

Binelli, Chiara; Rubio-Codina, Marta

Working Paper

The returns to private education: Evidence from Mexico

IFS Working Papers, No. W12/08

Provided in Cooperation with:

The Institute for Fiscal Studies (IFS), London

Suggested Citation: Binelli, Chiara; Rubio-Codina, Marta (2012) : The returns to private education: Evidence from Mexico, IFS Working Papers, No. W12/08, Institute for Fiscal Studies (IFS), London, <https://doi.org/10.1920/wp.ifs.2012.1208>

This Version is available at:

<https://hdl.handle.net/10419/91572>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

The returns to private education: evidence from Mexico

IFS Working Paper W12/08

Chiara Binelli
Marta Rubio Codina

The Returns to Private Education: Evidence from Mexico*

Chiara Binelli[†] and Marta Rubio-Codina[‡]

This draft: March 9, 2012.

Abstract

Despite the rapid expansion and increasing importance of private education in developing countries, very little is known about the impact of studying in private schools on educational attainment and wages. This paper contributes to filling this gap by estimating the returns to private high schools in Mexico. We construct a unique dataset that combines labor market outcomes and historical school census data, and we exploit changes in the availability and size of public and private high schools across states and over time for identification. We find substantial evidence of a positive effect of studying in a private high school on wages after college graduation, and we discuss alternative mechanisms that can explain this finding.

Key Words: Private and Public Schools, Returns to Education, Mexico.

JEL Codes: J31, J24, C36.

*We thank seminar participants at the University of Mississippi, the University of Oxford, the IFS, the 2010 RCEA conference, the 2011 RES conference, and the 2011 LACEA meeting for useful comments. We are grateful to Armando Correa at CONAPO for sharing the population data; and to Rafael de Hoyos, Juan Manuel Espino and Fernando Ulises González at SEP for sharing the ENTELEMS and Census 911 datasets and books and for providing institutional knowledge throughout the project. Delphine Ghekiere and James Wisson provided excellent research assistance to prepare the final dataset. A previous version of the paper circulated under the title “The Market Returns to Private High Schools: Evidence from Mexico”. The usual disclaimer applies.

[†]Department of Economics, University of Southampton, IFS and RCEA: C.Binelli@soton.ac.uk

[‡]Centre for the Evaluation of Development Policies, Institute for Fiscal Studies: marta_r@ifs.org.uk

1 Introduction

In recent years there has been considerable debate over the privatization of the education sector in developing countries given the rapid expansion of private education in response to a growing demand for schooling that the public sector cannot meet. Several international organizations have been heavily involved in this expansion with the International Financial Corporation (IFC) being the largest multilateral investor: as of January 2011, IFC provided \$523 million in financing to 68 private education projects in 33 developing countries for a total value of \$1.8 billion.¹

A leading example of this recent trend in education provision is Latin America where the private sector has become a prominent provider of high school and college education: in 2005 private institutions accounted for more than 40% of higher education enrolments in the region (World Bank 2005). Mexico is no exception: school Census data show that between 1985 and 2000 the per capita number of both private and public high schools almost doubled and by 2004 the number of students enrolled in private high schools was almost nine times the one in 1970. Similarly, the proportion of private universities increased from around 20% in 1970 to almost 70% in 2000. In 2004 the number of college entrants was almost five times the one in 1970 for public universities and over twenty times the one in 1970 in the private sector.

Proponents of privatization argue that the private sector can be used as a means of increasing access to education via efficient supply: attending a private school has been associated with better test score results, increased school attainment and higher wages (e.g. Riddell 1993). In high-income countries, an extensive literature has estimated the effect of attending private schools on education and wages using a number of identification strategies to control for selection bias. A review of the US and UK studies by Brown and Belfield (2001) presents wage returns to private schools that range between 7 and 10% for the UK and between 10 and 23% for the US, with the magnitude of the estimates varying depending on the level of education and sample considered.

On the contrary, the evidence for low and middle-income countries remains mainly descriptive. Largely due to data limitations, most studies simply compare differences in mean outcomes, such as wages and school attainment between students from private and public schools, without controlling for self-selection into the school of choice (e.g. Bedi and Garg 2000 for Indonesia; Asadullah 2009 for Bangladesh and Pakistan; Calónico and Ñopo 2007 for Peru). A noticeable exception is Bravo, Mukhopadhyay and Todd (2008) who use a school voucher program introduced in Chile in 1980 to identify a dynamic structural model of private/public school attendance and wages. They find that the voucher program increased enrolment in private subsidized schools, and had a positive significant effect on labor force participation and wages.

Thus, despite the importance of the issue and the policy implications that could be drawn from such analysis, very little is known on the relative efficiency of private and public schools in boosting educational attainment and wages in low and middle-income

¹ www.ifc.org/

countries. This paper contributes to filling this gap by constructing a unique dataset for Mexico. Using historical school census data we show that during the 1990s in Mexico there were significant changes across states and over time in the availability of public and private high schools with the public high school sector expanding much faster than the private sector. We use these changes in the availability of high schools to identify the effect of studying in a private or in a public high school on wages. Specifically, we focus on a sample of workers aged between 23 and 35 in 2008 who were enrolled in high school in the 1990s for whom we know the private/public type of high school attended and the state where they went to high school. We instrument the choice of attending a private/public high school with measures of the relative availability and size of public high schools in the state and in the year when the high school choice was made.

We study the returns to private education at the high school level because of data availability but also, and importantly, because Mexican private high schools can be thought of as a homogenous group that is markedly different from public high schools. On the contrary, at the college level, there is substantial variation in quality amongst both private and public institutions, which makes the private-public colleges' comparison uninformative unless detailed data on the actual university attended by a given individual were available.²

We find no wage returns to having studied at a private relative to a public high school for those that enter the labor market upon high school graduation. On the contrary, we estimate a substantial 54% wage return for those that completed college education. Given average returns to college of around 10% and average education costs about 8% higher for students in private than in public high schools, this result implies that—net of costs—having attended a private high school explains, on average, around 22% of the wage returns to college. This result is robust to a number of validity checks of the strength and exogeneity of the instruments.

The finding of substantial returns to private high school only for those that have completed college is a novel and interesting result, which needs to be thoroughly investigated in order to draw policy implications. We explore four main mechanisms that can explain this finding. First, differences in education quality, which is reported to be higher in the private sector (World Bank 2005; Gamboa and Waltenberg 2011). Second, increased school attainment, that is a higher probability of attending and completing college after completion of a private high school. Third, the role of family background in private high school attendance and wages, albeit only for a sub-sample of our data. Fourth, the extent to which attending a private high school is associated with better professional networks and access to higher paying and more stable jobs. We find that attending a private high school does not affect the probability to enroll into college nor to graduate from college. Moreover, private high school attendance maintains a strong positive effect on wages for college graduates even after controlling for measures of school quality and family back-

²In Mexico there are both very prestigious private universities such as the Autonomous Technological Institute of Mexico (ITAM), and public universities such as the National Autonomous University of Mexico (UNAM).

ground. We also find no differences in the types of jobs performed by college graduates that attended a private and a public high school, at least for the first two jobs after college graduation.

The young age of our sample (23-35) allows estimating the short run return to private education, which could change in the long run if an individual's earning potential is affected more by job experience than by the type of school attended. We thus conclude that our results provide strong evidence of an independent effect of studying in a private relative to a public high school on college earnings, at least in the short run. This independent effect could partly capture the impact of unobserved factors, such as peer effects, that the data available do not allow measuring.

The remainder of the paper is organized as follows. Section 2 describes the private and public high school sectors in Mexico and their evolution across states over the last decades. Section 3 describes the data and presents summary statistics together with descriptive evidence of the effect of private and public high school education on wages. Section 4 outlines the empirical framework. Section 5 presents and discusses the main results. Section 6 and 7 discuss the validity of the instruments and alternative explanations of the main results. Section 8 concludes. All Figures and Tables are included in the Appendix.

2 Public and Private High Schools in Mexico

The Mexican education system is one of the largest in Latin America covering 33.3 million students in 2008, or 31.5% of the country's population (SEP 2008). Twelve years of formal education are completed prior to college: six years of primary, three years of secondary, and two or three years of high school. In 2008 the enrolment rate at high school was 61%, of which about 19% was in a private school (SEP 2008).

There are three main types of high school education: (i) *bachillerato general*, which leads students on an academic track in preparation for college education; (ii) *bachillerato tecnológico*, which teaches predominantly technical skills and prepares students for either vocational work or for higher education to become qualified technicians in specific areas; and (iii) *profesional técnico*, which is a two-year program designed for students that wish to obtain a markedly more technical or vocational training.³

These different types of high school education are offered by a mixture of public and private institutions either in schools or via distance education. Private schools are legally established after obtaining an official license, the *Reconocimiento de Validez Oficial* (RVOE), which is offered by the federal and state governments and ensures that the basic educational and teaching standards established by the General Education Law act of

³*Profesional técnico* used to be a terminal degree that did not allow continuation into higher education. However, since the beginning of the 1990s, students in this education track can enrol in university conditional on completing certain courses. The 2009 Integral Reform of Higher Education (*Reforma Integral de la Educación Media Superior*) consolidated the different study plans by setting common standards, improving their curricular content and allowing for student mobility across plans.

1983 are achieved. Once RVOE has been obtained, there is no further regulation as to the quality or type of academic programs offered by private institutions.

Enrolment in both public and private high schools is generally open up to capacity and, if there is excess demand, schools administer an entrance exam to select students.⁴ However, there are some monetary barriers to entrance. Public high schools are free of charge as they are funded through funds from the federal, state, or municipal governments even if students are often encouraged to give a voluntary contribution.⁵ On the contrary, private high schools are primarily financed via tuition fees. In addition, students in either type of school have to pay the costs of exam fees, transport and/or other living costs, and schooling materials. Data from the Mexican National Consumption and Expenditure Survey (*Encuesta Nacional de Ingresos y Gastos de los Hogares* or ENIGH) for 2002 on the direct costs of studying (books and other materials, exams, boarding, etc.) show that the average cost of attending a public high school amounts to around 15% of median yearly household income, whereas the average cost of attending a private high school amounts to around 23%.

There are no public subsidies to private schooling in primary and secondary education, while there are some programs that finance poor students through private high schools and colleges. The main fellowship program is offered in the context of *Oportunidades*, the biggest anti-poverty program in Mexico, which covers 5 million families all over the country.⁶ The educational component of the program provides cash transfers to poor families conditional on children's regular school attendance in primary, secondary and, starting in 2001, high school education.

Since 2003 an additional component of the program, *Jóvenes con Oportunidades*, provides incentives to complete high school by depositing points (exchangeable for Mexican pesos) for each high school grade passed in an account under the student's name. At the end of high school, the student has two alternative options: wait for two years and cash in the account balance plus interests; or have immediate access to the funds conditional on using them to either attend college, purchase health insurance, get a loan to start a business, or apply for public housing.⁷

Student loan programs are also very limited in scope and coverage, and only provide resources to study at university. In 2007 only around 2% of Mexican students benefited from a student loan (*Educafin* 2007), which is a very small proportion even relative to other Latin American countries such as Colombia (9%) and Brazil (6%). The largest student loan scheme, SOFES (*Sociedad Fomento a la Educación Superior*), is run by a consortium of private universities and covers 1.5% of students. While loans are allocated

⁴Note that public high schools in the metropolitan area of Mexico City recruit students through a public competition with no exception (see <http://www.comipems.org.mx>).

⁵The amount of the suggested contribution varies depending on the poverty level of the area where the school is located, the specific needs of the school, and the administrative authority (federal government, state government or autonomous).

