Nuns and the Effects of Catholic Schools
Evidence from Vatican II

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Abstract

This paper examines the causal effects of Catholic schooling on educational attainment. Using a novel instrumental-variable approach that exploits an exogenous shock to the Catholic school’s system, we show that the positive correlation between Catholic schooling and student outcomes is explained entirely by selection bias. With the universal call to holiness and the opening to lay leadership, the reforms occurring at the Second Vatican Council produced a dramatic exogenous change in the cost/benefit ratio of religious life in the Catholic church. The decline of vocations that followed contributed to a significant increase in costs and in many cases to the closure of Catholic schools. We document that this decline was heterogeneous across US dioceses and more marked in those governed by a liberal bishop. Merging diocesan data drawn from the Official Catholic Directory (1960-1980) and the US Census, we show that the variation in the supply of female religious teachers across US dioceses is strongly related with Catholic schooling. Using the abrupt decline in female vocations as an instrument for Catholic schooling, we find no evidence of positive effects on student outcomes.

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1 Introduction

Several empirical studies in the literature have attempted to frame the debate on public versus private schools, vouchers, charter schools and more generally the debate on school choice. Researchers have focused their attention on the role of Catholic schools that account for the largest share of private school analysing their performance and effectiveness. There is a substantial consensus on the positive correlations between Catholic school attendance and educational outcomes. However, a causal interpretation of these findings has been severely limited by the spurious correlation between Catholic school attendance and other unobserved characteristics that might affect educational outcomes.

Most of the previous studies attempted to estimate the effects of Catholic schooling on student outcomes using different instrumental strategies (e.g., religious affiliation, distance from the Catholic schools, density of Catholic population) and found evidence of positive effects of Catholic schooling on high school graduation and college attendance rates. However, Altonji et al. (2005) cast doubt on the holding of the exclusion restrictions for the proposed instruments. They used a different method based on the idea that selection on the observed characteristics provides a measure of the potential selection on the unobservables. They still find positive effects of Catholic schooling on high school graduation and college attendance, however their results suggest smaller effects than previous studies.

More recently Cohen-Zada and Elder (2009) proposed an alternative instrument using historical religious concentration in a county. Their argument is that historical Catholic shares are much more likely to be exogenous to student outcomes than previous instruments used in the literature. Their findings are very similar to those of Altonji et al. (2005). Yet, a potential omitted variable bias might still exists if historical shares are correlated with other unobservable characteristics of the local area such as private competition or local population density.

We contribute to this literature using a new strategy. With the universal call to holiness and the opening to lay leadership, the Second Vatican Council inadvertently produced a
dramatic change in the cost/benefit ratio of religious life and drained Catholic schools of critical human capital. Between 1966 and 1980 the number of Catholic sisters reduced by more than 30%. This unexpected collapse was followed by a parallel decline in the number of Catholic schools. Following the decline in vocations, the share of religious teachers in Catholic schools fell by more than 50%. As religious teachers were on average paid one third of lay teachers, the sudden and rapid shift in personnel imposed severe financial constraints on Catholic schools and forced many schools to close. The closure of Catholic schools was mostly caused by supply effects and not driven by changes in the demand for Catholic schooling (Michael P. Caruso, 2008). The decline in the supply of Catholic sisters was more marked in dioceses that were more exposed to the reforms occurring at the Second Vatican Council (Stark and Finke, 2000). We argue that the heterogeneity in the decline of vocations was partially explained by the unpredictable reactions of local bishops to the “religious earthquake” occurring in Rome. We exploit the sudden shock to the supply of Catholic sisters and its heterogeneous impact across US dioceses as an exogenous instrument for Catholic schooling. This approach allows us to control for both local area fixed effects, which account for time invariant characteristics, and cohort fixed effects, which capture any systematic difference in school outcomes across cohorts. At the same time we control for a set of local-area time-varying characteristics.

