Is Education a Safety Rope? A Longitudinal Study of Inter-generational Consequences of Temporal Shocks on Mexican Families

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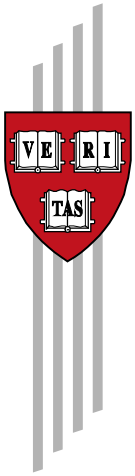

Working Papers

Center for International Development at Harvard University

Is education a safety rope? A longitudinal study of inter-generational consequences of temporal shocks on Mexican families

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This paper studies long term implications of temporary macroeconomic shocks with the aim to identify welfare effects to certain groups of the society. We focused on the impact to education attainment given its relevance in determining permanent income and wealth, and the availability of a unique panel dataset of Mexican households and historical GDP variation. Based on the identification assumption that macroeconomic shocks are exogenous to individuals decisions to pursue education and a complex data construction, we found that there is indeed a strong correlation between economic shocks and years of education for all school periods and cohorts born between 1950 and 1990, with differentiated magnitude depending on the shock's timing.

GDP contractions are related to an average reduction of around 0.053 years of education if the shock is realized during secondary education, but its potential negative effect is about 0.165 years of schooling less if the negative shock is experienced when the individual was enrolled in college. Our exploration suggests that opportunity cost is the main driver of the decision to drop out of school when the economy experiences sudden temporary shocks. This distinction has important policy implications since decisions to drop out of school are made mostly by the student as they grow older, pointing out the need to develop policies targeted to students in junior high and higher levels during economic shocks in order to reduce the drop out rate.

Keyword(s): Poverty, vulnerability, education

JEL Code(s): I24 - Education and Inequality, I25 - Education and Economic Development, I28 - Government Policy, I32 - Measurement and Analysis of Poverty

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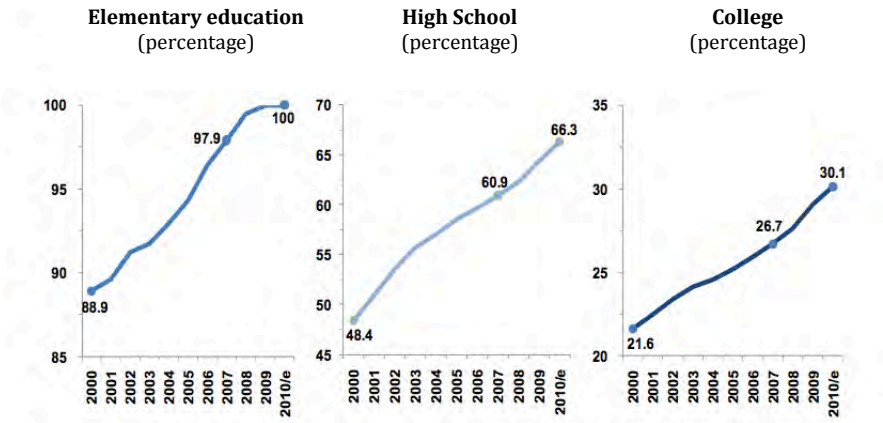
Introduction

We motivate this study on the need to have a deeper understanding of poverty dynamics in a globalized world where macroeconomic shocks are becoming increasingly common, affecting certain groups of the society who have no accessible tools to avoid their impact, generating persistency of low consumption levels, inequality and limited welfare.

Today there is a wide discussion over the optimal design of social safety networks motivated either by the impact of global crisis in the midst of fighting poverty, the renovated impetus to reach the Millennium Development Goals, or the concerns of potential fiscal impact that already has certain European nations in deep trouble. Mexico is not isolated from that discussion, there is a growing concern of the role of social policy, its effective implementation and its impact on the overall welfare of the population. The design and launching of modern social policy aimed to reduce poverty and its intergenerational impact goes back to 1997 with the birth of Progresa-Oportunidades, followed by a series of strategies that aimed to provide basic services to those in need through public efforts -such as *Seguro Popular*- or improving public services already in place, especially public education. Regarding the latest Mexico is in the middle of an important transformation. Mexico reached universal coverage in elementary school in 2010 and has constantly increased supply in secondary and tertiary levels. Growing public resources have been invested to ensure that all Mexicans have access to education and health based on a supply-side strategy that mandates a growing role of the State. Lately the effort has shifted towards improving the quality of education making it today's most important priority to the current Administration that has embarked in a deep education reform.

Figure 1
Public education coverage in Mexico: 2000-2010



Source: Ministry of Education

We ought to provide evidence to reinforce the importance of education policy in the design of social safety networks by exploring its role in coping with external shocks. Recent research has shown us that there are certain households characteristics that make them more prone to fall into poverty meaning that they are more "vulnerable". Our aim is to find out who are they and whether their education attainment can explain the different degrees of vulnerability to poverty. We want to explore as well if this risk exposure is persistent across time and generations meaning that certain families experience more long-lasting consequences of shocks. We want to provide evidence to help in the design of policies to reduce current and future risk-exposure. Finally, we want to enlighten the discussion and draw the lines between existing concepts related to poverty such as structural poverty and vulnerability, providing valuable information to designers of social safety *ropes* and *networks* in developing countries.

To reach our goals we identify persistent effects of macroeconomic shocks over education across generations, linking relevant literature on poverty determinants and vulnerability to poverty. We use the Mexican Family Life Survey (MxFLS)[4] from 2002 to 2012, a panel dataset of 19,300 individuals of all ages, along historical data

[4] Winner of the first *Regional Award for Innovation in Statistics* by the World Bank in 2006.

on macroeconomic shocks -starting in 1910- to estimate potential effects of sharp GDP variations over educational attainment. We estimate the effect of macroeconomic shocks differentiating by cohorts and types of households characterized by parents education and dwelling characteristics. Our identification strategy relies on the exogeneity of these shocks.

The dataset comprises three waves of the MxFLS, a multi-thematic and longitudinal database which collects, with a single scientific tool, and a wide range of information on socioeconomic indicators, demographics and health indicators on the Mexican population with national representation. The study takes advantage that the survey is tracking the Mexican population for long periods of time regardless of migration decisions helping to our aim. This is the first study that uses the whole 10-year span panel dataset starting in 2002 exploring the three completed waves of MxFLS altogether.