⁶www.oportunidades.gob.mx/informacion_general/main.html

⁷However, note that neither *Jóvenes con Oportunidades* nor the high school component of *Oportunidades* affected our sample since all individuals entered high school before the year 2001.

on the basis of need and merit, students that can provide collaterals are preferred. There are also two additional very small programs: ICEES in Sonora State and ICEET in Tamaulipas.

2.1 Trends in the Provision of High School Education

While the main provider of primary and secondary education in Mexico continues to be the public sector, the private sector has been playing an increasingly important role in the provision of high school and college education. At college, the fast expansion of private education has been extensively documented (World Bank 2005; Prieto 2010); on the contrary, changes in the provision of private and public high school education have received much less attention. In this section, we use yearly school census data between 1970 and 2000 to document these changes.⁸

The provision of high school education has been characterized by significant differences in the expansion and size of the private and public sectors that have developed at differential rates over time and across states. After a period of sustained growth until the beginning of the 1980s, the number of public high schools over the 16-18 age population group⁹ jumped up in the mid-1980s, and steadily increased since then. The private sector also expanded but did not experience such a dramatic increase (see Figure 1). Overall, between 1985 and 2000 the per capita number of both private and public high schools almost doubled.

The increase in the number of public high schools in the mid-1980s was the result of a long term change in educational policies that started in the 1950s with the expansion of primary and secondary education, and accelerated in the 1970s as a result of a government strategy to increasing social pressure due to demographic changes, rising enrollment rates at secondary education, a process of urbanization, and the emergence of an educated middle class (Gómez 1999). While boosting the public high school sector, the Mexican government promoted the development of new types of high school education with increased resources devoted to technological-type high schools so that students could enter the qualified work force immediately. Consistently, the proportion of technological high school students (over the total number of high school students) increased from 10.37% to 18.93% between 1980 and 1985 (Domínguez and Pérez 1993).¹⁰

The sustained growth in the number of high schools resulted into increasing enrolment rates in both public and private schools, as shown in Figure 2, which presents the total number of private and public high school entrants divided by the 16-18 age population group. Enrolments in public high school, however, increased faster and by the year 2000

⁸The next section will provide a detailed description of these data.

⁹Population data obtained from the National Population Council (*Consejo Nacional de Población* or CONAPO): <http://www.conapo.gob.mx/>

¹⁰This change in education policy was in line with the recommendations set forth by international organizations such as UNESCO and the World Bank that advocated for channelling funds to basic and technological education, which was thought to have the highest rate of return (Gómez 1999).

the number of high school entrants was over eight times the one in 1970 for private high schools and over ten times the one in 1970 in the public sector.

Despite rising enrolment rates, the number of public high schools increased more than the number of students. As a consequence, the size of the public sector, as measured by the number of students per public high school, has been steadily decreasing since the beginning of the 1980s (Figure 3). In contrast, the number of students per private high school remained almost unchanged throughout the 1970s, 1980s and 1990s.

Arguably, the changes in the availability and size of the private and public high school sector between the mid- to late-1980s and the year 2000 (Figure 1 and 3) affected the educational decisions of teenagers about to start high school in that period. As it will be further discussed below, there is also substantial variation in high schools' availability and size across states. Hence, in the next sections, we will focus on the sample of workers aged 23 to 35 in 2008, that is on the sample of those that made their high school decisions in the 1990s, and we will exploit the variation in the availability of private and public high schools by state and year between 1988 and 2000 to identify the effect of studying in a private or public high school on wages.

3 Data

3.1 Data Sources

We use two main sources of data for the empirical analysis: the National Survey on Labor and Educational Trajectories (*Encuesta Nacional de Trayectorias Educativas y Laborales* or ENTELEMS) and the Mexican School Census (*Censo Escolar* or *Estadística 911*).

The ENTELEMS survey was collected by the division of the Secretariat of Public Education (*Secretaría de Educación Pública* or SEP) in charge of high school education. It was administered to all individuals aged between 15 and 35 who had completed at least one year of high school education and were living in households included in the third round of the 2008 Mexican National Employment Survey (*Encuesta Nacional de Ocupación y Empleo* or ENOE).¹¹ If there was more than one household member satisfying these characteristics in any given household, the individual whose birth date was closer to the date of the interview was included. Overall, the ENTELEMS surveyed 34,901 individuals, or about 8.5% of the individuals surveyed in the 2008 ENOE.

The survey contains information on basic individual characteristics (sex, age, marital status, if an individual is the head of household, and number of children even if only for women), current and previous employment status, type of employment, hours of work, wages, years of high school and college education completed, state where high school and college were attended, and, crucially for us, whether the individual attended a private or

¹¹The ENOE is Mexico's main employment survey and is collected by the National Statistical Office (INEGI) every three months on a nationally representative sample of 120,260 households. It has a rotate panel structure (every trimester, the fifth of the sample that has already been visited five times is replaced) and it collects detailed information on employment, education and household socio-demographics.

a public high school and/or college.¹² For those individuals living with their parents, it is also possible to construct some family background variables (parental education and type of employment) exploiting the information available in the ENOE. In addition, for the sub-sample of those aged between 15 and 29, the ENTELEMS includes a module on employment trajectories, which we will exploit in Section 7.4. We deflate all wages to June 2011 using the most recent National Consumer Price Index data available at the time of the analysis.

The Mexican School Census contains yearly information on the number of schools, teachers, students and classes for each of the 32 Mexican states by education level and by type of school (public/private) since 1970. Data from 1970 to 1989 are recorded on paper while data from 1990 onwards are available on line from the SEP website.¹³ We have combined these historical series to construct one single dataset that includes the number of schools, teachers, students and classes by year and by state in both private and public high schools from 1970 to 2000. We use these data to construct various measures of school quality, such as the student teacher ratio and the student class ratio, as well as the measures of school availability and size of the education sector described in Section 2.1.

We merge the ENTELEMS and the Mexican School Census datasets by state of residence in 2008 and by year at age 15, which is the median age of entry into high school in the sample and in the country. About 90% of the individuals in the sample reside in the state where they went to high school and 84% continue to live in the state where they were born. Hence, the choice of the relevant state—birth, high school attendance, residence in 2008—at which to merge the information is trivial, and results (available upon request) are robust to this choice. Regarding the year of entry to high school, the ENTELEMS explicitly asks for this information. However, the question is only answered meaningfully by a small proportion of the sample (about 40%) as there are a lot of missing observations and inconsistent answers (i.e. reports that are at odds with the age and educational achievement of the respondent in 2008).¹⁴ Therefore, we assume that all individuals started high school at age 15, the sample median age of starting high school, and we merge the measures of school availability in the year when the individual was 15 years old.

¹²To the best of our knowledge, the only other available Mexican survey that includes data on the public/private type of high school attended are the Mexican Family Life Survey (MxFLS) and the ENILEMS Survey, although only for a very small number of workers.

¹³<http://www.sep.gob.mx/>

¹⁴Of those reporting valid and consistent answers, 50% report to have started high school at age 15, 20% at age 16, 13% percent at age 17, and the other 17% at age 18 or later. Individuals can be older than 15 when they start high school if they have repeated grades at primary and secondary education or if they have worked for some years before enrolling at high school. Unfortunately, the ENTELEMS contains no information regarding the reasons for delayed high school entry.

3.2 Sample and Descriptive Statistics

Our final sample consists of 8,523 workers aged between 23 and 35, 27% (2,327) of which attended a private high school (Table 1). We restrict the sample of analysis to workers that are at least 23 years old and are not studying at the time of the survey, so as to focus on the subset of individuals that have completed education, possibly including college, and are fully participating in the labor market. As discussed above, and given that we take the sample (and national) median entry age to high school to proxy for the actual entry age, we assume that individuals in our sample started high school between 1988 and 2000.

In Figure 4 we plot the proportion of individuals in the sample that attended a private or a public high school by age cohort; and in Figure 5, the distribution of individuals by state and type of school attended. As shown in Figure 4, the proportion of individuals that attended a private or a public high school is well distributed across cohorts. We also observe lower enrolments in private high schools amongst younger cohorts: while only 22% to 24% of the 23-25 year old studied in a private high school, about 30% of the 32-35 year old cohorts did. This is consistent with the larger increase in the per capita number of public high schools with respect to the per capita number of private high schools in the 1990s, which we discussed in Section 2.1. The sample is less well balanced across states (Figure 5), which is likely due to differences in the availability of high schools of each type by state. We will get back to this point in Section 6.1.

Table 1 presents summary statistics on the sample of analysis. On average, private high school attendants are more likely to be female, have a higher probability to live with their parents (and consistently, a lower probability of being heads of household), and are less likely to be working for someone (as opposed to being self-employed) and married or in partnership (as opposed to being single). Importantly, while high school completion rates are higher for those that attended a public high school, the proportion of those attending and graduating from college does not depend on whether a private or a public high school was attended. We will come back to this point in Section 7.2.

3.3 Preliminary Evidence on Wage Returns

Table 2 compares raw means of real hourly wages (in 2011 prices) between workers that attended a private high school and workers that attended a public high school by the highest level of education achieved. The last column reports the t-statistic of the difference in these means.¹⁵ We find that hourly wages are neither significantly different between individuals that have studied in a private or a public high school for the entire sample of workers (last row), nor for the sub-samples that have at most high school completed or some years of college (first two rows).

¹⁵Note that real wages appear to be non-monotonic with educational attainment for those that attended a public high school. This is due to significant variation in wages between states. Within-state wages are monotonic with educational attainment. We will include state fixed effects in all empirical specifications to control for this.

On the contrary, we observe a statistically significant difference in mean wages for college graduates: college graduates that have studied in a private high school earn, on average, \$7.5 pesos more per hour than college graduates that have studied in a public high school. This difference may be suggestive of a wage premium associated to studying at a private high school, for example due to a higher quality of education offered by private schools. Consistently with this indicative evidence, individuals in the sample report perceived prestige/quality of the school as the most common reason why they chose to study in a private high school. On the other hand, the most commonly reported reason to study in a public high school is distance to the house. Interest in the subjects and courses offered by a given high school ranks as the second most important reason to attend both private and public high schools.

Clearly, the observed wage premium to college graduates that have attended a private high school may be driven by several factors including individual and household characteristics that simultaneously affect school performance and wages. For example, it may be the case that private high schools attract better performing students, or rather, that better performing students prefer to study at private high schools because these schools are perceived to provide education of higher quality. Or it could even be the case that the perception of private schools offering higher quality education comes from the universities themselves with prestigious colleges preferentially enrolling students that attended a private high school.

In the next sections we will try to separately identify these different factors. We will first present and estimate an empirical specification that accounts for self-selection into a private or a public high school. We will then discuss the validity of the empirical strategy, assess the robustness of the results, and explore alternative mechanisms that may explain our findings.

4 Empirical Framework

In order to quantify the wage returns to attending a private relative to a public high school, we specify the following standard wage equation:

$$w_{ija}^s = \beta_0 + \xi_j + \lambda_a + \delta PvHS_{ija} + X'_{ija}\beta + \varepsilon_{ija}^s \quad (1)$$

where w_{ija}^s is the logarithm of real hourly earnings for individual i aged a with education level $s = \{\text{high school, college}\}$, and living in state j . $PvHS_{ija}$, our main variable of interest, is an indicator variable that equals one if i studied in a private high school, and zero otherwise. X_{ija} is a matrix of observable individual characteristics that were predetermined at the time when the private/public high school choice was made and thus might have affected this choice, namely gender and a dummy accounting for whether i lives with her parents.¹⁶ ξ_j are dummies for the state of residence in 2008, which are included to control for any permanent regional difference and labor market trend that

¹⁶On the contrary, other individual characteristics that are observed in the ENTELEMS survey, namely

could affect earnings; λ_a are cohort dummies to account for time effects; ε_{ija}^s is the error term.