In addition, the focus of the literature has been on the effectiveness of Catholic high-schools, however, little is known about the effects of Catholic primary schools. This paper focuses on the effects of Catholic schooling on grade repetition of students aged between 7-15, contributing to a recent set of studies on the effects of Catholic primary schools (Elder and Jepsen, 2011; Reardon et al., 2009; Lubienski et al., 2009; Carbonaro, 2006).

To conduct this analysis, we collected a unique data based on diocesan records of Catholic sisters, priests and schools (1960-1980), drawn from the Official Catholic Directory (OCD). Using the voting records of Bishops at Vatican II, collected by (Wilde, 2009) to classify progressive and conservative bishops, we provide evidence that the change in the number of
sisters per Catholic was more pronounced in dioceses governed by liberal bishops. We then merge the diocesan data with US Census information for different cohorts of students who were in school between 1960 and 1980. US Census data contain individual information on parochial school attendance for individuals enrolled in school at the time of the Census.\footnote{U.S. Census does not identify the religious denomination of the school, but only whether the school was a "parochial" or "church-related" school. However, the vast majority of private schools over the period considered in the paper were Catholic schools (Kim, 2011). Of course, this is even more true, when restricting the analysis to parochial schools. Therefore, in the paper we will use parochial and Catholic schooling interchangeably.} While these data do not contain information on test scores, we can use the information on educational attainment to analyze the effects of Catholic schooling on grade repetition.

Our results show that the rapid decline in vocations was associated with a significant decline in parochial school attendance, despite an increase in the Catholic population due to the new immigrants flows. In particular, a one standard deviation decrease in the number of Catholic sisters in a MSA is associated with a 14% reduction in the likelihood of attending a parochial school. We provide evidence that our instrument is more likely to be exogenous than alternative instrumental variable strategies previously used in the literature. Turning to the analysis of the effects of parochial schooling on educational performance, OLS estimates confirm a positive relationship between attending a parochial school and school outcomes. However, using the number of Catholic sisters in a given cohort-MSA to instrument for parochial school attendance, we do not find evidence of significant effects on grade repetition and reject the OLS estimates. If anything, we find evidence of negative effects, consistently with recent findings of Elder and Jepsen (2011) on Catholic primary schooling. These results suggest that the OLS estimates are entirely driven by positive selection bias. To verify the plausibility of our results we also use the techniques of Altonji et al. (2005) and show that even a modest degree of selection on unobservables is sufficient to eliminate and reverse the sign of Catholic schooling. When examining different measures of educational attainment (high-school dropout, high-school graduation, and college attendance) using reduced-form relationships, we find no evidence of positive effects.
Finally, we discuss whether the sudden shock to the number of religious teachers affects the validity of our identification strategy by changing the average quality of surviving Catholic schools. Focusing on children attending Catholic schools, we provide evidence that the share of religious teachers was negatively associated with grade repetition. If the prior is that the higher quality of Catholic sisters had a significant and positive impact on the student school outcomes, we should expect our reduced-form coefficient to be upward-biased. Since we find a null or negative effect we interpret our IV estimates as plausibly identifying an upper bound on the Catholic school effects on student outcomes.

The paper is organized as follows. Section 2 provides a brief description of the Second Vatican Council, its causes and consequences. In Section 3, we describe the identification strategy and the data. Results are presented and discussed in Section 4. Section 5 concludes.

2 The Second Vatican Council and the Decline in Vocations

Less than three months after his election Pope John XXIII announced his decision to convene a new Council in Rome to “open the windows of the Church and let some fresh air in”. Given that the Conclave elected Angelo Roncalli, nearly eighty years old, in the context of a transitional pontificate, no one expected this to happen. The surprising decision of calling a new Vatican Council was undertaken by the pope alone exercising his papal primacy. Alberigo (2006), one of the most qualified historians to comment on Vatican II, starts his brief history of the Second Vatican Council remarking how this announcement “was unexpected and surprising for most sectors of the Church, which were dominated by the climate of the Cold War and satisfied with a Catholicism unyielding its certainties”. As reported in Alberigo (2006), the Pope himself acknowledged later on in the Journal of Soul that the Council was entirely a pope initiative.
doctrine and practices.