This paper organizes as follows, first we provide a revision to recent relevant literature to poverty and vulnerability to frame our analysis and provide a theoretical background to our study. Then we explain our empirical strategy, the complex dataset construction and the specification used. We provide our results afterwards using different dataset in order to explore various hypotheses regarding the potential differentiated impact of macroeconomic shocks depending on households and individuals' socioeconomic characteristics. Finally we present our main remarks in the conclusion.

Recent literature on poverty and vulnerability

There are different perspectives on how to understand poverty and its dynamics that are relevant to our study. One branch of the literature focuses on poverty measurement. A basic formal definition of poverty instrumental to measure poverty prevalence was provided by Bidani and Ravallion (1994) who used a functional form that allows going from poverty in terms of utility to poverty in terms of

expenditure. They consider that households minimize costs to acquire a bundle of goods, given prices and preferences that depend on households' characteristics. The poverty line is thus set as the minimum cost of reaching certain utility level reference at prevailing prices and household characteristics. Since this approach does not tell us how to define the minimum level of utility they refer to two methods. The first one is the food-energy intake method (FEI), that defines the poverty line by finding the consumption expenditures or income level at which a person's typical food energy intake is just sufficient to meet a predetermined food energy requirement. The second method is the cost of basic needs (CBN), that values an explicit bundle of foods typically consumed by the poor at local prices where a specific allowance for nonfood goods, consistent with spending by the poor, is added. However this approach is subject to high arbitrary elements, acknowledged by the authors; for example, the variability of the calorie threshold might vary with age or the fact that the poverty profile is highly sensitive to some aspects of measurement, as proved in their case study on Indonesia's regional and sectorial poverty measurement. Several efforts have been made to refine the definition of poverty measured by monetary units such as adjusting by different needs according to household formation, regional differences, shadow prices and underreporting.

A second relevant branch of the literature relates to analyzing poverty from different perspectives, recognizing that it is a situation associated not only to insufficient income or consumption but also to other dimensions that may reinforce themselves such as insufficient health, nutrition and literacy, weak social relations, lack of security, and even low self-confidence and powerlessness that are difficult to measure[5]. Conceptual writings by Amartya Sen on the capability approach have been complemented by the effort to generate a coherent framework of multidimensional measurement consistent with unidimensional techniques that can be empirically analyzed. Nevertheless as of today there is no clear linkage across

[5] See World Bank: http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTPOVERTY/EXTPA/0,,contentMDK:20242876~isCURL:Y~menuPK:492130~pagePK:148956~piPK:216618~theSitePK:430367~isCURL:Y,00.html

dimensions nor a conceptual neither practical framework that groups different dimensions in order to understand the mechanics of poverty regardless of its metrics.

A third literature category is dedicated to study poverty dynamics with the aim to identify poverty determinants. From a pure statistical perspective Jalan and Ravallion (2000) provide valuable insights regarding the identification of these potential determinants using panel data of rural China. They distinguish between different types of poverty measured by consumption bundles using time-mean consumption disaggregating the population. They split households between those that are "structurally poor", meaning households who have fundamentally low earning power, and those that are not, and then dividing them in different groups depending in their persistency of poverty. The authors find that the determinants for "chronic" and "transient" poverty are different, suggesting that the two types of poverty follow different processes with important policy implications.

Within the same literature Kamanou and Morduch (2002) perform an empirical exercise using two-year panel data from Cote d'Ivoire in an effort to isolate a set of measures of "vulnerability to poverty" akin to poverty measures. After a brief review to different measures where they analyze other measures such as standard deviation of household consumption that requires an ample panel data and has the disadvantage of weighting the same downside and upside risk, they focus on the statistical properties of the distribution of possible future outcomes for households. The authors construct synthetic distributions by combining Monte Carlo simulations with nonparametric methods to estimate standard error based on household characteristics and consumption fluctuations. After computing the difference between expected value of a poverty measure -obtained from those distributions- and its actual value they come up with a measure of vulnerability. Their approach has the virtue of identifying potential difficulties faced by households that cannot be identified when using historical data.

Even though the aforementioned literatures offer compelling insights they lack a

proper framework that puts the pieces together in a tractable manner that can be used to design policy. Moreover, our understanding of long-term implications of poverty is limited to theoretical argumentation since empirical studies have been unable to address them given the limited number of same-household observations. Our aim is to contribute to the understanding of poverty determinants with special emphasis in the intergenerational transmission of poverty, by taking advantage of a unique panel data set of households and exogenous shocks over the economy.

Empirical strategy

The focus of our analysis is understanding how macroeconomic shocks affect households decisions to acquire education and the persistence of such effects across different cohorts. We use the Mexican Family Life Survey (MxFLS) from 2002 to 2012 which is a panel dataset of 19,300 individuals of all ages, a multi-thematic and longitudinal database which collects a wide range of information on socioeconomic indicators, demographics and health indicators on the Mexican population with national representation. Along the MxFLS we use historical data on macroeconomic shocks -starting from 1900- to estimate potential effects of sharp GDP variations over educational attainment. We estimate the effect of macroeconomic shocks on educational achievement differentiating by cohorts and conditioning by relevant households characteristics, including parents education. Our identification strategy relies on the exogeneity of macroeconomics shocks.

Data description and robustness

Our dataset is unique. It contains complete and consistent individual-level information of Mexican households across 10 years, regardless of their migration decisions and housing arrangements variations, making it an ideal tool to perform our analysis and helping to our aim. The data set was built merging the three waves

of the MxFLS[6]: 2002, 2005-2006 and 2009-2011, generating a 10-year span panel dataset that has never been used before containing a wide range of information on socioeconomic indicators, demographics and health indicators on the Mexican population with national representation.