$\hat{\delta}$ measures the estimated effect of having studied in a private relative to a public high school on wages. This estimate will be biased if students sort themselves into private and public high schools based on factors that are not accounted for in the regression but that matter for wages. A classic example is sorting by ability: if better performing or more able students prefer to enroll in private high schools, $\hat{\delta}$ will reflect both students quality or type and the independent effect of private schooling on wages.

In order to correct for self-selection, we instrument the private/public high school choice with two measures of relative availability of public with respect to private high schools in the state and at the time when the high school choice was made. Specifically, we use: (i) the logarithm of the share of public high schools, $SharePb_{ij\bar{a}}^s$; and (ii) the logarithm of the relative size of public high schools, $SizePb_{ij\bar{a}}^s$. Both $SharePb_{ij\bar{a}}^s$ and $SizePb_{ij\bar{a}}^s$ are measured in the state of residence and in the year when individual i was $\bar{a} = 15$ years old, that is about to start high school.

We construct $SharePb_{ij\bar{a}}^s$ by dividing the number of public high schools over the total (private and public) number of high schools in a given state and year. $SharePb_{ij\bar{a}}^s$ measures the *share* or proportion of public high schools and it is a proxy for the *potential* availability of public relative to private high schools right before the individual enters high school. The *effective* relative availability of public high schools will depend both on the number of schools and on the number of vacancies in a school (i.e. on the size of the school). In the absence of data on the actual number of places available in a given school, we use the number of students enrolled in a school as a proxy of the size of the school and therefore of the school's capacity. We construct $SizePb_{ij\bar{a}}^s$ by dividing the total number of students enrolled in public high schools in a given state and year over the total number of students enrolled in high schools (private and public) in that state and year. $SizePb_{ij\bar{a}}^s$ is therefore a measure of the *relative size* of the public high school sector: the higher the proportion of students in public high schools, the larger the relative size of the public high school sector.

Taken together the two variables $SharePb_{ij\bar{a}}^s$ and $SizePb_{ij\bar{a}}^s$ are meant to capture the *effective availability* of public relative to private high schools, which we expect to significantly affect the individual choice of studying at a private/public high school. We thus jointly estimate the wage equation (1) together with the following school equation:

$$PvHS_{ija} = \tilde{\beta}_0 + \tilde{\xi}_j + \tilde{\lambda}_a + X'_{ija}\tilde{\beta} + Z'_{ij\bar{a}}\gamma + \omega_{ija} \quad (2)$$

where $Z_{ij\bar{a}} \equiv \{SharePb_{ij\bar{a}}^s, SizePb_{ij\bar{a}}^s\}$ are the instruments and ω_{ija} is the error term.

being married, being a head of household and being employed as a wage worker or rather as a self-employee might have been affected by the choice of attending a private or a public high school, and are thus not included in the main specification. However, that all main findings are robust to the inclusion of these additional variables (results available upon request).

5 Main Results

Table 3 presents 2SLS estimates of equations (1) and (2) for the overall sample (column 1), and for three different sub-samples that condition on the highest level of education achieved: completed high school education (column 2), uncompleted college (column 3), and completed college (column 4).

We find an overall wage premium of 46% to having attended a private high school for the entire sample of workers – i.e. irrespective of stopping studying at high school or rather continuing onto college (column 1). This premium increases to 50% for those that entered but did not complete college (column 3), and to 54% for college graduates (column 4). On the contrary, we find no differential wage returns to completing a private relative to a public high school for those that enter the labor market upon high school graduation (column 2).

In the first stage both instruments are highly significant and have the expected sign: an increase in the share and relative size of public high schools decreases the probability of graduating from a private relative to a public high school. The first-stage statistics show that the instruments are strong predictors of the private/public high school choice (probability of the first stage F-test statistic much lower than 0.05 and Cragg-Donalds F-statistic much bigger than 10), and the Sargan test for over-identifying restrictions cannot reject the null that the instruments are uncorrelated with the error term.¹⁷

5.1 Interpretation of Results

The strong estimated effect of attending a private high school on wages conditional on college completion (column 4 Table 3) is consistent with the evidence observed in the raw data (Table 2), and implies that returns to college are substantially larger if a private rather than a public high school was attended. An extensive literature has discussed the interpretation of the IV estimates of the returns to education as the wage returns for the individuals induced to change their schooling by the instrument (e.g. Card 1999; 2001), and interpreted high returns for "switchers" as evidence that they face higher marginal costs of schooling due, for example, to binding credit constraints (Card 2001). In our context this interpretation would suggest that the marginal returns to education among those that attend private high schools are relatively high because of higher marginal costs of schooling, which is consistent with private high schools being more expensive than the public ones (Section 2). As discussed in Section 2, ENIGH data show that the average education cost (over median household income) is 8% higher for students in private than in public high schools. Thus, net of direct education costs, having attended a private relative to a public high school is associated with 46% (54-8) higher returns to college.

¹⁷We do not estimate returns to private and public colleges separately since they are two very heterogeneous groups that cannot be consistently compared. As discussed in the Introduction, in the absence of information on the actual public and private college attended, it is very difficult to interpret any estimates on the return to having attended a public versus a private college in any meaningful way.

A useful way to interpret this finding is by computing the contribution of attending a private high school to the return to college unconditional on the type of high school attended. We can obtain an estimate of the overall return to college by estimating equation (1) for the sub-sample of those with at least completed high school and by replacing $PvHS_{ija}$ with an indicator function that equals one if individual i has completed college, and zero otherwise. We find that returns to college are at around 10%, that is, on average, someone with a college degree earns 10% more than someone with a high school degree. Thus, net of high school direct education costs, having attended a private relative to a public high school explains, on average, around 22% ($0.10/0.46$) of the college wage returns.

6 Validity of the Instruments

By jointly estimating equations (1) and (2) we have identified the effect of studying in a private relative to a public high school on wages through the variation in the share and in the relative size of public high schools across age cohorts and states. The validity of our findings depends on the validity of the instruments, which in turn relies on the instruments having enough variation over time and across states, and on them being strongly correlated with the choice of studying at a private/public high school, exogenous and satisfying the exclusion restriction.

6.1 Variation and Strength of the Instruments

Figure 6 presents the variation in $SharePb_{ija}^s$ and $SizePb_{ija}^s$ for those aged between 23 and 35 in 2008, or, equivalently, for those aged 15 between 1987 and 2000. As shown, the share of the public high school sector (the proportion of public high schools over the total number of private and public high schools) increased from a minimum value of 0.62 in 1987 to a maximum value of 0.64 ten years later, while the relative size of the public high school sector (the proportion of students enrolled in public high schools) decreased from around 0.74 in 1987 to 0.69 in the year 2000.

Figures 1 and 2, presented in Section 2.1, provide further evidence on the variation of the instruments across age cohorts. Between 1987 and 2000, the public sector continued to be the main high school education provider and expanded faster than the private sector with a larger increase in the per capita number of public high schools, especially after 1993 (Figure 1). As already discussed, the expansion of the public sector started in the 1970s as a government strategy to respond to demographic and socio-economic changes that increased the potential demand for high school education (Gómez 1999). Not surprisingly, as shown in Figure 2, enrolment rates in public high schools increased by 10 percentage points during the 1990s. On the other hand, enrolment rates in the private sector started to increase slightly later (around 1995), increased much less (by around 3%) and remained substantially lower (at 9% in private high schools and 33% in

public high schools).

The maps in Figures 7 and 8 illustrate the variation in the instruments across states in 1987 and 2000, which are the years when the oldest and youngest cohort in the sample were about to start high school. As shown, both the proportion (share) of public high schools and its relative size vary substantially across states. Moreover, not all states follow a similar trend over time: the relative availability of the public sector increased in some states, while it remained almost constant or decreased in some others.

In addition to showing enough variation to identify the effect of interest, a valid instrumental variable has to be strongly correlated with the endogenous explanatory variable that it instruments. In our setting, this means that the two measures of the share and the relative size of public high schools in the state and in the year of high school enrolment have to be significantly correlated with the individual decision to attend a private or a public high school. It seems plausible to expect that if the proportion of public high schools and their relative size increase at the state level, students are more (less) likely to enroll in a public (private) high school. One may be concerned, however, that individual schooling decisions are driven by the educational supply at a more local level such as the province or the town of residence. This is unlikely to be the case in Mexico, where within-state migration has become more and more common since 1970, especially towards medium-sized cities (CONAPO 1999). Consistently, the first stage results in Table 3 show that our state-level measures of schools' availability are strong determinants of the private/public high school choice.

6.2 Endogenous Placement Bias, State-Level Variables and Between-States Migration

In our setting, the exogeneity condition requires that the instruments are uncorrelated with the individual demand for schooling, or, in other words, that there is no feedback effect from the individual demand for high school education to the aggregate relative availability and size of public high schools in a given state at different points in time. As discussed in Section 2.1, the number of students per private high school remained almost unchanged throughout the 1970s, 1980s and 1990s, which is consistent with the demand for private high school having not changed over time. On the contrary, the steady increase since the early 1980s in the number of students per public high school (Figure 3) is evidence of an increasing demand for public high school education that could, in principle, have triggered the supply response that we document in Figure 1.

Three main considerations allow to partially dismiss the concern that the increase in the number of public high schools is demand driven. First, as discussed in Section 2.1, the number of public high schools increased much more than the number of students, so that, consistently, the size of the public sector has been steadily decreasing since the beginning of the 1980s (Figure 3). Second, the steady increase in the per capita number of public high schools shown in Figure 1 was the result of a governmental policy to raise average educational attainment and respond to demographic pressures. Third, the inclusion of

state and cohort dummies in equation (1) and (2) allows to control for any aggregate variable that could be correlated with the individual demand for schooling and, in turn, with the aggregate demand for schooling (such as the supply of health care facilities in a given state and year), as well as for any other indicator that could induce the state or federal government to expand the supply of educational services in one particular state and year (for example, lower enrolment and educational attainment rates, or lower income levels in a given state and year).¹⁸

However, it could still be the case that the relative increase in the number of public high schools was non-random if the government policy to expand public education had a compensatory nature—i.e. if it increased school availability more in states that had fewer high schools before the expansion. The lack of an identifiable pattern in the variation of the instruments across states and over time plotted in Figures 7 and 8 suggests that endogenous placement bias is not a serious concern. Nonetheless, to further dismiss this concern, we re-estimate equations (1) and (2) by adding interaction terms between cohort dummies and enrolment rates in 1980, that is before the booming expansion of the mid-1980s (Section 2.1). Model 1 in Table 4 reports the results. As shown, returns to college conditional on private high school attendance remain positive and significant, at 62%, and first stage estimates confirm the ability of the instruments to predict the choice of high school.