For the purpose of this paper, it is important to note that most of the scholars emphasize the exogenoeity of the announcement. Not only the Curia was literally caught by surprise, but even liberal scholars like Alberigo and those who in the Council happened to be among the most liberal reformers were not expecting the old pope to convene all the Bishops in Rome to renew and update Church’s beliefs, liturgies and practices (Stark and Finke, 2000; Berman et al., 2012).

These changes had important practical and theological consequences on the life of the entire Catholic church, starting from the life of religious men and women. Stark and Finke (2000) explain in depth how three Vatican II documents (Lumen Gentium, Gaudium et Spes and the Perfectae Caritatis) involved important changes in the religious life. In particular, by establishing the universal call to holiness the Lumen Gentium contributed to overcome the notion of superior holiness of the religious state and gave new importance to the role of lay people in the Church. Overall, the Second Vatican Council emphasized the need for the Church to recognize “what changes with the passing of time” and open to the modern world.

Stark and Finke (2000) and Berman et al. (2012) point out how these changes unintentionally affected the marginal benefit of a religious life by eliminating the superiority of the religious status without substantially reducing the costs of a religious life with its vows of celibacy, poverty, etc. The changes in the cost-benefit ratio of a religious life were marginally higher for women. Indeed, the Vatican II did not bring any progress on the ordination of women in the Church, and, de facto, equiparated Catholic sisters to lay-women in their path to “holiness”. The loss of this special status contributed to the large decline in the number of religious women observed in the late 60s and early 70s.

Scholars agree that these shocks in the life of the Catholic church are the primary cause of the unexpected decline in vocations and the rise in defections, while there is more debate on the mechanism underlying these patterns with liberals thinking that many priests and
nuns left because they were hoping for more extensive reforms and conservative blaming the excessive modernization of the Church and the universal call to holiness (Ebaugh, 1993; Stark and Finke, 2000). Like Berman et al. (2012) who use the natural experiment provided by the Second Vatican Council and the decline in female vocations to explain fertility patterns in Europe, we do not focus directly on the causes of the decline.\(^3\) We are simply interested in establishing the exogeneity of the shock to the supply of Catholic sisters and its validity as an instrument to study the effects of Catholic schooling. In particular, it is important to establish that this shock was exogenous and not related to individual unobservable characteristics that might affect both Catholic schooling and student outcomes.

The obvious concern when using a historical event as a natural experiment is that there might be many other factors happening at the time of the Vatican II that could explain the trends in vocations and be endogenous to the outcome of interest. One could think that female religious vocations decreased because of the expanded opportunities for women. Stark and Finke (2000) argue that the timing of the collapse of vocations suggests other factors, such as trends in income and female labor force participation, could only have a minor role in explaining the abrupt fall in the number of Catholic sisters. After World War II female labor force participation and income grew slowly and steadily. On the contrary, as shown in Figure 1, there was a steady growth in the number of nuns until the mid 60s, followed by a rapid decline. We further discuss the validity of our identification strategy in the next section.

\section{Data and Empirical Specification}

We use data from three main sources: the US diocesan records contained in the Official Catholic Directory; the records of votes expressed at the Second Vatican Council, collected

\footnote{They use a panel on church attendance and clergy employment for the years 1960-2000 and show evidence that the interaction of service provision and religiosity largely explain the declining fertility observed in Southern Europe. In particular, they show that their results are consistent with a model in which social service provided by the Church affect fertility by lowering the cost of raising children.}
by Wilde (2009); and individual data drawn from the US Census (1970 and 1980) containing information on parochial school attendance and educational attainment.