Another feature of the dataset is its time and intrahousehold robustness. The panel characteristic of the MxFLS allows us to compare responses across waves in terms of age, schooling of the person interviewed and schooling of his/her parents, among others, to ensure consistency across time, diminish measurement errors and increase accuracy of information. As well, intrahousehold consistency is assured since the MxFLS interviews all members of the household including the head of the family who provides general information of all members. In this way the information self-reported by household members can be contrasted with the information provided by the head of the household. In particular the education and age of each member of the household was refined following this comparison method.

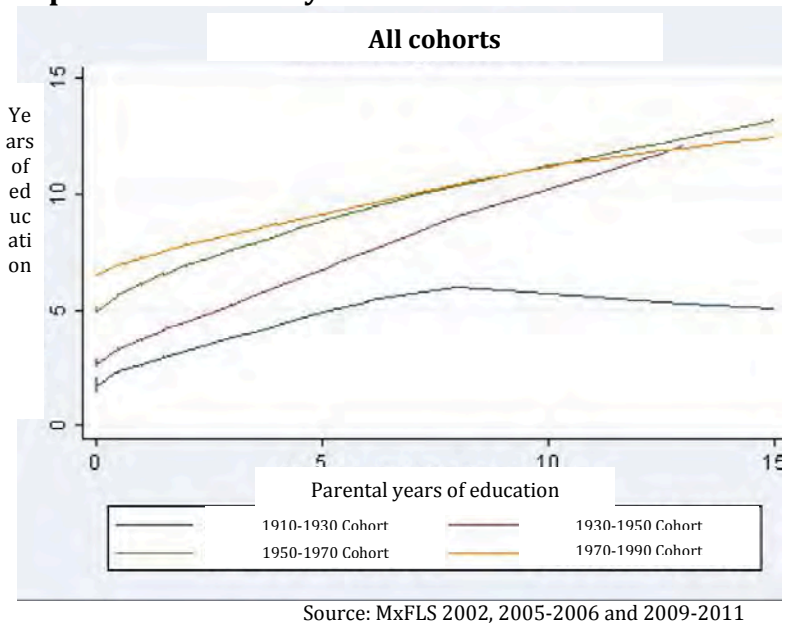
Two criteria were used to compare information across time and individuals in terms of education attainment. Whenever the self-reported data matched in two of the three waves and one differed, the information of the coinciding waves was considered correct. When the information on the three waves did not match we computed the average of the two closest waves as long as the standard deviation was not greater than two years of education. The observation was dropped in case the standard deviation was greater than two years.

Parental education was obtained using the self-reported information whenever available. If the parents still lived in the household they were interviewed and the information was obtained. It was only when the information could not be confirmed either because of parental death or migration that parental information was reported by their children only. Self-reported information was prioritized and if needed to complete missing data, the information reported by the head of the

[6] MxFLS-1, MxFLS-2 and MxFLS-3.

household was used to complement.

Figure 2
Relation parents-children years of education for different cohorts



Source: MxFLS 2002, 2005-2006 and 2009-2011

We restricted our analysis to population older than 20 years and younger than 60 years, meaning that they were born between 1950 and 1990. Theses individuals have already finished their schooling years in theory -or are about to finish-. Finally, when measuring education achievement we gave special treatment to dropouts in schooling age, meaning younger than 15 years who reported not being enrolled at school in any of the three survey waves. The reason is that we cannot determine their definitive education level nor whether they are temporally or permanently out of the classroom. However, those who reported to be out of school for the three waves were considered to have already reached the maximum level of schooling given the low probability to return to school.

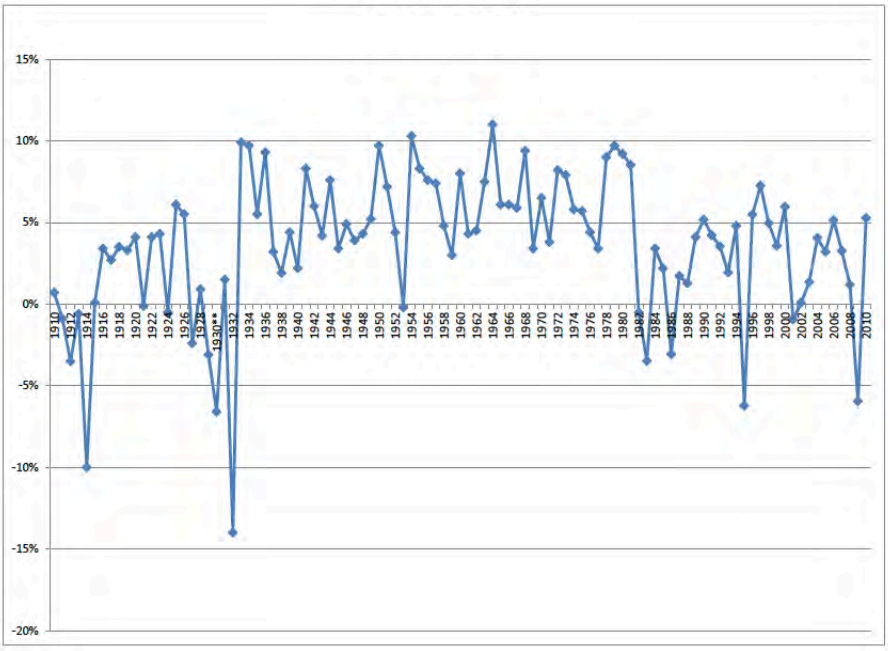
Mexico's GDP between 1950 and 2010

We employed a real GDP series that goes from 1950 to 2010 to estimate yearly GDP variation for the period of interest (1950-2010) [7]. Every spell of GDP variation was linked to each household member in the MxFLS according to her estimated period of studies. To do it we used every individual's year of birth as reference to calculate *when* she attended school and *what* level (pre-school, elementary, junior high, high school and college), assuming the period of time to acquire education lasts a maximum of 21 years[8]. Once we linked the spells of GDP variation with each individuals estimated years of schooling by level we generated an indicator variable to reflect whether for each level of studies there was year where GDP grew more than 6.6% -i.e. economic boom- and another indicator variable for those years when GDP fall below 0% -i.e. crisis-.

