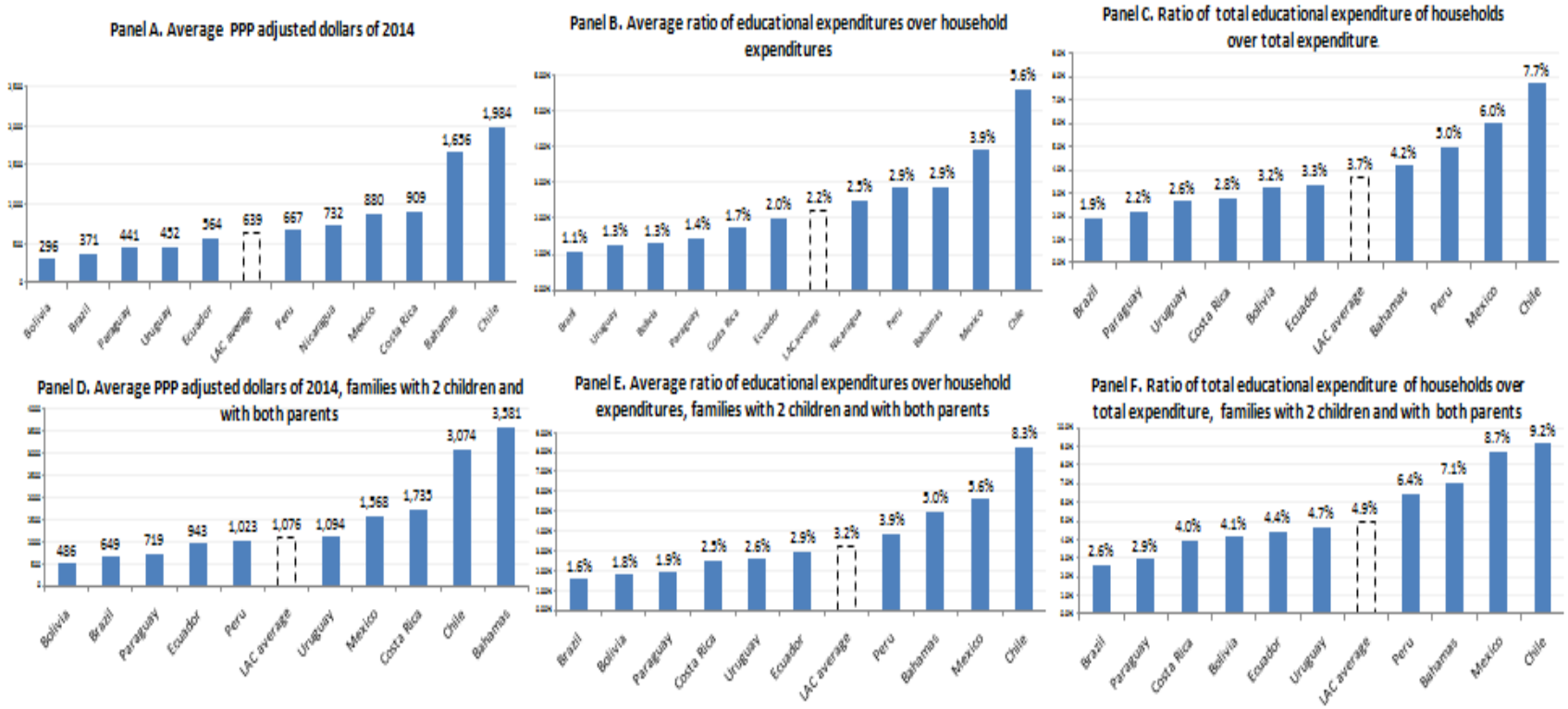

Figure A2. Average household educational expenses by expenditure quintile

PPP adjusted dollares of 2014 (columns, left axis); % of household expenditure (lines, right axis)