The Official Catholic Directory (OCD) was first published in 1817 by P.J. Kennedy & Sons and contains detailed annual statistics on American dioceses including the number of priests and nuns serving the dioceses, the number of seminarians, Catholic schools, religious and lay teachers. We collected data for the years 1961 to 1980 for each US diocese. In order to be able to conduct a consistent analysis over time and across US dioceses, we constructed a balanced panel of dioceses for which we have information available every year since 1961. In the case where new dioceses were created, we aggregated the information to reconstruct the original set of dioceses. In the few cases in which a new diocese was created by merging territories of two or more dioceses, we attributed its numbers to the major contributing diocese. After these adjustments we were left with a panel of 122 dioceses for which we have consistent information for the period 1961-1980.

3.1 Catholic Sisters and Parochial Schools Before and After the Second Vatican Council

Figure 1 shows the pattern of vocations and changes in the staff composition in Catholic schools over time. As previously noted, in the years preceding the Second Vatican Council there was a substantial and steady growth in the number of nuns and a more moderate growth in the number of Catholic priests. The increase in the number of nuns was accompanied by an expansion of the Catholic school system in the US, which is reflected in the growth of sister teachers and lay teachers. However, in the years immediately following the Second Vatican Council, we observe a sharp decline in the number of nuns. This decline is only partially compensated by the increase in the number of lay teachers in Catholic schools. The number

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4 Figure 5 shows an extract of the Diocesan data in the Official Catholic Directory for 1965.
5 When using alternative criteria such excluding these dioceses from our analysis our results were not substantially changed.
6 We exclude from the analysis the Vicariate Apostolic of Alaska, the Belmont Abbey, the Byzantine rite and the Pittsburgh (Greek Rite) diocese.
of Catholic sisters reached a peak of about 180,000 in 1966 to then fall dramatically down to about 125,000 in 1980 (-30%).\textsuperscript{7} At the same time the number of lay teachers increased significantly (+56%). Yet, was not enough to compensate for the decline in the number of Catholic sisters teachers.\textsuperscript{8}

Catholic sisters accounted for 60\% of the total number of teachers in 1960, but for less than 25\% in 1980. Since religious teachers were on average paid one third of lay teachers, the dramatic collapse of female vocations had an immediate impact on tuitions and on the ability of parishes to keep their schools open by replacing former religious teachers with lay ones.\textsuperscript{9} Figure 2 illustrates how the trends in Catholic schools across US dioceses closely resemble the trends in female religious vocations. Between 1965 and 1980 parochial high-school went down by about 40\% and elementary schools by 35\%. It is worth noting that the decline in the availability of Catholic schools occurred in a context of “voracious demand of families for Catholic schools” as noted by Michael P. Caruso (2008). The closure of Catholic schools was mostly caused by supply effects. Without nuns to staff schools, Catholic schools needed to hire lay teachers and pay competitive salaries to meet the demands. The increase in the

\textsuperscript{7}Ebaugh (1993) remarks how the sharp decline in the number of Catholic sisters between 1966 and 1986 was due to both a decrease in the rates of entry and an increase in the defections. The shortage of new vocations and the fact that the majority of those defecting were under 40 dramatically affected the age structure within the religious orders. In few years the percentage of sisters over 65 years old doubled from 17\% in 1966 to 38\% in 1982 (Neal, 1984).

\textsuperscript{8}Interestingly the absolute number of priests remained relatively stable over the period. However, normalizing by the size of Catholic population the decline follows a similar, though less marked, pattern. This is consistent with the idea suggested by Stark and Finke (2000) that the changes occurring at the Second Vatican Council were particularly devastating for women religious who “unlike males, had never been granted ordination, and now their holiness was reduced to that of all other lay Catholics”.