Additionally we estimated GDP moving average that considers two periods before and two afterwards for every period *t*, to account for differentiated degrees of GDP variation[9].

[7] Millions of 2003 pesos.
[8] The first six years of life without schooling, the next six years of elementary school, three of junior high, three years of high school and three years of college.
[9] GDP moving average in t= $(GDP_{t-2} + GDP_{t-1} + GDP_t + GDP_{t+1} + GDP_{t+2}) / 5$

Figure 3
100 years of GDP growth in Mexico: 1910-2010



Historical data shared by Aurora Gómez Galvarriato

Specification and results

The regression takes the following form:

$$educ_i = \alpha_0 + \sum_{j=1}^{4} \alpha_j \cdot I(parenteduc_{i,k}) + \sum_{j=5}^{9} \alpha_j \cdot I(GDP_{i,k,m}) + GDP_i + \boldsymbol{X_i} \cdot \boldsymbol{\beta} + \gamma_{i,c} + \varepsilon_i$$

where $educ_i$ is education in years for individual i in 2012; $I(parenteduc_{i,k})$ is an indicator for individual i parents' educational achievement where k is the educational level –elementary, junior high, high school and undergraduate studies[10]-; $I(GDP_{i,k,m})$ is also an indicator function that captures whether GDP variations were below or above m when individual i was studying k school level,

[10] Computed as the average of parents reported education.

where m is either 0% (below) or 6.6%[11] (above); GDP_i is a moving average of the GDP growth during individual's i estimated schooling period, X_i is a vector of individual-specific demographic variables; $\gamma_{i,c}$ is individual's cohort c which can be either being born between 1950 to 1970 or later, and ε_i is the error term. Our objective is to identify the magnitude and significance of α_j where $j>4$, meaning the long-term effect in education achievement generated by GDP extreme variations *during periods of potential school enrolment of individuals.*

We ran different specifications with selected datasets in order to obtain covariates than can reflect differentiated potential effects of GDP volatility. The first specification uses all individuals born between 1950 and 1990, shown in column 1 in table 1, meaning those who should had already obtained their last degree. We found what has been reported in previous literature: more parental education is associated with increasing children educational achievement, and variables that closely reflect income such as access to piped water or toilets are positively correlated with education. Also, we found that men have on average 0.28 years of education more than women, and that living in a city is related to more years of education as well as age –with a decreasing rate for the later-. When adding indicators that capture economic shocks the story of vulnerability starts to unravel: estimates of parental education reduce dramatically and become symmetric across different categories, meaning that although parents schooling is positively correlated with children's educational attainment this relationship is limited to the first years of parental schooling.

Estimates of economic shocks have the expected signs: positive for GDP spikes and negative for GDP contractions. Positive economic shocks are strongly correlated to more years of education for *all school periods* for all cohorts with differentiated magnitude depending on the shock's timing: higher estimates are found when the

[11] We tried different cut-offs to identify the one that best captures economic booms. For instance, when using the 5% cut-off the magnitude of the effect of positive economic shocks are reduced to about a half, and their statistical significance is also affected.

economic boom is reported during junior high and high school years, meaning that individuals who were studying during periods of economic bonanza reached on average more years of education that those who weren't fortunate enough to experience GDP spikes while being enrolled. On the opposite side, negative economic shocks are correlated to decreasing years of schooling only from junior high onwards suggesting that elementary education is not sensitive to economic downturns; a potential cause of this finding is the expansion of public coverage of elementary schools that provided a safety net to Mexican families. GDP contractions are related to an average reduction of around 0.053 years of education if the shock is realized during secondary education, but its potential negative effect is about 0.165 years of schooling less if the negative shock is experienced when the individual was enrolled in college. There are two potential channels to this differentiated effect: economic downturns bounds families capacity to afford kids schooling and increases the opportunity cost of joining the labor market; junior high and high school are on average less expensive than college in terms of tuition and other expenses making them relatively more affordable than college when economic activity contracts. Additionally, the opportunity cost of finding a job increases with age with a potential discrete increase right after high school when children reach legal adulthood.

Colum 3 of table 1 restricts the sample to those individuals whose parents have 0-5 years of education -i.e., they did not complete elementary education- to test the affordability channel just described under the believe that parents with lower education may find more difficulties to cover children school expenses during temporary economic downturns. Shocks estimates are in general very similar than when using the whole sample suggesting that children of less educated parents faced similar school vulnerability than those with more educated parents, strengthening the hypothesis of higher opportunity costs as the main cause of dropping out of school when economic activity reduces dramatically. This distinction has important policy implications since decisions to drop out of school are made mostly by the student as they grow older, pointing out the need to develop

policies targeted to students in junior high or higher levels during bad economic times in order to reduce drop out rate.

Column 4 restricts the sample to those individuals whose parents are the most educated within our sample –i.e. they have 10-15 years of education meaning they studied high school, college or more- to contrast with the previous sample. When using this subsample all shocks estimates lose significance except of the impact on college studies during economic booms, when the data suggest that these students opt *out* of school rather than staying at school, reinforcing further the opportunity cost channel as the main hypothesis to explain educational attainment at secondary and tertiary levels.

Finally, we tested whether there is a differentiated effect of shocks by gender. Column 5 restricts the sample to men only and column 6 to women. Our estimates indicate that there is certain difference that may generate relevant welfare implications differentiated by gender. Boys education is on average more sensitive to economic activity since GDP moving average estimates are significant. Specifically they tend to achieve higher levels of education when economic bonanza materializes regardless their age. When economic activity collapses women tend to reduce their years of schooling if they are in age of being in high school suggesting that they are the most affected[12]. In contrast when GDP experience sudden positive shocks women are the most benefited if they are enrolled in college. As found in all previous columns, neither women or men are significantly affected by GDP contractions if they are in age of receiving elementary education.

[12] Although boys seem to be the only ones affected if they are in junior high the difference of estimates significance between genders seems to obey higher variance for women, while magnitude and sign is very similar across groups.