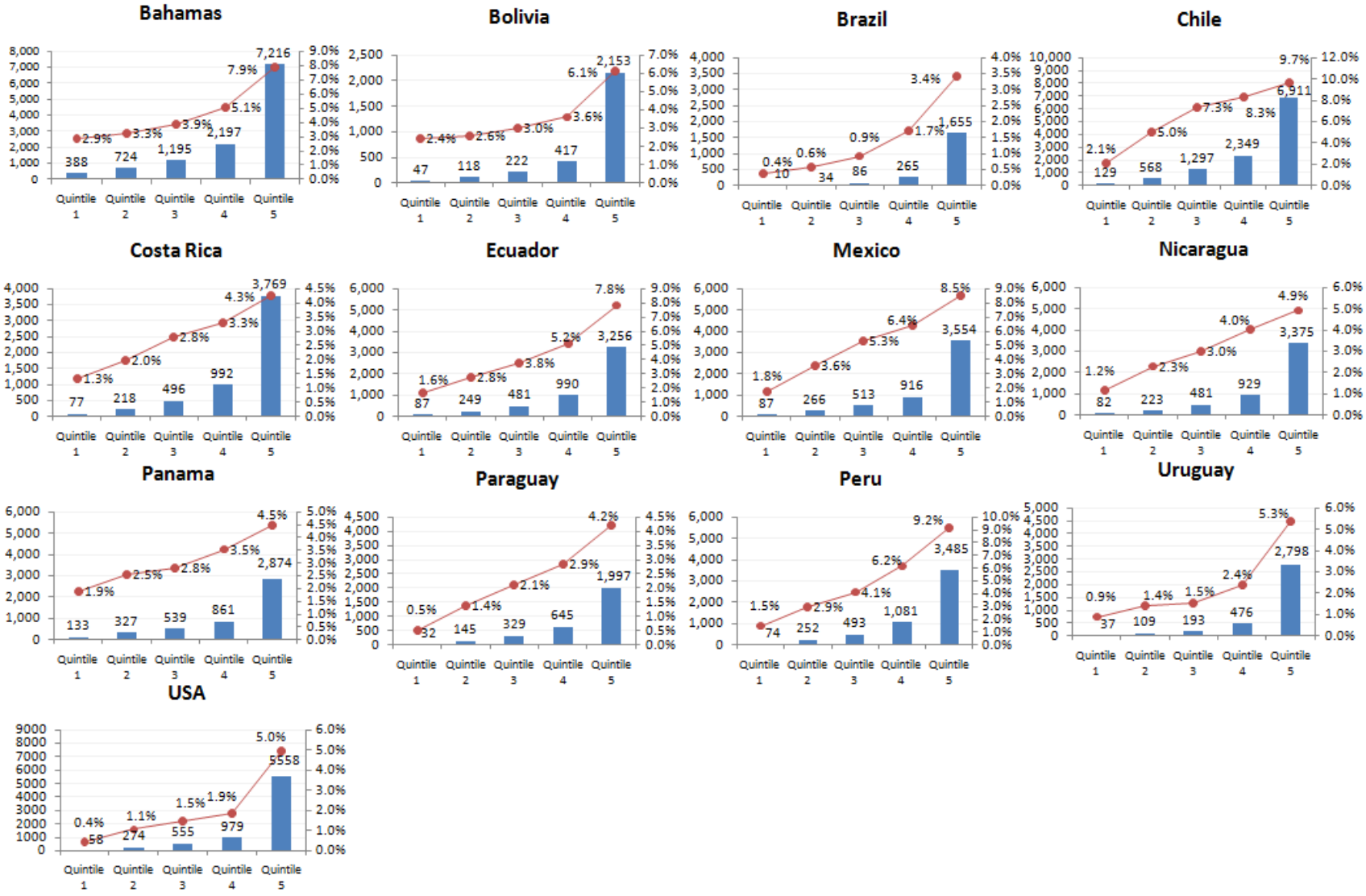

Figure A3. Average household educational expenses by number of children in the household

PPP adjusted dollares of 2014 (columns, left axis); % of household expenditure (lines, right axis)