Compliance with the exclusion restriction relies on the instruments affecting wages only through their effect on the decision to enroll in a private or public high school. While this assumption is not directly testable, we can assess the robustness of our results to a number of threats to its validity. For example, there could be time-varying and state-specific variables, such as GDP, that are correlated with changes over time in the availability of education and that also matter for wages. If states adjusted expenditure on education to GDP, changes in the availability of education in a given state could be correlated with changes in GDP in that state. We thus re-estimate the model by including the average per capita GDP growth by state in the period under consideration (Model 2 Table 4).¹⁹ We also re-estimate the model with state-specific time trends by controlling for a full set of state-period interactions (Model 3 Table 4). We consider four periods: 1988 to 1992, 1992 to 1994, 1995 to 1997, and 1998 to 2000, and use period 1988 to 1992 as the reference group. Results in Model 2 Table 4 show that the inclusion of GDP growth does not significantly affect the probability of attending neither a private high school nor hourly earnings. As a consequence, results are very similar to those in our benchmark model with the returns to college, conditional on private high school attendance, being estimated at around 54%. Results in Model 3 also show significant positive returns to college after private high school attendance, at around 60%. In both models, the instruments continue

¹⁸We are not the first to use aggregate measures of education supply as an instrument for educational choices arguing that aggregate availability of schools does not have a direct impact on earnings once its effect via education has been taken into account. A commonly used supply-side measure is distance to school (Card 1999).

¹⁹Data on per capita GDP by state are only available between 1993 and 2000.

to be significant and strong in the first stage.

An additional threat to the exclusion condition is the existence of unobservable characteristics that affect both wages and the choice of school, such as individual tastes that motivate between-state migration in search for better schools. If there is migration across states, the estimated impact of the schooling availability measures on the choice of attending a private or rather a public high school would reflect in part individual self-selection. As discussed in Section 3.1, about 84% of the individuals in the sample reside in the state where they were born and 90% continue to live in the state where they went to high school. Hence, the proportion of students in the sample that moved states in search of better educational opportunities is likely to be very small and certainly insufficient to bias the estimation results. Moreover, the proportion of those that attended high school in a state other than that of birth varies very little over time and, most importantly, it is not correlated with the changes in school supply.²⁰ Nonetheless, as a further robustness check, we re-estimate the model by controlling for state of birth dummies and for an indicator variable that is equal to one if the state of birth and the state of high school attendance coincide. As shown in Model 4 in Table 4, both instruments remain highly significant in the first stage and returns to college and private high school are estimated at a significant 54%.

6.3 Sensitivity to Sample Re-definition

Finally, we assess the robustness of our result to redefining the estimation sample. In particular, we exploit information in the ENTELEMS on the academic vs. technical type of high school attended, and drop from the estimation sample all individuals that studied in a technical high school (*profesional técnico*).

If attending a private high school has a positive impact on wages, and especially on the wages for those that have completed college, we would expect to estimate a stronger impact of studying at a private high school on the restricted sample of workers that followed a more academic (i.e. college-oriented) track at high school. Results in Model 5 in Table 4 confirm this expectation: returns to college if a private high school has been completed are estimated at around 56% on this sub-sample, which is 2% higher than the average returns estimated for the entire sample. The instruments remain strong and significant in the first stage.

7 Mechanisms

How to interpret the positive effect of attending a private high school on college wages? An exploration and understanding of the mechanisms driving this effect is crucial to interpret our findings and draw policy implications. We consider four possible mechanisms: (i)

²⁰The proportion of students that moved states was fairly constant between 1988 and 1994, increased in 1995, and then decreased mildly between 1996 and 2000 (results available upon request).

the higher quality of education provided by private high schools; (ii) increased school attainment due to a higher probability of attending and completing college if a private high school is attended; (iii) a more privileged family background of students attending private high schools; and (iv) increased networks and more access to better paying and more stable jobs after graduation from private schools. The exploration of these mechanisms will also offer a test of the robustness of our main results to the omission of some important variables that could affect the choice of attending a private or a public school, such as parental background and the quality of education offered in the two education sectors.

7.1 Quality of Education

A first possible interpretation of the college premium to private high schools is that these schools offer education of higher quality, which improves college readiness and performance and, in turn, will be rewarded with higher wages in the labor market.

We use data from the Mexican School Census to compare private and public high schools along a number of commonly used measures of education quality, such as the students-teacher ratio and the students-class ratio. Figures 9 and 10 report, respectively, the evolution of the number of students per teacher and the number of students per class from 1987 to 2000 for private and public high schools. Over time, the number of students per teacher is consistently higher in public high schools, which suggests that these schools offer lower quality of schooling as teachers have to share their time and attention amongst a larger number of students (Figure 9). Moreover, this “quality” gap increased during the 1990s with respect to the 1980s: by the year 2000, the number of students per teacher in public high schools was, on average, double the number of students per teacher in private high schools. Figure 10 provides additional evidence of a quality differential between private and public high schools: despite a reduction in the number of students per class in both types of schools, the rate of decrease has been faster in private high schools, thus indicating a trend towards higher quality in these schools. In 2000, there were, on average, around ten more students per class in public than in private high schools.²¹

This empirical evidence is consistent with previous results in the literature showing a higher performance in standardized assessments amongst Mexican students in private high schools. Somers, McEwan and Willms (2004) use 1997 UNESCO test score data on third and fourth grade students in ten Latin American countries and show that in Mexico students in private schools obtain higher scores. Similarly, data from the 2003 OECD Program for International Student Assessment (PISA) show that students in private high schools achieve higher scores in math than students in public high schools at each quintile of the test scores distribution (World Bank 2005). Gamboa and Waltenberg (2011) report similar results using more recent PISA information from 2006 and 2009.²²

²¹We obtain very similar results if we use alternative measures of education quality such as the number of teachers per school and the number of teachers per class, which have been used as measures of the effective supply of teachers (e.g. Black and Smith 2006; Card and Krueger 1996).

²²There is a vast literature that compares test scores of private and public schools in developing

Since 2008 the Mexican Secretariat of Public Education administers standardized examinations in math and language (reading comprehension) to all students enrolled in the last year of high school, the National Assessment of Academic Achievement in School Centers (*Evaluación Nacional del Logro Académico en Centros Escolares* or ENLACE). Consistently with the PISA evidence, ENLACE data also show higher test scores in both math and language amongst students in private high schools.²³

We assess the importance of education quality as a determinant of the wage premium to attending a private high school by including a measure of education quality—namely the log number of teachers per class in public and private schools—in the analysis. Model 6 in Table 4 presents results. Quality of education is insignificant in both the first and in the second stage and the college wage premium after having attended a private high school is estimated at around 54%, which is remarkably close to the benchmark estimate in column 4 Table 3.

Some comments are important to qualify this finding. From one side, while it shows that the college wage premium is not driven by the number of teachers per class, it does not exclude that education quality could play an important role when measured with alternative proxies such as the quality of the teachers, the quality of the curriculum followed and learning methods and practices used in private and public schools. Unfortunately, our data do not allow assessing the effect of alternative measures of education quality.

Moreover, this finding offers an additional robustness test of our main result. Indeed, education quality could have been an important omitted variable in our estimation that would have violated the exclusion restriction. In particular, the increased availability of high schools documented in Figure 6 could have affected quality of education differentially across states depending on the initial availability of schools in a given state. If so, changes in education quality could have been correlated both with changes in the availability of education and with wages. The results of Model 6 in Table 4 show that this was not the case in Mexico, thus confirming the results of our basic specification.

7.2 Increased School Attainment

A second possible explanation of the wage return is that attending a private high school promotes school attainment by increasing the probability of entering and successfully completing college education. This would be the case if, for example, private high schools offer a better education and/or incentivize students to put effort into studying.

countries. Several studies find that students in private schools achieve better results (e.g. Alderman et al. 2001 and Khan and Kiefer 2007 for Pakistan; Lassibille and Tan 2003 for Madagascar; Kindgon 1996 and Muralidharan and Kremer 2008 for India), while others reach the opposite conclusion or find no significant differences between achievement of private and public schools (e.g. Knight and Sabot 1990 for Kenya; Lassibille and Tan 2001 for Tanzania; Uribe et al. 2006 for Colombia; Rubinstein and Sekhri 2010 for India).

²³ENLACE data can be downloaded from <http://www.enlace.sep.gob.mx/>. However, using ENLACE 2008 data De Hoyos et al (2011) find no effect of private high school on test scores once a vast array of individual and parental characteristics is controlled for.

We investigate this possibility by estimating the unconditional probability of high school completion—i.e. the probability of completing high school regardless of continuation into college—as a function of private high school attendance. Next, we consider the sample of those that transitioned onto college education and estimate the effect of attending a private high school on college attendance and on college completion. We report the results in Model 7 in Table 5.²⁴

In all three regressions the first stage results show that the instruments remain very strong and affect the decision to attend a private or a public high school in the expected direction. However, we find that studying in a private high school does not give any advantage on progression from high school to college: attending a private high school does neither affect the probability of high school completion, nor the probability of college attendance and completion. These results combined with those in the previous Section are consistent with the wage premium not being due to differences in the quality of teaching provided in private and public high schools. Rather, family factors could be the driving determinant.

7.3 Family Background

The level of parental education and income could be one of the main reasons why private high schools are chosen over public ones. First, given the high costs of private schools and the very limited availability of funding for private schooling (Section 2), it could well be that only high income families can afford the costs of private education. Second, if private high schools are perceived to offer better education, it could also be that students coming from more educated families or from families with a greater interest in education select themselves into private schools so that higher earnings later on in life are the result of parental inputs (more learning resources in the house, parental preferences and motivation, genetic endowment, etc.) rather than of having studied in a private high school. Finally, families with a preference for private high schools could be better connected socially and professionally, which could in turn facilitate finding better (and better paying) jobs for their children. In short, parental background variables are likely to influence wages and education outcomes substantially.

As noted in Section 3.1, the ENTELEMS survey only reports parental background information (level of education and work status) for the sub-sample of individuals that

²⁴When estimating the probability of attending or completing a given education level, both the outcome and the endogenous variable are binary, which means that, unless the model is saturated, the first stage conditional expectation function is likely to be non-linear. This violates the linearity assumption imposed by the 2SLS estimator (Angrist 2001). Thus, we follow the two-steps procedure proposed by Wooldridge (2002, Chapter 18): we first estimate equation (2) using a probit and next, we compute the predicted probability of having studied in a private high school, which we then use as an instrument for the choice of going to a private or a public school in the attendance/completion equation that we estimate using a probit. The results obtained with the Wooldridge procedure are very similar, which suggests that the probit functional form is not contributing to stronger identification of the model. Hence, we only report the results obtained via the standard 2SLS procedure.

were living with their parents at the time of the survey, which represents less than half of our sample and it is a highly self-selected sub-sample as shown by comparing mean characteristics: on average, individuals still living with their parents are younger, less likely to be married, and importantly, are more likely to enroll in private rather than public high schools and colleges (results available upon request).²⁵

Despite this data limitation, we use this sub-sample to assess the role of parental background for college wages. We start the analysis by taking a closer look at the data. Table 6 presents a mean test comparison of log hourly earnings of private and public high school students by their mother's maximum level of education attained. Over 70% of mothers have completed college education and, interestingly, only for this sub-group are wages of college graduates that attended a private high school significantly higher than wages of college graduates that attended a public high school. This association is consistent with parental background playing an important role in the private/public high school decision and, possibly, on wages.

In order to investigate this possibility, we re-estimate equation (1) and (2) for the sub-sample of young living with their parents, by including maternal education and work status in the schooling equation. Models 7 and 8 in Table 4 present results. In the first stage, maternal education has a positive significant impact on private high school attendance and relative availability remains a strong instrument, although relative size becomes insignificant. Importantly, returns to college, given private high school attendance, remain significant between 30% (if only maternal education is included as an additional regressor) and 32% (if both maternal education and maternal employment are included).

Thus, while, as expected, the magnitude of the estimated returns decreases (from 54% to around 30%) when controlling for parental background, it remains substantial. Keeping the sample selection caveat in mind, these results show that, even if parental inputs are an important determinant of educational outcomes, attending a private rather than a public high school has an independent and significant impact on college wages.