Table 1

Estimation of impact of economic shocks in years of schooling

	(1)	(2)	(3)	(4)	(5)	(6)
1-5 years of parental	1.847	0.336	0.3		0.387	0.283
education	[0.060]**	[0.026]**	[0.026]**		[0.035]**	[0.039]**
6 years of parental	2.652	0.384			0.437	0.332
education	[0.077]**	[0.028]**			[0.039]**	[0.042]**
7-9 years of parental	3.328	0.326			0.358	0.3
education	[0.079]**	[0.029]**			[0.040]**	[0.043]**
10-15 years of parental	4.33	0.375			0.401	0.356
education	[0.081]**	[0.030]**			[0.041]**	[0.044]**
Age	0.208	0.067	0.071	0.037	0.069	0.064
	[0.016]**	[0.008]**	[0.010]**	[0.022]	[0.011]**	[0.013]**
Age square	-0.003	-0.001	-0.001	0	-0.001	-0.001
	[0.000]**	[0.000]**	[0.000]**	[0.000]	[0.000]**	[0.000]**
1=male, 0=female	0.28	-0.022	-0.009	-0.021		
	[0.040]**	[0.015]	[0.021]	[0.031]		
1=city, 0=town at 12	0.54	0.011	0.05	-0.011	-0.004	0.03
years old	[0.049]**	[0.016]	[0.023]*	[0.038]	[0.022]	[0.023]
1=toilet, 0=otherwise at	0.883	0.077	0.085	0.027	0.06	0.104
12 years old	[0.052]**	[0.018]**	[0.023]**	[0.053]	[0.024]*	[0.027]**
1=piped water	1.084	0.201	0.195	-0.078	0.227	0.17
0=otherwise 12 years old	[0.059]**	[0.023]**	[0.027]**	[0.069]	[0.031]**	[0.034]**
GDP moving average	-7.428	2.527	3.908	-0.001	4.427	0.173
	[3.207]*	[1.500]	[1.981]*	[3.582]	[2.065]*	[2.181]
GDP moving average	54.789	-52.274	-67.681	-11.392	-71.64	-26.495
square	[43.739]	[20.10]**	[25.52]**	[45.231]	[27.31]**	[29.67]
GDP growth in		0.025	0.02	0.004	-0.012	0.069
preschool <0%		[0.021]	[0.027]	[0.047]	[0.028]	[0.030]*
GDP growth in		0.052	0.047	0.026	0.064	0.036
preschool >6.6%		[0.015]**	[0.018]**	[0.037]	[0.020]**	[0.022]
GDP growth in		-0.017	-0.032	-0.023	-0.064	0.039
elementary school <0%		[0.029]	[0.038]	[0.071]	[0.040]	[0.044]

	(1)	(2)	(3)	(4)	(5)	(6)
GDP growth in elementary school >6.6%		0.043 [0.014]**	0.033 [0.017]	0.014 [0.039]	0.04 [0.019]*	0.044 [0.021]*
GDP growth in junior high <0%		-0.053 [0.020]**	-0.058 [0.024]*	-0.028 [0.058]	-0.056 [0.026]*	-0.047 [0.030]
GDP growth in junior high >6.6%		0.13 [0.015]**	0.13 [0.017]**	0.003 [0.052]	0.153 [0.020]**	0.098 [0.022]**
GDP growth in high school <0%		-0.054 [0.021]**	-0.052 [0.030]	0.025 [0.061]	-0.01 [0.029]	-0.09 [0.031]**
GDP growth in high school >6.6%		0.164 [0.017]**	0.149 [0.025]**	0.056 [0.045]	0.188 [0.024]**	0.135 [0.025]**
GDP growth in college <0%		-0.165 [0.020]**	-0.145 [0.030]**	-0.029 [0.050]	-0.163 [0.028]**	-0.155 [0.029]**
GDP growth in college >6.6%		0.066 [0.016]**	0.084 [0.021]**	-0.081 [0.037]*	0.042 [0.021]*	0.079 [0.023]**
1970-1990 Cohort		0.073 [0.066]	0.11 [0.085]	0.141 [0.143]	0.233 [0.089]**	-0.125 [0.098]
Observations	19,065	19,065	12,523	1,519	10,425	8,640
R-square	0.904	0.914	0.887	0.916	0.915	0.913

Note: Sample of individuals over 20 who were born between 1950 and 1990. The control variable is excluded 1950-1990 cohort. The control variable education is excluded when parents are uneducated. The GDP variable by school level is an indicator function if GDP fell in the range of shock in her age of preschool, elementary school, junior high, high school and college, respectively. Robust errors are included in brackets.

* Significant at 5%; ** significant at 1%.

Column (1) includes only demographic variables, (2) same as above plus GDP shocks in each individuals' grade level. Column (3) restricts the sample to those individuals whose parents have 0-5 years of education (incomplete elementary education). Column (4) restricts the sample to those individuals whose parents have 10-15 years of education (high school, college or postgraduate degree). Column (5) restricts the sample to men and column (6) to women.

Source: Based on information MxFLS-1, MxFLS-2 and MxFLS-3.

Conclusions

This paper studies long term implications of temporary macroeconomic shocks with the aim to identify welfare effects to certain groups of the society. We focused on the impact to education attainment given its relevance in determining permanent income and wealth, and the availability of a unique panel dataset of Mexican households and historical GDP variation. Based on the identification assumption that macroeconomic shocks are exogenous to individuals decisions to pursue education and a complex data construction, we found that there is indeed a strong correlation between economic shocks and years of education for *all school periods* and cohorts born between 1950 and 1990, with differentiated magnitude depending on the shock's timing. GDP contractions are related to an average reduction of around 0.053 years of education if the shock is realized during secondary education, but its potential negative effect is about 0.165 years of schooling less if the negative shock is experienced when the individual was enrolled in college. Our exploration suggests that opportunity cost is the main driver of the decision to drop out of school when the economy experiences sudden temporary shocks. This distinction has important policy implications since decisions to drop out of school are made mostly by the student as they grow older, pointing out the need to develop policies targeted to students in junior high and higher levels during economic shocks times in order to reduce drop out rate.