\textsuperscript{9}Differences in the extent of the vow of poverty and the Congregational needs would reflect different salaries across congregations and schools. Unfortunately, we did not find more precise data on religious women’s salaries. However, Finke and Stark (2005) emphasize that their salary was not only lower than what paid to public school teachers, but also lower than what paid to religious brothers. We found more information on the salaries paid to lay teachers (see Hesburgh et al. (1966), which was also lower than the ones paid in public school, but still about three times higher on average than what paid to Catholic sisters. In particular, Koob and Shaw (1970) report than in the late 60s in many dioceses lay teachers’ salaries were set at 90-95\% of those in public schools. The increased need for lay teachers forced the Catholic schools to provide more competitive salaries to attract trained teachers. The gap between religious and lay teachers salary shrank in the more recent years, probably due to the increasing financial difficulties of religious congregations (Fialka, 2003). However, in 2009 a religious teacher was paid on average (30,806) around 4,000\$ less than a lay teacher (34,656\$) in a Catholic school and less than 30\% of the schools applied the same rate to the two categories of teachers.
share of lay teachers became financially unbearable forcing schools to increase their tuition fees or to close (Michael P. Caruso, 2008; Dolan, 1992; Bryk et al., 1993).

### 3.2 Heterogeneity Across US Dioceses

The decline in female religious vocations was heterogeneous across the different dioceses. Scholars speculated that the variation in the decline across US dioceses can be partially explained by variation in the receptiveness to Vatican II reforms. With the help of a group of experts, Stark and Finke (2000) classified dioceses to identify the most traditional and most progressive ones. They showed that liberal dioceses faced a much sharper decline in religious vocations in the aftermath of Vatican II. We take a different approach and use the voting records of Bishops at Vatican II to classify progressive and conservative bishops. Wilde (2009) obtained Council votes from the Vatican Secret Archive (Archivio Segreto Vaticano) and entered them into an electronic database now publicly available on the ARDA website. The voting data contain information on individual bishops, their diocese and their votes on ten of the most contentious Council reforms. As suggested by Wilde (2009) we use the vote on the document “On the Sources of Revelation”, as a measure of openness to change of the Bishop. The document “On the Sources of Revelation” was a particularly conservative document refuting the historical and anthropological contextualization of the Bible and emphasising the importance of Church “tradition” with respect to the Scripture-centered protestant culture. Since most of the Bishops who expressed liberal views in the other votes opposed this document, we define liberal a Bishop if he voted against it. In cases where two or more Bishops who took part at the Council where residing in the same diocese, we averaged the votes and considered conservative the dioceses where the votes were tied.\(^\text{10}\)

Figure 3 and Table 1 provide evidence that the change in the number of sisters per Catholic was more pronounced in liberal dioceses. In Figure 3, we show how the the number of Catholic sisters, sisters teachers, parochial elementary schools and high-schools follow a

\(^{10}\)Alternatively, we consider only the vote of the residential Bishop and found no significant differences in the main results.
similar pattern. However, the decline following Vatican II occurred at a faster rate in liberal dioceses (solid line in the graphs). Table 1 shows that accounting for persistent differences in the dioceses and time fixed effects the fall in the number of Catholic sisters per Catholic was 11% lower in conservative dioceses than in the liberal ones (see column 1). Column 2 reports a similar pattern when we look at the number of sisters teachers. The difference in the rate of decline is more evident when we focus on the most conservative dioceses as classified by Stark and Finke (2000) (see columns 3 and 4).\footnote{When comparing the most conservative and most liberal dioceses we adopted the same categorization used by Stark and Finke (2000) who asked a group of expert to identify the ten most traditional and the ten most liberal dioceses. We consider as traditional the following dioceses: Lincoln, Arlington, Bridgeport, Scranton, St.Louis, Camden. The most liberal dioceses are Saginaw, New Ulm, Albany, Milwaukee, Joliet, San Francisco, Rochester, Richmond.} For these dioceses the decline is about 65% lower than what observed in more liberal dioceses.

The evidence presented suggests that the heterogeneity in the decline of vocations was partially explained by the reactions of bishops to the “religious earthquake” occurring in Rome. Moreover, the votes of Bishops at the Second Vatican Council, and more generally their attitudes towards the unexpected reforms were largely unpredictable at the beginning of the Council (Alberigo, 2006; Wilde, 2009). Taken together, this analysis strengthens our belief that the variation in the decline in the supply of Catholic sisters was exogenous to unobservable time-varying diocesan characteristics that might have been correlated with both the drop in the number of nuns and student outcomes. Under this identifying assumption, we exploit the sudden shock to the supply of Catholic sisters and its heterogeneous impact across US dioceses as an exogenous instrument for parochial schooling.