However, families with a preference for private high schools could still be playing an important role by being better connected socially, which could in turn facilitate finding better paying jobs for their children. We investigate this possibility next.

7.4 Networks and Better Jobs After Graduation

The ENTELEMS survey contains data on the employment trajectories after college graduation for the sub-sample of those aged between 23 and 29 in 2008. We exploit these

²⁵Another Mexican survey that collects information on family background (parental education level and work status) is the Mexican Family Life Survey (MxFLS). The MxFLS reports family background information for all individuals in the sample and can be used to construct information on family networks (Angelucci, De Giorgi, Rangel and Rasul 2010). However, the waves of the MxFLS currently available contain too few workers that have attended a private high school to credibly estimate the wage returns to private schooling using IV (e.g. in the MxFLS 2005 there is information on 445 workers aged between 23 and 35 that have completed college; out of these, 75 attended a private high school and 370 attended a public high school).

data to shed light on the role of private high schools in facilitating entrance into the labor market and accessing better jobs, possibly because of family networks and contacts of the family of origin, by comparing the characteristics of their occupations (type and duration) in the first and second jobs after college graduation for private and public high school graduates. Because the data do not include the year of college graduation, we use the year of high school graduation plus five years (which is the average length of a college degree in Mexico) as a proxy. We consider the first two jobs after college graduation since only a handful of individuals report having been employed on a third job after college. This is partly due to the young age of this sub-sample of workers.

Table 7 compares the mean values of job duration (in months), weekly hours and monthly wages for the first and second job after college graduation for graduates that have attended a private or a public high school. For the first job after college graduation we additionally have some information on the type of employment—namely, whether the individual is employed or self-employed—and whether he/she holds a professional position. We consider two types of professional jobs: “type A” that includes white collar-type jobs such as teachers, doctors, lawyers, architects, designers, and consultants, executives and other high rank firm employees, and “type B” that includes liberal (arts) jobs. The final column presents the t-stat of the difference in means.

Consistently with our main findings, average wages in both the first and in the second job after college graduation are significantly higher for graduates that attended a private rather than a public high school and, interestingly, increasingly higher in the second relative to the first job after graduation. Nonetheless, we do not find any significant difference in any of the other variables considered, which suggests that both private and public high school graduates have access to similar types of jobs, at least in their first jobs, conditional on college graduation. Further, and consistently with this finding, our basic result remains unchanged if we add the type of job (salaried or self-employed) as an additional control in our benchmark model.²⁶

Finally, and importantly, unreported results (available upon request) show that by re-doing the exercise presented in Table 7 but conditional on maternal education, we find that both first and second-job wages for college graduates that attended a private high school are significantly higher than wages of college graduates that attended a public high school both for the sub-sample of those with mothers that completed college and for the sub-sample of those with mothers with less than a college degree. This finding is consistent with the lack of a significant role of family background variables to explain the private high school wage premium, which we discussed in Section 7.3.

8 Conclusions

Assessing the relative efficiency of private and public schools in developing countries is important for a number of reasons. First, the private sector can be used to expand

²⁶Results available upon request.

educational provision under conditions of increasing demand for schooling and stringency of funding for social development. Second, private schools are often regarded as more efficient than public schools, so much that families are willing to pay high tuition fees because of the greater choice on offer, which satisfies particular educational preferences (e.g. single-sex, religious schools or different language alternatives) or because private schools are regarded as an easy way of getting a degree in exchange of cash. Hence, a number of large-scale education reforms have been proposed where public schools are encouraged to mimic the technologies of private schools and access to private schools is promoted via voucher and education subsidies. A leading example is the nationwide school voucher program implemented in Chile in 1980. A more recent example is the program of subsidies to private schools introduced by the Mexican government in February 2011.²⁷

This paper measures the impact of private schooling on wages, which is an important way of assessing the relative efficiency of private and public schools. We use the significant increase in the relative availability and size of public high schools in Mexico in the 1990s by state and year as exogenous shifters that affect the individuals' decisions to enroll into high school and in turn, wages. We find evidence of substantial positive wage returns to private high school conditional on college completion: returns to graduating from college are 54% higher if a private rather than a public high school was attended, which, net of schooling costs, explains around 22% of overall college returns.

This result has important implications. In a number of developing countries attendance and completion rates at college are low despite high wage returns (e.g. Binelli, Meghir and Menezes-Filho 2010 for Brazil). Mexico is no exception and the main reason appears to be binding credit constraints: the overall costs (direct and opportunity) of college attendance and completion are unaffordable for high returns individuals (Binelli 2011; Kaufmann 2009). An important determinant of the opportunity costs of studying at college is the amount of learning acquired at high school. The substantial college wage premium if a private high school is attended means that in Mexico the opportunity costs of college education are much lower for private high school graduates, which suggests that the extent of credit constraints at college crucially depends on the private or public type of high school attended. Therefore, programs that aim at increasing college graduation rates should account for the higher opportunity costs of college attendance faced by public high schools' students and accordingly provide more generous support for these students.

We investigate four alternative mechanisms that could explain the impact of attending a private school on wages: school quality, school progression from high school to college, family background, and jobs after graduation. We find that attending a private high school does not affect school progression and retains a strong positive effect on wages when controlling for school quality, family background variables and jobs after graduation.

Unfortunately, with the data available, we cannot account for other potentially important mechanisms such as peer effects and different learning methods in private and public high schools, or for family background in a comprehensive way (i.e. controlling for

²⁷<http://www.eluniversal.com.mx/editoriales/51699.html>

an array of detailed parental variables for the full sample). Therefore, policy implications require some notes of caution. First, the positive effect of private schooling on earnings may not be generalized to students who are attending public schools. Enrolment in private high schools is expensive and those currently attending these schools are likely to have access to relatively low-cost financing. For others, the cost of private schooling may be prohibitive. Thus, while private schools improve access to education and can do so efficiently (Bravo, Mukhopadhyay and Todd 2008), the route to increase access and equity relates to the implementation of programs that address the equity concerns, such as scholarships targeted at students that cannot afford the costs of private schooling, which include foregone wages and the extra effort of studying in high quality and demanding schools. Second, if peer group effects are important to explain the differences in the performance between private and public schools (e.g. Somers, McEwan and Willms 2004 and Riddell 1993), then the effectiveness of the private alternative could become questionable since, inevitably, if some schools are able to attract students from a more privileged background, others will be less able to do so. Overall, the results of this paper motivate an effort to collect detailed data on schools, students, their peers and families in order to ascertain the exact ways in which studying at a private high school affects educational achievement and labor market outcomes, and thus understand how effective educational policies should be designed.

References

- [1] Alderman, Harold, Peter Orazem, and Elizabeth M. Paterno, (2001) "School quality, school cost, and the public/private school choices of low-income households in Pakistan", *Journal of Human Resources*, Vol. 36: 304-326.
- [2] Angelucci M., De Giorgi G., Rangel M. A. and I. Rasul (2010) "Family networks and school enrolment: Evidence from a randomized social experiment", *Journal of Public Economics*, Vol. 94: 197-221.
- [3] Angrist, Joshua D., (2001) "Estimation of Limited Dependent Variable Models with Dummy Endogenous Regressors: Simple Strategies for Empirical Practice", *Journal of Business and Economic Statistics*, Vol. 19, No. 1, pp. 2-25.
- [4] Angrist, J., Bettinger, E., Bloom, E., King, E. & Kremer, M. (2002), 'Vouchers for Private Schooling in Colombia: Evidence from a Randomized Natural Experiment', *American Economic Review*, 92(5), 1535-1558.
- [5] Asadullah Mohammad Niaz, (2009) "Returns to Private and Public Education in Bangladesh and Pakistan: A Comparative Analysis", *Journal of Asian Economics*, Vol. 20(1), pp. 77-86.
- [6] Bedi, Arjun and Ashish Garg, (2000) "The effectiveness of private versus public schools: the case of Indonesia", *Journal of Development Economics*, Vol. 61(2): 463-494.
- [7] Behrman J. R., Birdsall N., (1983) "The Quality of Schooling: Quantity Alone is Misleading", *American Economic Review*, Vol. 73, No. 5, pp. 928-946.
- [8] Brown, Celia and Clive Belfield, (2001) "The relationship between private schooling and earnings: a review of the evidence for the US and the UK", Teachers College Occasional Paper No 27, Columbia University.
- [9] Binelli C., (2011) "How the Wage-Education Profile Got More Convex: Evidence from Mexico", Mimeo.
- [10] Binelli C., Meghir C., Menezes-Filho N., (2010) "Education and Wages in Brazil", Mimeo.
- [11] Bravo D., Mukhopadhyay S., Todd P. E., (2008) "Effects of a Universal School Voucher System on Educational and Labor Market Outcomes: Evidence from Chile", Mimeo.
- [12] Calónico S., Nopo H., (2007) "Where did you go to school? Private-public differences in schooling trajectories and their role on earnings", *Well-Being and Social Policy*, Vol. 3, Num. 1, pp. 25-46.

- [13] Card D., (1999) "The causal effect of education on earnings", Chapter 30 in O. Ashenfelter & D. Card (ed.) *Handbook of Labor Economics*, pp. 1801-1863.
- [14] Card, D. (2001) "Estimating the Return to Schooling: Progress on Some Persistent Econometric Problems", *Econometrica*, 69 (5), 1127-60.
- [15] Card, D. and A. Krueger, (1996) "Labor Market Effects of School Quality: Theory and Evidence", NBER Working Paper Series 5450.
- [16] CONAPO, (1999) "25 años de cambio de la migración interna en México", Consejo Nacional de Población. México D.F.
- [17] Domínguez Álvarez Héctor and Pérez Gómez Ma. Hortensia, (1993) "El Bachillerato: Su Evolución e Influencia en la Demanda de Carreras Científicas en el Nivel de Licenciatura". *Perfiles Educativos*, octubre-diciembre, número 62, Universidad Nacional Autónoma de México, UNAM, México D.F.
- [18] De Hoyos Rafael, Juan Manuel Espino y Vicente García, (2011) "Determinantes del Logro Escolar en México: Primeros Resultados Utilizando la Prueba ENLACE Media Superior", Mimeo.
- [19] Gamboa L. F. and F. D. Waltenberg (2011) "Inequality of opportunity in educational achievement in Latin America: Evidence from PISA 2006-2009", ECINEQ WP 2011 – 206.
- [20] Gómez Roberto Rodríguez , (1999) "The modernisation of higher education in Mexico", *Higher Education Policy*, Vol. 12, Issue 1, pp. 53-67.
- [21] Griliches, Zvi (1977): "Estimating the Returns to Schooling: Some Econometric Problems," *Econometrica*, 45, 1-22.
- [22] Hensvik Lena, (2010) "Competition, wages and teacher sorting: foru lessons learned from a voucher reform", Institute for Labor Market Policy Evaluation Working Paper 2010:8.
- [23] Heckman J. J., Lochner L. J. and Petra E. Todd, (2006) "Earnings Function, Rates of Return and Treatment Effects: The Mincer Equation and Beyond", Chapter 7 *Handbook of the Economics of Education*, Volume I, Eric A. Hanushek and Finis Welch Editors.
- [24] Hopkins D., E. Ahtaridou, P. Matthews, C. Posner and D. Toledo, (2007) "Reflections on the performance of the Mexican Education System", Mimeo.
- [25] Hoxby Caroline Minter, (1994) "Do Private Schools Provide Competition for Public Schools?" NBER working paper no. 4978.