Also, our estimates indicate that boys education is on average more sensitive to economic activity since GDP moving average estimates are significant, tending to achieve higher levels of education when economic bonanza materializes regardless their age. An important feature of the data indicates that women are more vulnerable to negative shocks since they tend to be the most affected if they are in age of being in high school, at the same time they are the most benefited if they are enrolled in college during good economic times.

Finally, we found robust results that education achievements are not sensitive to economic downturns when children are in age of being enrolled in elementary

school regardless parents education. A potential cause of this finding is the constant expansion of public coverage of elementary schools that reached universality in 2010 and have provided a safety net to Mexican families. This fact has central policy implications in today's discussion over the optimal design of social safety networks and raises even more the importance of education policy as a chief element in the overall strategy.

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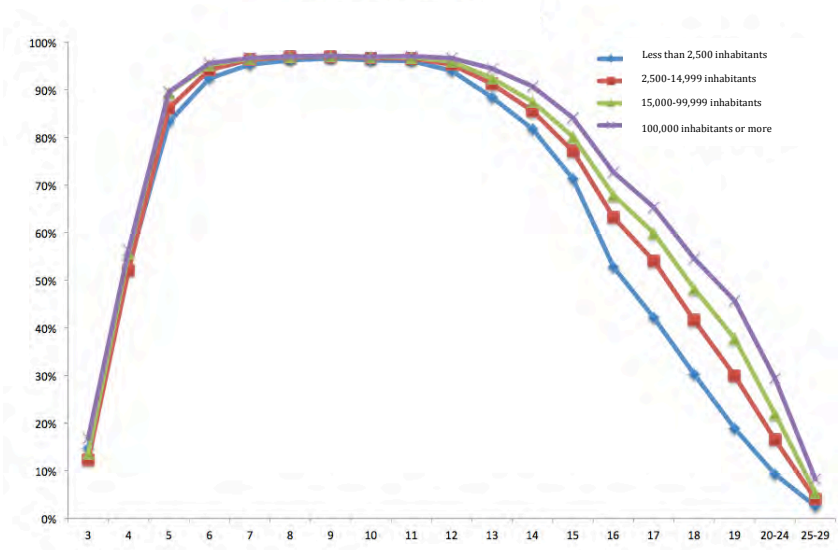
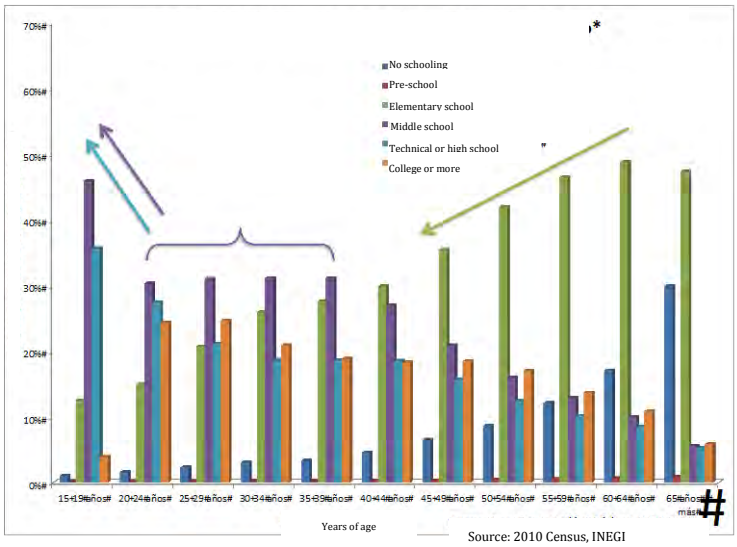
Appendix A