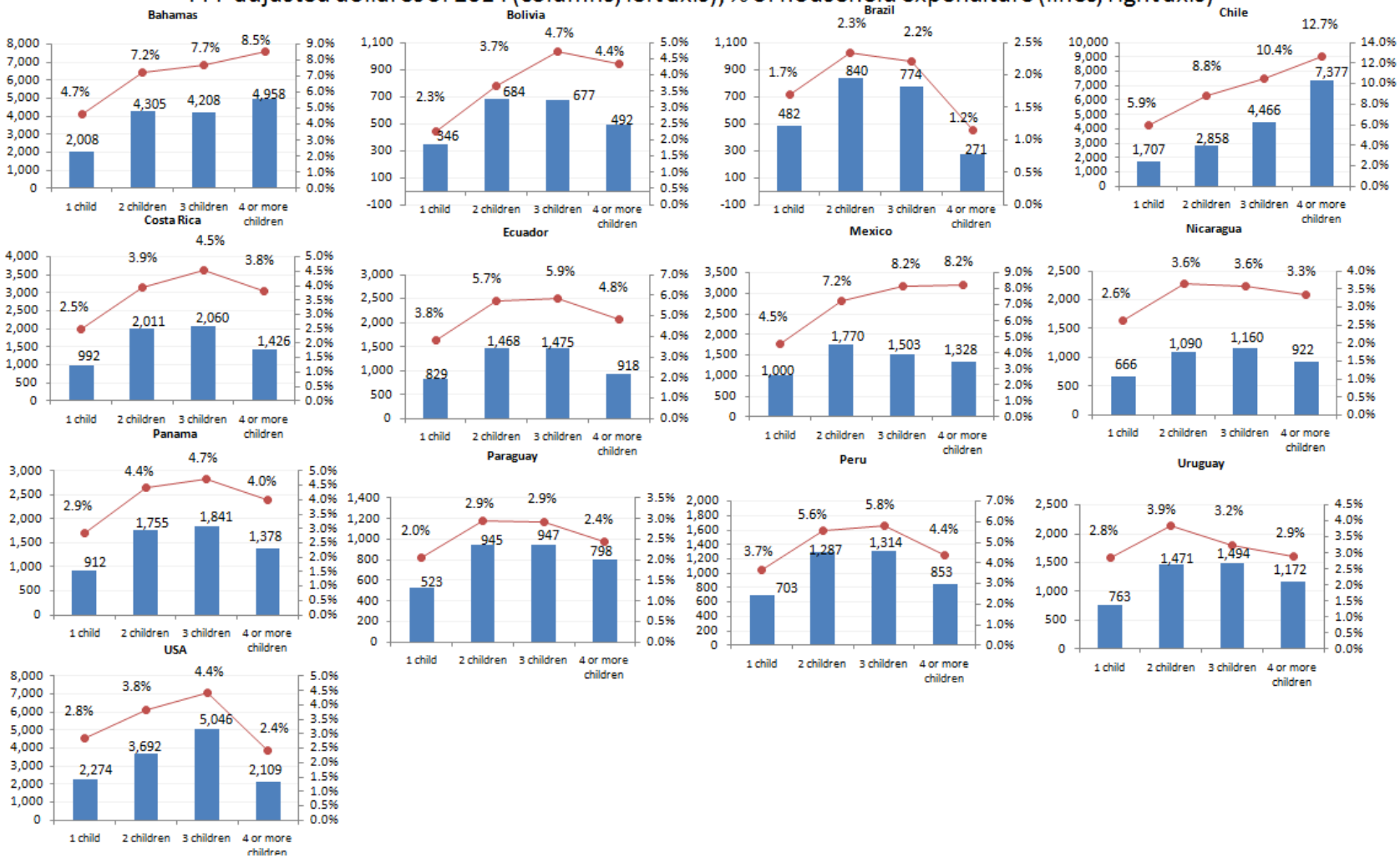

Figure A4. Average household educational expenses by number of children in the household by Quintiles