- [26] Hsieh, C.-T. & Urquiola, M. (2003), ‘When Schools Compete, How Do They Compete? An Assessment of Chile’s Nationwide School Voucher Program’, NBER Working Paper No. 10008.
- [27] Kaufmann M. Katja, (2009) "Understanding the Income Gradient in College Attendance in Mexico: The Role of Heterogeneity in Expected Returns", Mimeo.
- [28] Kent Rollin, (1993) "Higher education in Mexico: From unregulated expansion to evaluation", *Higher Education*, Vol. 25, pp. 73-83.
- [29] Khan, R. and D. Kiefer, (2007) “Educational Production Functions for Rural Pakistan: A Comparative Institutional Analysis”, *Education Economics*, 15(3): 327–342.
- [30] Kingdon, Geeta, (1996) “The quality and efficiency of public and private education: A case study of urban India”, *Oxford Bulletin of Economics and Statistics*, Vol. 58(1): 57-82.
- [31] Knight, J. B. and Sabot, R. H., (1990) *Education, Productivity and Inequality: The East African National Experiment*. Oxford University Press. New York.
- [32] Jepsen Christopher, (1999) “The Effects of Private School Competition on Student Achievement”, Mimeo.
- [33] Lassibille, G and Jee-Peng Tan, (2003) “Student Learning in Public and Private Primary Schools in Madagascar”, *Economic Development and Cultural Change*, Vol. 51: 699-717.
- [34] Lassibille, G and Jee-Peng Tan, (2001) “Are private schools more efficient than public schools? Evidence from Tanzania”, *Education Economics*, Vol. 9(2): 145-172.
- [35] MacLeod, B. and M. Urquiola, (2009) “Anti-Lemons: School Reputation and Educational Quality,” NBER Working Paper Series 15112.
- [36] Muralidharan, K. and Michal Kremer, (2008) “Public and Private Schools in Rural India”, Forthcoming in *School Choice International*, ed. by Paul Peterson and Rajashri Chakrabarti. MIT Press.
- [37] OECD, (2006) "Education at a Glance", Anexo 3, www.oecd.org/edu/eag2006.
- [38] Oliveira J. B. A., Schwartzman S., (2002) "A Escola vista por dentro". Belo Horizonte, Alfa Educativa Editora.
- [39] Parker Susan, (2003) "The Oportunidades program in Mexico", Analytical Case Study Shanghai Poverty Conference - Scaling Up Poverty Reduction.

- [40] Prieto Carlos, (2010) "Mexican Private Higher Education: The Potential of Private and Public Goods", Master of Arts Thesis, The University of British Columbia, Vancouver, Canada.
- [41] Riddell Abby Rubin, (1993) "The Evidence on Public/Private Educational Trade-Offs in Developing Countries", *International Journal of Educational Development*, Vol. 13, No. 4, pp. 373-386.
- [42] Rubinstein Y., and Sheetal Sekhri, (2010) "Do Public Colleges in Developing Countries Provide Better Education than Private ones? Evidence from General Education Sector in India", Mimeo.
- [43] SEP, (2003) "Informe Nacional sobre la Educacion Superior", México.
- [44] SEP, (2008) "Sistema Educativo de los Estados Unidos Mexicanos. Principales Cifras. Ciclo escolar 2007-2008", México.
- [45] SEP, (2008) "Reforma Integral de la Educación Media Superior. Anexo Único", México.
- [46] Somers M. A., McEwan P. J., Willms J. D., (2004) "How Effective Are Private Schools in Latin America?", *Comparative Education Review*, Vol. 48, No. 1, pp. 48-69.
- [47] Uribe, Claudia, Richard Murnane, John Willett and Marie-Andree Somers, (2006) "Expanding School Enrollment by Subsidizing Private Schools: Lessons from Bogotá", *Comparative Education Review*, Vol. 50, pp. 241-277.
- [48] Weiss, A., (1995) "Human capital versus signalling explanations of wages", *Journal of Economic Perspectives*, 9, 133-154.
- [49] Wooldridge, Jeffrey M., (2002). *Econometric Analysis of Cross Section and Panel Data*. Cambridge, MA: MIT Press.
- [50] The World Bank (2005) *Higher Education in Latin America. The International Dimension*, Hans de Wit, Isabel Christina Jaramillo, Jocelyne Gacel-Ávila, and Jane Knight Editors

APPENDIX: Figures and Tables

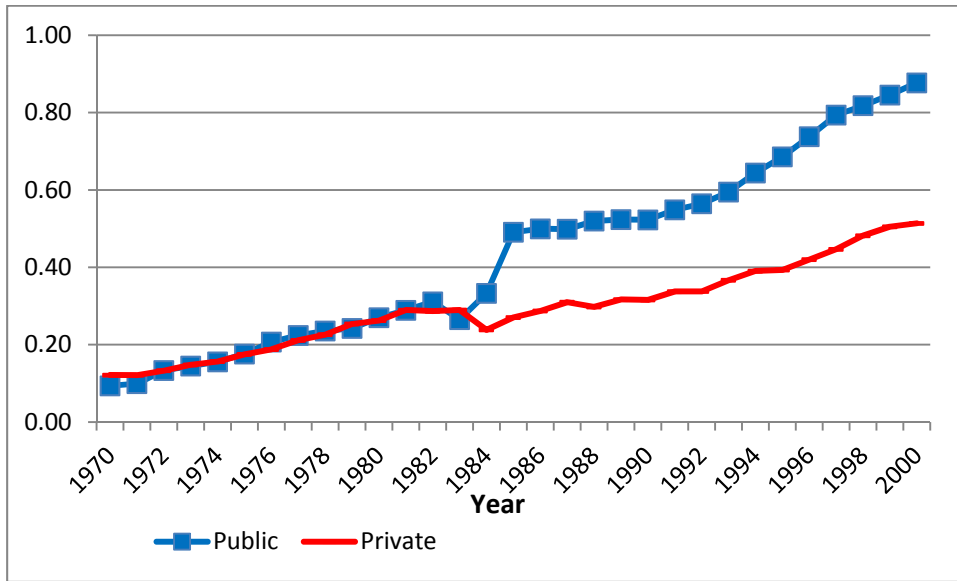


Figure 1: per capita number of public and private high schools over the 16-18 age population. Values multiplied by 1000. Source: authors' calculations based on data from the Mexican School Census.

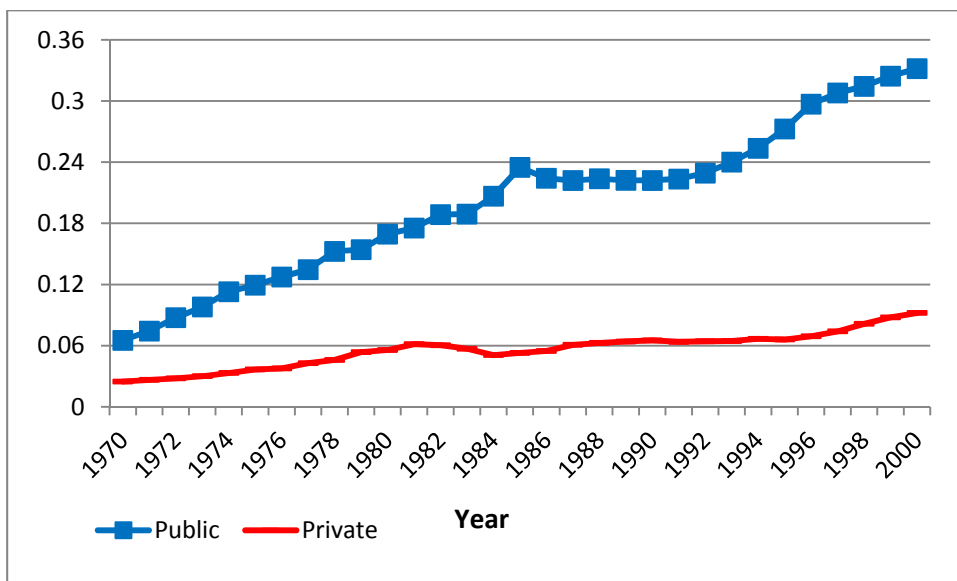


Figure 2: enrolment rate in public and private high schools. Source: authors' calculations based on data from the Mexican School Census.

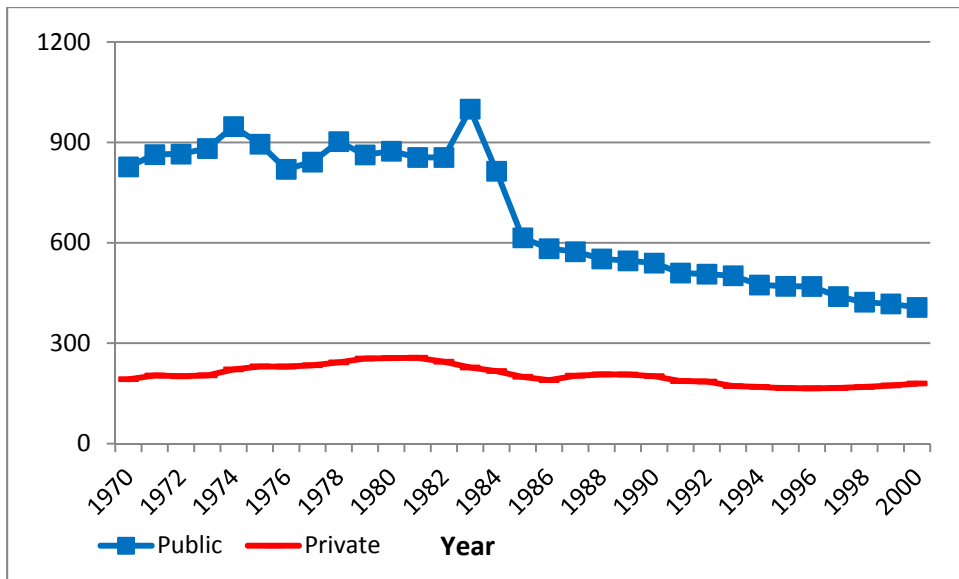


Figure 3: number of students per public and private high school.
Source: authors' calculations based on data from the Mexican School Census.