Figure 1A
School attendance rate by population size in 2010



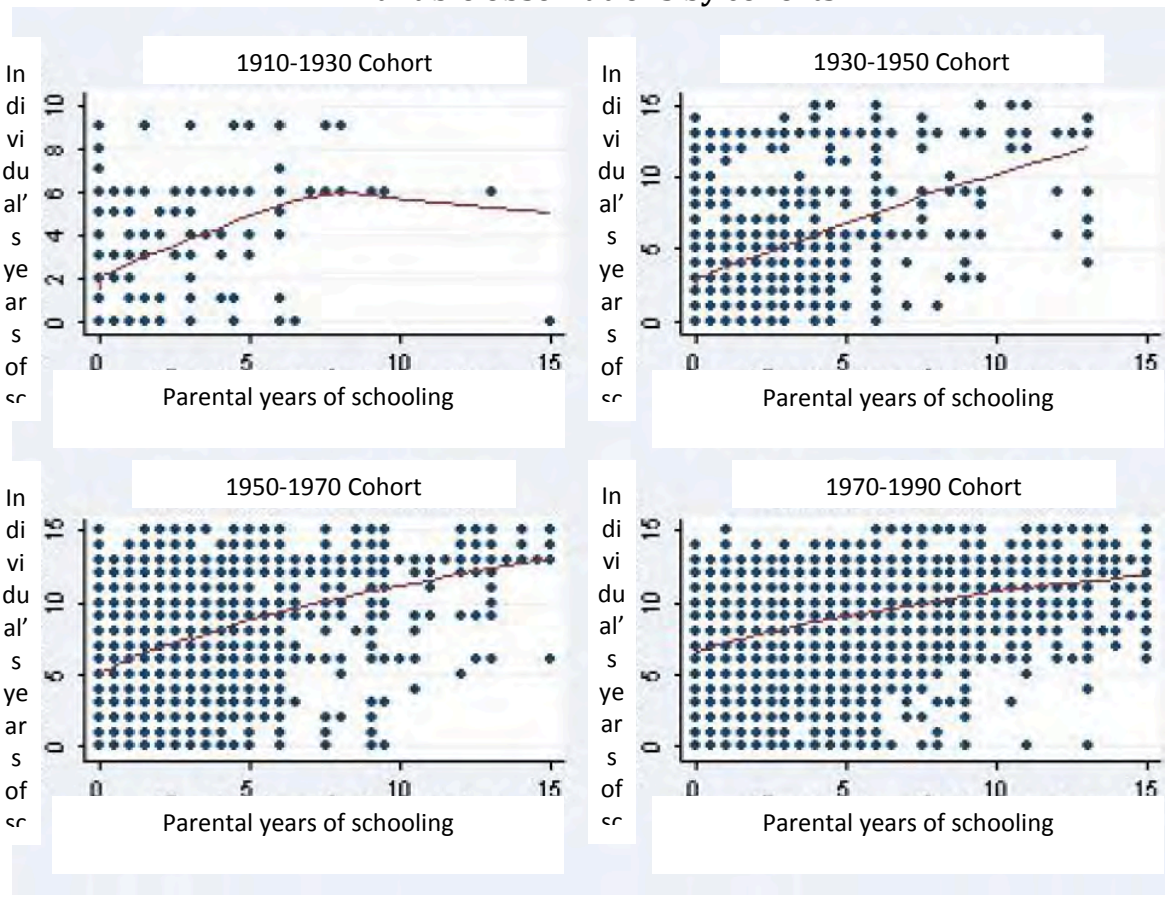
Source: 2010 Census, INEGI

Figure 2A
Education attainment by age in 2010



Source: 2010 Census, INEGI

Figure 3A
Available observations by cohorts



Source: MxFLS-1, MxFLS-2 and MxFLS-3.

Table 1A
Summary Statistics

Variable	Obs	Mean
Generación 10_30	544,868	3.43%
Generación 30_50	544,868	11.49%
Generación 50_70	544,868	28.63%
Generación 70_90	544,868	56.46%

Variable	Obs	Mean
i_ne	544,868	6.53%
i_prm	544,868	37.62%
i_sec	544,868	29.61%
i_prp	544,868	13.08%
i_uni	544,868	13.17%

Variable	Obs	Mean
sin estudios si PIB<-0.033	544,868	1.21%
sin estudios si -0.033<PIB<0	544,868	2.05%
sin estudios si -0<PIB<0.033	544,868	4.38%
sin estudios si 0.033<PIB<0.066	544,868	13.45%
sin estudios si PIB>0.066	544,868	7.53%
primaria si PIB<-0.033	544,868	1.70%
primaria si -0.033<PIB<0	544,868	1.81%
primaria si -0<PIB<0.033	544,868	3.65%
primaria si 0.033<PIB<0.066	544,868	14.39%
primaria si PIB>0.066	544,868	7.05%
secundaria si PIB<-0.033	544,868	0.44%
secundaria si -0.033<PIB<0	544,868	0.76%
secundaria si -0<PIB<0.033	544,868	1.71%
secundaria si 0.033<PIB<0.066	544,868	3.85%
secundaria si PIB>0.066	544,868	1.24%
prepa si PIB<-0.033	544,868	0.17%
prepa si -0.033<PIB<0	544,868	0.33%
prepa si -0<PIB<0.033	544,868	1.00%
prepa si 0.033<PIB<0.066	544,868	1.77%
prepa si PIB>0.066	544,868	0.49%
universidad si PIB<-0.033	544,868	0.11%
universidad si -0.033<PIB<0	544,868	0.16%
universidad si -0<PIB<0.033	544,868	0.54%
universidad si 0.033<PIB<0.066	544,868	0.82%
universidad si PIB>0.066	544,868	0.25%

Table 2A
Estimation of impact of economic shocks in years of schooling with alternative characterization of positive economic shocks (GDP growth > 5%)

	(1)	(2)	(3)	(4)	(5)	(6)
1-5 years of parental	1.847	0.343	0.303		0.29	0.394
education	[0.060]**	[0.026]**	[0.026]**		[0.038]**	[0.035]**
6 years of parental	2.652	0.388			0.335	0.441
education	[0.077]**	[0.028]**			[0.042]**	[0.039]**
7-9 years of parental	3.328	0.325			0.299	0.356
education	[0.079]**	[0.029]**			[0.043]**	[0.040]**
10-15 years of parental	4.33	0.368			0.351	0.394
education	[0.081]**	[0.030]**			[0.045]**	[0.041]**
Age	0.208	0.063	0.069	0.033	0.062	0.065
	[0.016]**	[0.009]**	[0.011]**	[0.023]	[0.014]**	[0.013]**
Age square	-0.003	-0.001	-0.001	0	-0.001	-0.001
	[0.000]**	[0.000]**	[0.000]**	[0.000]	[0.000]**	[0.000]**
1=male, 0=female	0.28	-0.021	-0.008	-0.021		
	[0.040]**	[0.015]	[0.021]	[0.031]		
1=city, 0=town at 12	0.54	0.012	0.05	-0.01	0.032	-0.004
years old	[0.049]**	[0.016]	[0.023]*	[0.037]	[0.023]	[0.022]
1=toilet, 0=otherwise at	0.883	0.078	0.086	0.023	0.104	0.06
12 years old	[0.052]**	[0.018]**	[0.023]**	[0.054]	[0.027]**	[0.024]*
1=piped water	1.084	0.203	0.196	-0.082	0.172	0.231
0=otherwise 12 years old	[0.059]**	[0.023]**	[0.027]**	[0.069]	[0.035]**	[0.031]**
GDP moving average	-7.428	6.312	8.772	-0.39	1.351	10.287
	[3.207]*	[1.784]**	[2.401]**	[4.264]	[2.605]	[2.445]**
GDP moving average	54.789	-64.631	-91.396	22.892	-26.736	-94.419
square	[43.739]	[21.132]**	[26.952]**	[46.708]	[31.218]	[28.696]**
GDP growth in		0.046	0.019	0.05	0.118	-0.015
preschool <0%		[0.032]	[0.044]	[0.073]	[0.047]*	[0.043]
GDP growth in		0.021	0.007	-0.013	0.035	0.01
preschool >6.6%		[0.015]	[0.019]	[0.037]	[0.022]	[0.021]