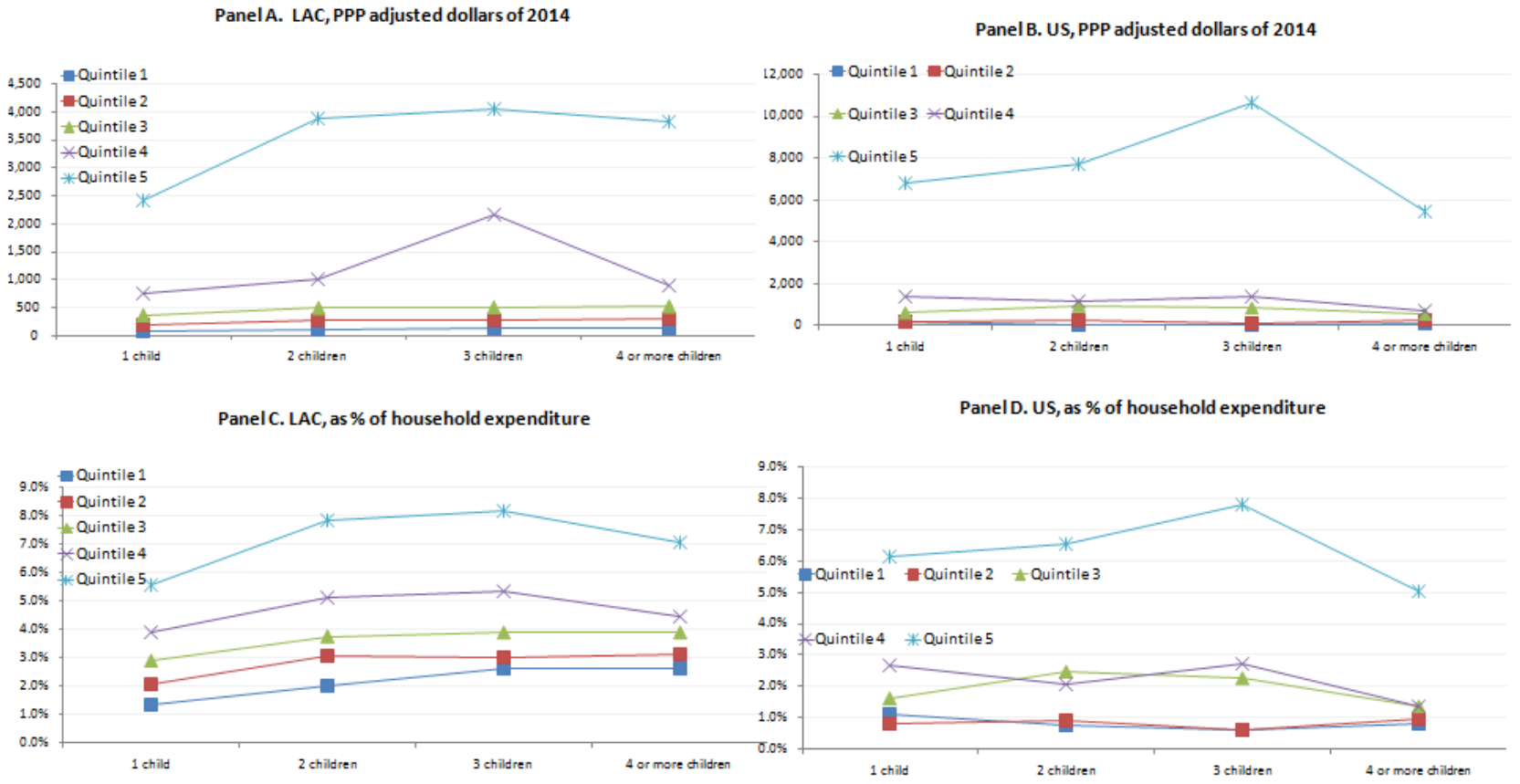

Figure A5. Average household educational expenses by educational level of household head

PPP adjusted dollares of 2014 (columns, left axis); % of household expenditure (lines, right axis)