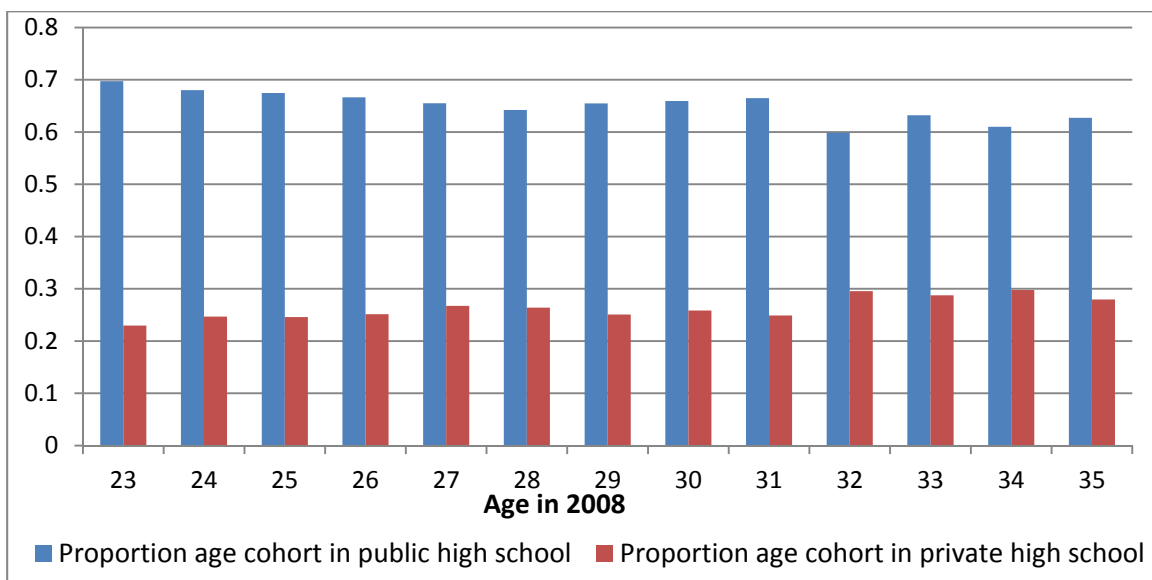


Figure 4: proportion of individuals in the sample that attended a public or a private high school by age cohort. **Source: authors' calculations based on the ENTELEMS survey.**

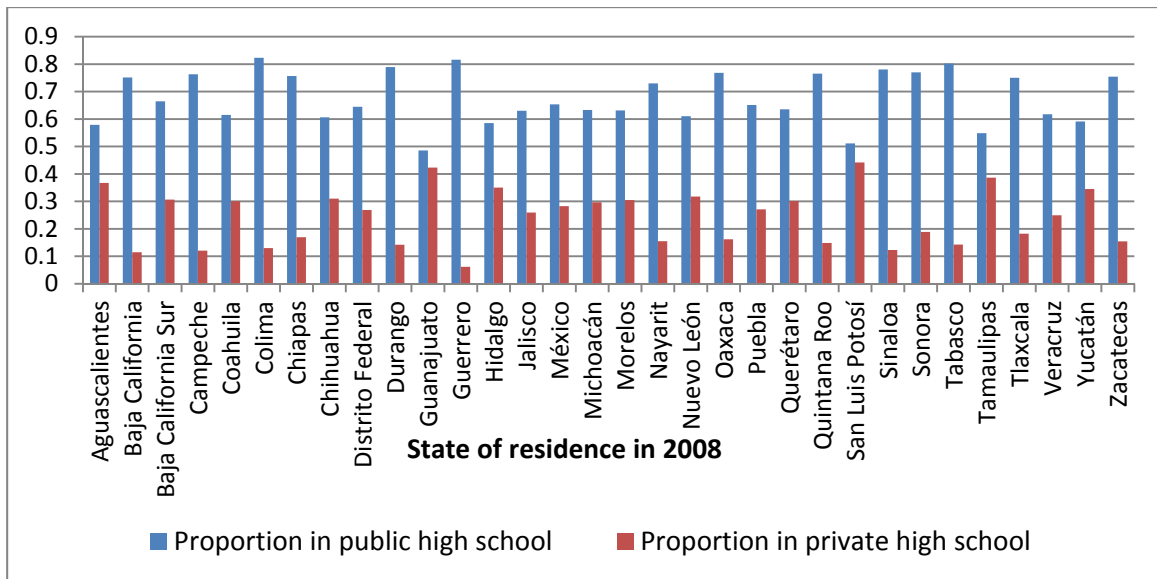


Figure 5: proportion of individuals in the sample that attended a public or private high school by state.
 Source: authors' calculations based on the ENTELEMS Survey.

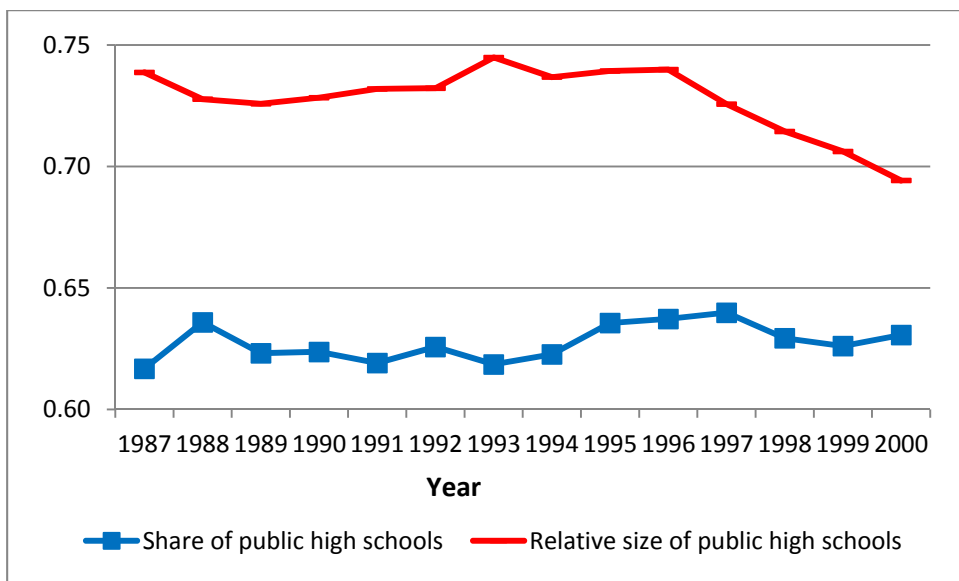


Figure 6: share and relative size of public high schools.
 Source: authors' calculations based on data from the Mexican School Census.

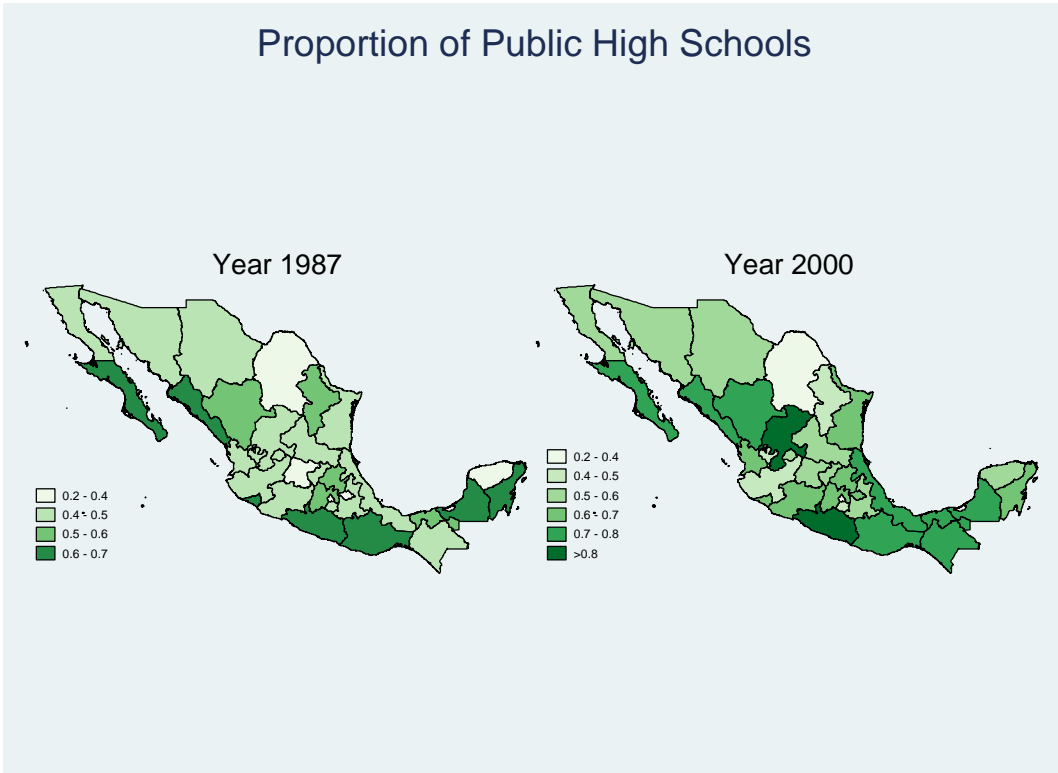


Figure 7: proportion of public high schools by state in year 1987 and 2000.
 Source: authors' calculations based on data from the Mexican School Census.

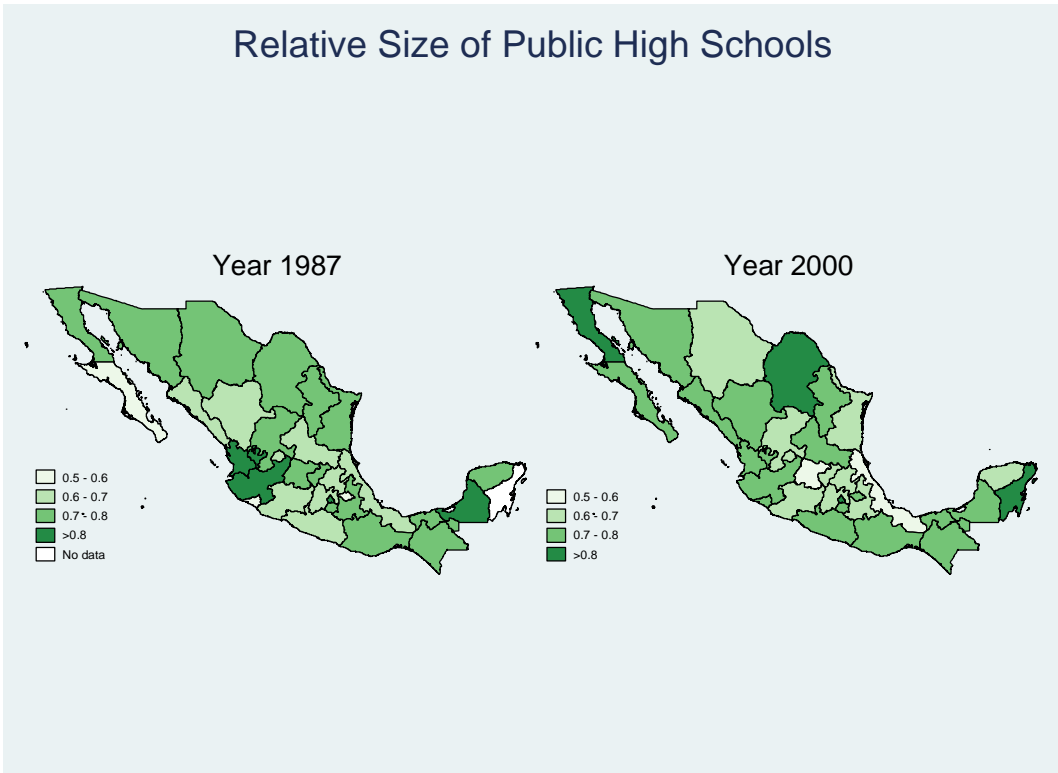


Figure 8: relative size of public high schools by state in year 1987 and 2000.
 Source: authors' calculations based on data from the Mexican School Census.

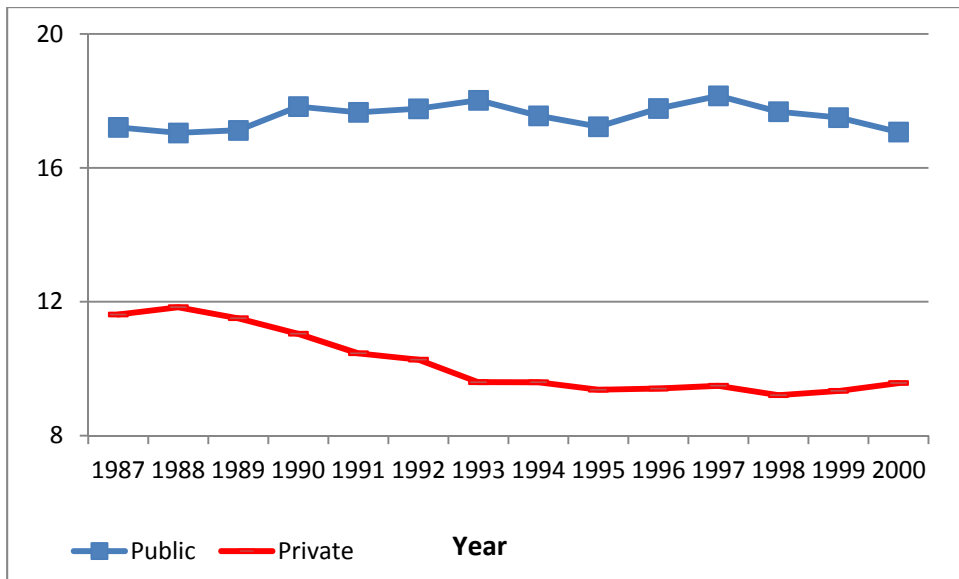


Figure 9: students per teacher in public and private high schools.
Source: authors' calculations based on data from the Mexican School Census.