	(1)	(2)	(3)	(4)	(5)	(6)
GDP growth in		0.04	0.008	0.031	0.101	-0.015
elementary school <0%		[0.036]	[0.047]	[0.084]	[0.053]	[0.048]
GDP growth in		0.029	0.012	0.025	0.049	0.012
elementary school >6.6%		[0.015]	[0.021]	[0.040]	[0.023]*	[0.020]
GDP growth in junior		0.001	0	0.007	0.003	-0.001
high <0%		[0.022]	[0.026]	[0.061]	[0.033]	[0.029]
GDP growth in junior		0.121	0.126	0.03	0.097	0.139
high >6.6%		[0.015]**	[0.018]**	[0.053]	[0.023]**	[0.021]**
GDP growth in high		-0.003	0.008	0.013	-0.052	0.049
school <0%		[0.021]	[0.031]	[0.054]	[0.031]	[0.029]
GDP growth in high		0.08	0.089	-0.02	0.064	0.087
school >6.6%		[0.013]**	[0.019]**	[0.034]	[0.019]**	[0.018]**
GDP growth in college		-0.091	-0.05	0.001	-0.09	-0.086
<0%		[0.021]**	[0.029]	[0.055]	[0.029]**	[0.029]**
GDP growth in college		0.036	0.05	-0.043	0.046	0.027
>6.6%		[0.012]**	[0.017]**	[0.029]	[0.018]**	[0.016]
1970-1990 Cohort		0.06	0.103	0.126	-0.127	0.212
		[0.066]	[0.085]	[0.143]	[0.100]	[0.089]*
Observations	19,065	19,065	12,523	1,519	8,640	10,425
R-square	0.362	0.914	0.887	0.916	0.913	0.915

Note: Sample of individuals over 20 who were born between 1950 and 1990. The control variable is excluded 1950-1990 cohort. The control variable education is excluded when parents are uneducated. The GDP variable by school level is an indicator function if GDP fell in the range of shock in her age of preschool, elementary school, junior high, high school and college, respectively. Robust errors are included in brackets.
* Significant at 5%; ** significant at 1%.
Column (1) includes only demographic variables, (2) same as above plus GDP shocks in each individuals' grade level. Column (3) restricts the sample to those individuals whose parents have 0-5 years of education (incomplete elementary education). Column (4) restricts the sample to those individuals whose parents have 10-15 years of education (high school, college or postgraduate degree). Column (5) restricts the sample to men and column (6) to women.
Source: Based on information MxFLS-1, MxFLS-2 and MxFLS-3.

Appendix B

Variables construction

For this research it was used the following questions of the Migration section (MG) of the Book IIIA of the MxFLS.

MG05 "Cuando usted tenía 12 años, ¿el lugar era (...)? 1. Ranchería, 2. Pueblo, 3. Ciudad, 4. Ejido, 5. Otro (especificar), 8. NS".

A dummy variable grouped the place the people lived when he was young. This variable was constructed with value of 1 when the answer was 3. City and value of 0 grouped the rest of the possible answers.

MG06. "Cuando usted tenía 12 años, ¿de dónde obtenía el agua para beber? 1. Garrafón, 2. Agua de la llave dentro de la vivienda, 3. Agua de la llave fuera de la vivienda, 4. Agua de pipa, 5. Agua por acarreo, 6. Otro (especificar)".

A dummy variable grouped the possible sources of water. This variable was constructed with value of 1 when the answer was either 1, 2 or 3 and value of 0 grouped the rest of the possible answers.

MG07. "En el lugar donde vivía usted cuando tenía 12 años, ¿disponía su vivienda de (...)? 1. Excusado, 2. Letrina, 3. Hoyo negro o pozo ciego, 4. Hacía al aire libre, 5. Otro (especificar)".

A dummy variable grouped the type of public services available to the household. This variable was constructed with value of 1 when the answer was 1. Toilet and value of 0 grouped the rest of the possible answers.

To calculate the years of education of the individual it was used section Education (ED) of Book IIIA of the MxFLS and for parental education it was used the questions in the section for Non Resident Parents Transfers (TP).

ED06. "¿Cuál es el último nivel al que asiste/asistió en la escuela? 01. Sin instrucción,

02. Prescolar o Kínder, 03. Primaria, 04. Secundaria, 05. Secundaria abierta, 06. Preparatoria o Bachillerato, 07. Preparatoria o Bachillerato abierta, 08. Normal básica, 09. Profesional, 10. Posgrado, 98. NS".

ED07. "¿Cuál es el último grado que terminó en la escuela? ,00. No completó el primer grado, 01. Primer grado, 02. Segundo grado, 03. Tercer grado, 04. Cuarto grado, 05. Quinto grado, 06. Sexto grado, 07. Séptimo grado o más, 08. Otro (especificar), 98. NS".

To group the answers and form a variable that contained the numbers of years of education it was used the following table. It is important to note that whenever the answer to ED06 was 00, 05, 06, 07, 08, 09, 10 or 98 the question ED07 was not asked.

Table 1B

Number of years of education	**ED06: "What is the final level assisted to school?"**	**ED07: "What is the last grade finished in school?"**
0	1 (sin instrucción)	N/A
	2 (prescolar)	N/A
	3 (primaria)	0
1	3 (primaria)	1
2	3 (primaria)	2
3	3 (primaria)	3
4	3 (primaria)	4
5	3 (primaria)	5
6	3 (primaria)	6

Number of years of education	ED06: "What is the final level assisted to school?"	ED07: "What is the last grade finished in school?"
7	4 (Secundaria)	1
	5 (Secundaria abierta)	N/A
8	4 (Secundaria)	2
9	4 (Secundaria)	3
10	6 (Preparatoria o Bachillerato)	1
	7 (Preparatoria o Bachillerato abierta)	N/A
11	6 (Preparatoria o Bachillerato)	2
12	6 (Preparatoria o Bachillerato)	3
13	8 (Normal básica)	N/A
	9 (Profesional)	N/A
15	10 (Posgrado)	N/A

The sample was divided into two generational cohorts: those born between 1950 and 1970 and those born between 1970 and 1990. In this way the youngest, who was born in 1990 will be 20 year in 2010, the last year of the sample.