### 3.3 Identification Strategy

Figure 4 illustrates the heterogeneity in the decline in the number of Catholic sisters and parochial schools across US states in the aftermath of Vatican II. Our identification follows a difference-in-differences approach exploiting the variation in the availability of Catholic sisters across US Census Metropolitan Statistical Areas (MSAs) between 1960 and 1980,
covering the years preceding and following the Second Vatican Council. We merged the panel of US dioceses with the 1% US Census Sample of 1970 and the 5% US Census Sample of 1980. Following previous literature (Lankford and Lee, 1995), we assigned to each MSA the diocesan characteristics of the dioceses contained in the MSA. Average across dioceses were used whenever a MSA would include counties from more than one diocese. As a robustness check, we also collected data at the county level for the four largest dioceses (Chicago, Detroit, Los Angeles, and New York) and merged them with the US census data at the county-level.

The US Census does not contain information on Catholic schooling, but it does contain information on parochial and private schooling attendance. We focus on the population of children between 7 and 15 years old, who are most likely to live with their parents and therefore more likely to be represented in the sample. This allows us to use the information on current enrolment in a parochial or a public school in the census year.

US Census data contain only limited information on children’s outcomes. However, grade retention can be computed using information on educational attainment and age. Grade retention has been shown to be significantly correlated with other measures of educational performance (Oreopoulos et al., 2006; Shepard and Smith, 1989). As in Oreopoulos et al. (2006), we define the likelihood of being a repeater as a dummy variable taking the value of one if a student is one grade behind the median grade by state, sex, quarter of birth and age. This measure of grade retention includes students who delayed entry into the school system and therefore it is, more accurately, a measure of grade-for-age.

We compare cohorts of students who were 7-15 at the time of the 1970 US Census and entered school between 1961 and 1969, to the outcomes of students who were 7-15 at the

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12 Results are substantially identical using the 1% sample for both years.
13 To match dioceses and MSAs we relied on the county composition of the diocese.
14 According to the National Center for Education Statistics around 80% of the total private schools in the 50’s were Catholic schools (see also Kim (2011)).
15 Alternatively, we measure grade retention treating that all children who turned age 6 before October 1 as if they entered first grade in the Fall of that year and those born after October 1 as though they entered school the following year. Our main results are substantially unchanged.
time of the 1980 US Census and entered school between 1971 and 1979. This allows us to compare different cohorts of students living in the same areas and control for both local area fixed effects, which account for time invariant characteristics, and cohort fixed effects, which capture any systematic difference in school outcomes within a given cohort. Furthermore, we control for a set of time-varying characteristics of the MSA (e.g., current density of Catholic population, female labor force participation, population density, and teacher’s education) that might be correlated with both the number of Catholic sisters and grade repetition. We restrict the sample to children living in identifiable MSA’s, with no missing information on parental education and family income. After these restrictions the sample includes 841,958 children. Formally we estimate the following linear probability model\footnote{As a robustness check we estimate probit models for our main estimates. Results are substantially unchanged and available upon requests.}:

\[
P_{imt} = \beta_0 + \theta N_{mt} + \beta_1 X_{imt} + \beta_2 D_{mt} + \tau_t + \lambda_m + u_{imt}
\]  