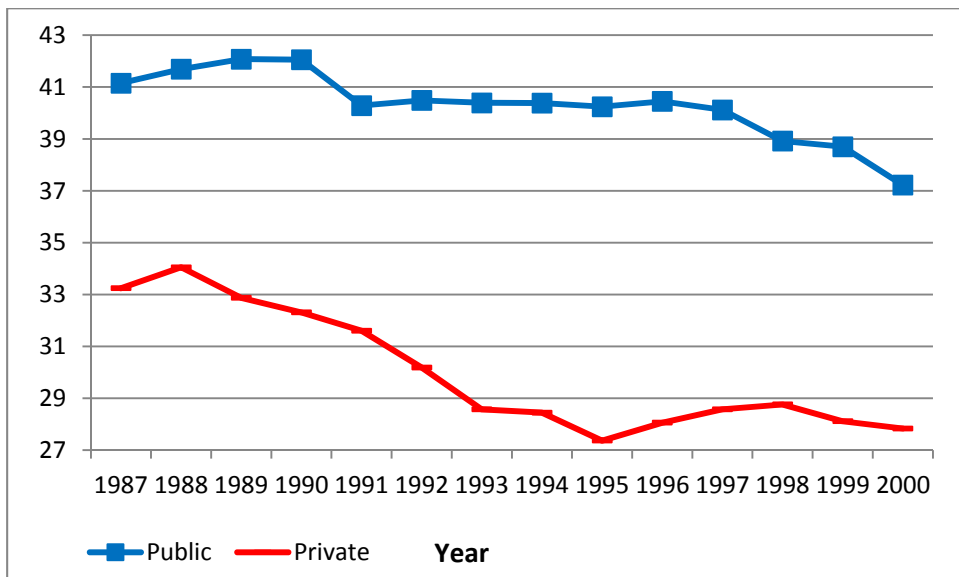


Figure 10: students per class in public and private high schools.
Source: authors' calculations based on data from the Mexican School Census.

Table 1: Descriptive Statistics

	Private High School (N=2327)		Public High School (N=6196)		t-test
	Mean	SD	Mean	SD	
Age	28.896	0.074	28.487	0.045	-4.737
Female =1	0.560	0.010	0.449	0.006	-9.201
Living with Parents =1	0.431	0.010	0.393	0.006	-3.267
Employee =1	0.826	0.008	0.874	0.004	5.622
Married or in partnership =1	0.458	0.103	0.518	0.006	4.918
Head of household =1	0.304	0.009	0.358	0.006	4.710
High School Completed =1	0.780	0.009	0.841	0.005	6.577
College Enrolment =1	0.507	0.010	0.490	0.006	-1.393
College Completed =1	0.389	0.010	0.403	0.006	1.143

Table 2: Real Hourly Earnings by Level of Education Attained and Type of High School

	Private High School		Public High School		dif	t-test
	N	Mean	N	Mean		
Completed High School	635	112.375	2172	113.565	-1.190	-0.238
Uncompleted College	1180	119.466	3037	117.476	1.990	0.596
Completed College	905	123.240	2494	115.713	7.527	2.070
All Workers	2327	116.719	6196	116.951	-0.232	-0.09

Table 3: Returns to Private High School

	Log Hourly Earnings			
	All	HS Grads	Some College	College Grads
<i>Endogenous Explanatory Variable</i>				
Private High School =1	0.467+ (0.260)	0.070 (0.632)	0.502* (0.243)	0.540* (0.271)
<i>Other Covariates</i>				
Female =1	-0.146** (0.025)	-0.149+ (0.089)	-0.081** (0.021)	-0.075** (0.027)
Living with Parents =1	-0.089** (0.018)	-0.101** (0.039)	-0.084** (0.027)	-0.103** (0.031)
<i>First Stage</i>				
lg(Share Public HS)	-0.205** (0.041)	-0.112** (0.056)	-0.297** (0.067)	-0.285** (0.077)
lg(Relative Size Public HS)	-0.335** (0.082)	-0.072 (0.131)	-0.436 (0.116)	-0.390** (0.145)
prob > F-stat First Stage	0.000	0.064	0.000	0.004
Cragg-Donald Wald F-stat	23.879	2.557	25.065	17.965
P-Value Sargan Test	0.199	0.076	0.926	0.138
Observations	8506	2800	4210	3392

Notes: State-clustered standard errors in parentheses. + $p < 0.10$, * $p < 0.05$, ** $p < 0.001$. Sample of workers aged 23 to 35 trimmed at bottom and top 0.5% of the earnings distribution. Hourly earnings are expressed in June 2011 prices. All specifications include state and cohort dummies.

Table 4: Robustness Checks and Mechanisms

	Log Hourly Earnings								
	Benchmark	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
<i>Endogenous Explanatory Variable</i>									
Private High School =1	0.540*	0.623*	0.541*	0.605*	0.539*	0.558*	0.545+	0.298+	0.318*
	(0.271)	(0.273)	(0.27)	(0.227)	(0.272)	(0.241)	(0.318)	(0.159)	(0.162)
<i>Other Covariates</i>									
Female =1	-0.075**	-0.076*	-0.075*	-0.078*	-0.075*	-0.088*	-0.075*	-0.06	-0.061
	(0.027)	(0.028)	(0.027)	(0.027)	(0.027)	(0.030)	(0.027)	(0.039)	(0.039)
Living with Parents =1	-0.103**	-0.107**	-0.103*	-0.109**	-0.103**	-0.103**	-0.103*		
	(0.031)	(0.032)	(0.031)	(0.031)	(0.032)	(0.030)	(0.033)		
State of birth same as state of high school=1					0.076+				
					(0.042)				
GDP Growth State by State 1993-2000			0.571						
			(2.807)						
Ig(Number of Teachers per Class Private HS)							-0.034		
							(0.107)		
Ig(Number of Teachers per Class Public HS)							-0.079		
							(0.111)		
<i>First Stage</i>									
Ig(Share Public HS)	-0.285**	-0.293**	-0.285**	-0.353**	-0.285**	-0.309**	-0.256**	-0.379**	-0.378**
	(0.077)	(0.078)	(0.077)	(0.076)	(0.078)	(0.086)	(0.076)	(0.115)	(0.115)
Ig(Relative Size Public HS)	-0.390**	-0.380*	-0.390*	-0.426*	-0.397*	-0.419*	-0.343*	-0.156	-0.162
	(0.145)	(0.146)	(0.145)	(0.181)	(0.151)	(0.172)	(0.158)	(0.258)	(0.261)
Gdp Growth State by State 1993-2000			-0.094						
			(1.979)						
Ig(Number of Teachers per Class Private HS)							-0.103		
							(0.070)		
Ig(Number of Teachers per Class Public HS)							0.126		
							(0.078)		
Mother's Education Level								0.053**	0.054**
								(0.007)	(0.007)
Mother is Working =1									-0.024
									(0.020)
Cohort dummies * enrollment rates 1980		YES							
State dummies*year period dummies			YES						
Dummies State of birth				YES					
prob > F-stat First Stage	0.004	0.000	0.004	0.000	0.005	0.005	0.008	0.000	0.000
Cragg-Donald Wald F-stat	17.965	18.349	17.952	22.173	18.093	17.676	13.652	38.807	29.396
P-Value Sargan Test	0.138	0.285	0.138	0.559	0.143	0.129	0.181	0.499	0.320
Observations	3392	3392	3392	3392	3389	2945	3392	1502	1502

Notes: State-clustered standard errors in parentheses. + p<0.10, * p<0.05, ** p<0.001

Sample of workers aged 23 to 35 trimmed at bottom and top 0.5% of the earnings distribution.

Model 1: interaction terms between cohort dummies and enrollment rates before high schools expansion.

Model 2: gdp growth 1993-2000 by State as additional control.

Model 3: interaction terms between State and year period (1992-1994, 1995-1997, 1998-2000) dummies. Reference group is period 1988-1991.

Model 4: State of birth dummies and indicator variable state of birth and state where high school was attended coincide.

Model 5: sample of those with bachillerato general and tecnologico.

Model 6: control for quality of education by adding log of the number of teachers per class in private and public high schools.

Model 7: mother's education as additional control.

Mother's education level: 0=no education, 1=pre-school, 2=primary, 3=secondary, 4=high school, 5, 6, & 7= college, 8=master, 9=phd

Model 8: mother's education and work status as additional controls.

Table 5: School Attainment

	HS Completion =1	College Attendance =1	College Completion =1
<i>Endogenous Explanatory Variable</i>			
Private High School =1	0.036 (0.161)	0.049 (0.208)	-0.038 (0.158)
<i>Other Covariates</i>			
Female =1	0.033* (0.015)	0.009 (0.019)	0.077** (0.014)
Living with Parents =1	0.024* (0.011)	0.113** (0.018)	0.031* (0.011)
<i>First Stage</i>			
lg(Share Public HS)	-0.205** (0.041)	-0.225** (0.049)	-0.296** (0.067)
lg(Relative Size Public HS)	-0.335 ** (0.082)	-0.276 ** (0.081)	-0.436 ** (0.116)
prob > F-stat First Stage	0.000	0.000	0.000
Cragg-Donald Wald F-stat	23.879	23.960	25.065
P-Value Sargan Test	0.741	0.409	0.028
Observations	8506	7010	4210

Notes: State-clustered standard errors in parentheses. + p<0.10, * p<0.05, ** p<0.001

Sample of workers aged 23 to 35 trimmed at bottom and top 0.5% of the earnings' distribution.

Table 6: Real Hourly Earnings by Mother's Level of Education and Type of High School

Mother's level of education	Private High School		Public High School		dif	t-test
	N	Mean	N	Mean		
Less than high school	170	104.835	675	107.127	2.293	0.317
High School	46	112.572	84	117.553	4.982	0.282
College or more	689	128.493	1735	118.964	9.529	2.195

Table 7: Jobs After Graduation

	Private High School			Public High School			T-stat
	N	Mean	SD	N	Mean	SD	
<i>First Job After College</i>							
Duration (in months)	287	16.97	15.123	816	17.40	16.860	-0.614
Weekly Hours	288	41.50	12.560	816	41.65	14.234	-0.265
Monthly Wage	286	6075.93	3241.247	813	5686.93	3494.991	2.004
Employed =1	288	0.95	0.223	816	0.95	0.208	-0.495
Self-employed =1	288	0.05	0.223	816	0.04	0.205	0.555
Professional A =1	288	0.43	0.496	816	0.43	0.496	-0.119
Professional B =1	288	0.20	0.402	816	0.22	0.417	-1.473
<i>Second Job After College</i>							
Duration (in months)	120	1.48	1.360	330	1.55	1.473	-0.749
Weekly Hours	124	40.65	15.493	325	42.29	13.237	-1.838
Monthly Wage	124	7194.19	5037.703	323	6314.75	4080.520	3.251