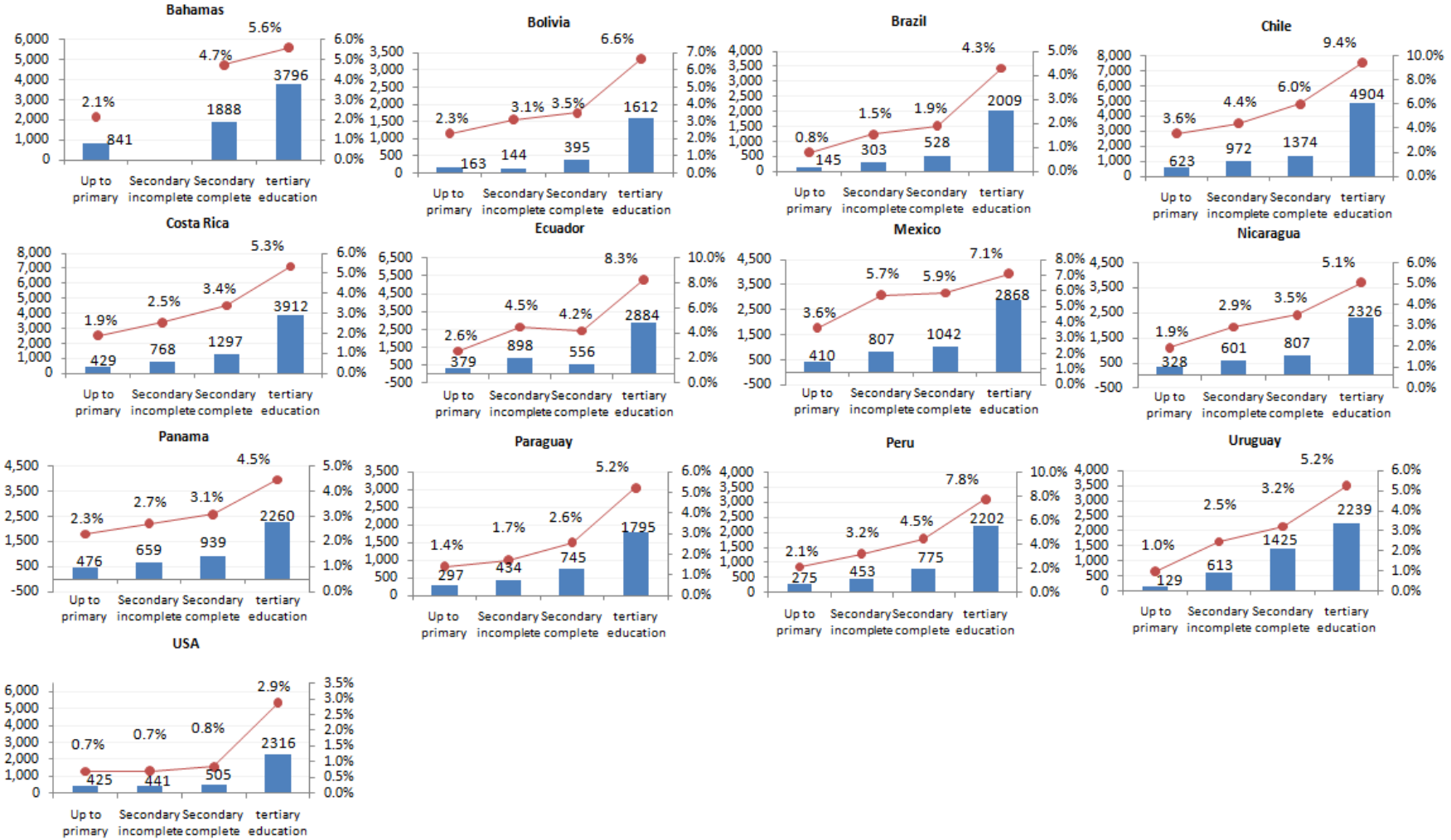

Figure A6. Average individual educational expenses by age

PPP adjusted dollares of 2014 (columns, left axis); % of household expenditure (lines, right axis)