where \(P_{imt}\) is a dummy variable indicating whether individual \(i\), of birth cohort \(t\), goes to a parochial school in MSA \(m\).\footnote{As mentioned earlier, MSA level data for Catholic sisters, teachers and Catholic population were computed using diocesan data. Therefore, the term diocese and MSA will be used interchangeably in this paper.} \(N_{mt}\) denotes a measure of average exposure to Catholic sisters (nuns) teachers throughout the schooling years of an individual \(i\) in MSA \(m\). Henceforth, we will use Catholic sisters to refer to Catholic sisters teaching in Catholic schools.\footnote{We alternatively use the total number of sisters (including those who were not teachers) in the diocese. Results go in the same direction, as the two metrics are strongly correlated.} This measure variates by birth cohort (we computed the starting school year based on quarter of birth and age) and MSA. For example, if a 10-years old student is observed in the 1970 Census in MSA \(m\), he will be assigned the average number of Catholic sisters in MSA \(m\), between 1967 and 1970.\footnote{We followed the same method to compute analogous measures of exposure to lay teachers and total teachers in Catholic schools, Catholic schools, and Catholic population in the MSA.} \(D_{mt}\) are MSA time varying characteristics. \(X_i\) are standard socio-demographic controls. \(\tau_t\) and \(\lambda_m\) are cohort and MSA fixed effects.
To analyze the effects on school outcomes, we estimate the following model:

$$Y_{imt} = \alpha_0 + \alpha_1 P_{imt} + \gamma_1 X_{imt} + \gamma_2 D_{imt} + \tau_t + \lambda_m + \epsilon_{imt}$$

(2)

where $Y_{imt}$ is an indicator for grade retention. In practice, we exploit within-MSA differences in the availability of Catholic sisters that created exogenous shifts in the likelihood of attending a parochial school, to analyze the effects of Catholic schooling on grade repetition. We believe that conditioning on MSA time varying characteristics and controlling for MSAs and cohort fixed effects, the sudden and sharp decline in the number of Catholic sisters, that induced the closure of many schools across the country, provides an exogenous shock in Catholic schooling.\footnote{A potential concern is that grade retention policies might be different across Catholic and public schools. As we use a diff-in-diff approach, our identification strategy is not affected by persistent differences between the two types of schools. One could still be concerned that grade retention policies were correlated with the changes in the supply of religious teachers. However, it is worth noting that while the number of Catholic sisters teaching in schools declined dramatically, the school administration and direction remained largely in the hands of religious staff (Michael P. Caruso, 2008).}

3.4 Evidence for the Exogeneity of the Instrument

In an attempt to assess the validity of our instrumental strategy, in Table 2, we analyze the correlation between our instrument and individual observable characteristics (column 3). We then the coefficients reported in column 3 to the ones Cohen-Zada and Elder (2009) observed when considering the most recent instrument used in the literature (Cohen-Zada and Elder (2009), column 4) and the simple parochial schooling indicator (column 5).

Columns 1 and 2 report the summary statistics of the main individual observables. In column 3, we present the standardised coefficients of separate regressions of the variables listed in the first column on the number of Catholic sisters, controlling for MSA and cohort fixed effects. In column 4, we repeat the same exercise for the instrumental variable proposed by Cohen-Zada and Elder (2009) and look at the relationship between observables and the
historical share of Catholic population.\textsuperscript{21} We restrict the sample to 1980 and condition each regression for state fixed effects and current Catholic population to mimic their empirical strategy. Finally, in column 5, we analyze the relationship between parochial schooling and the other observable characteristics.

Column 5 confirms the significant selection on observable characteristics with parochial schooling associated to both higher parental education, higher income and lower likelihood of minority status. The average number of Catholic sisters (column 3) is positively correlated with family income and parental education, suggesting some selection bias. As socioeconomic status is positively associated with student outcomes, this might bias upward our estimates, which should therefore be interpreted as an upper bound. Family income and parental education are included as controls in all our regressions. However, the coefficients on the other observables are non-significant. Furthermore, the absolute value of the coefficients is always lower with respect to the correlation between observables and both Catholic schooling (column 5) and the historical share of Catholics in the county (column 4). While this does not rule out that our estimates might still suffer from spurious correlation between unobservables and our instrument, Table 2 suggests that our instrumental variable might be less likely to suffer of selection on unobservables.

4 Main Results

4.1 Catholic School Supply and Likelihood of Attending a Catholic School

Table 3 illustrates the estimates for equations 1 (column 1) and 2 (columns 2-4). Each regression controls for a set of child’s characteristics (gender, race, Hispanic ethnicity, birth quarter, age dummies), family background (maternal and paternal age dummies, maternal

\textsuperscript{21}Data on the share of Catholic population in 1980 are drawn from the Religious Congregation and Membership in the United States, while data for 1890 were taken from the American Religion Data Archive and originally collected by the US Census of Religious Bodies.
and paternal education (4-groups), family income), MSA and cohort fixed effects, and a set of MSA time varying characteristics (female labor force participation, teachers’ education and Catholic population).\footnote{Adding to this specification teachers’ experience and the logarithm of teachers’ wages does not change the point estimate, but it reduces the precision of our estimates. Female labor force participation and teachers’ education vary by census year. The female labor force participation in each MSA is calculated by dividing the number of women aged 15 to 64 in employment by the total female population of the same age group. Teachers in each MSA were identified by industry (professional and related services - elementary and secondary schools) and occupation (elementary school teachers and secondary school teachers). Catholic population is drawn from the Official Catholic Directory.} We include a quadratic trend in all our estimates. Standard errors are clustered at the MSA level.

Column 1 reports the estimate of our first stage regression. There is a positive and significant association between attending a parochial school and the number of sisters available in the different dioceses. The coefficient implies that a one standard deviation increase in the number of Catholic sisters (789.12) is associated with a 14\% increase in the likelihood of attending a parochial school. The F-statistic of the first-stage is 14.84.

We now move to the examination of the relationship between Catholic schooling and grade repetition. Column 2 reports the OLS estimate. Attending a parochial school is associated with a 11\% reduction in the likelihood of repeating a grade. This finding is in line with previous evidence of a positive correlation between Catholic schooling and school outcomes. However, instrumenting parochial schooling with the cohort-MSA measure of exposure to Catholic sisters, we do not find evidence of significant effects on grade repetition. Column 3 reports the reduced form showing no significant relationship between the availability of nuns and the likelihood of repeating a grade. The 2SLS estimate (column 4) is also non-significant and, if anything, suggests a negative (positive) effect of Catholic schooling on the school outcomes (grade repetition). Even though standard errors are large, we reject the OLS estimate.\footnote{The Hausman test rejects the equality of the coefficients at the 10\% level on the overall sample and at the 5\% level when we restrict the sample to whites.}

Similar results are found when the sample is restricted to the four largest dioceses in the US (Chicago, Detroit, New York, and Los Angeles) using the number of Catholic sisters
at the county level (see Table 4). Column 1 shows that a one standard deviation in the
number of Catholic sisters increases Catholic schooling by 35%. The OLS and the reduced
form coefficients (columns 2 and 3) on grade retention are substantially identical to the ones
observed in Table 3. The 2SLS estimate in column 4 implies that Catholic schooling increases
the likelihood of repeating the grade by 10 percentage points.

4.2 Is the Selection Implied by Our Results Plausible?

The above findings suggest that the OLS estimates are entirely driven by positive selection
bias. To verify the plausibility of our results we use the techniques of Altonji et al. (2005)
and exploit the information about selection on the observables to gauge the role of selection
bias and verify whether our IV estimates are consistent with it. In particular, in Table 5 we
jointly estimate the following system of equations

\[ P = 1(X'\beta + u > 0), \]

\[ Y = 1(X'\gamma + \alpha P + \epsilon > 0) \]

and impose different values of \( \rho \), the correlation between the error terms of the above equa-
tions. Column 1 (\( \rho = 0 \)) presents the single-equation estimates. The marginal effect is sub-
stantially identical to the OLS estimate presented in Table 3, column 2. In column 2-7 we
illustrate how a modest amount of positive selection (small negative correlation between \( \epsilon \)
and \( u \)) is sufficient to explain away the positive effect of Catholic schooling and even reverse
the sign. Column 8 reports the estimates obtained assuming that selection on the observ-
ables equals selection on unobservables. In other words, we assume that the projection of \( P \)
on \( \epsilon \) equals its projection on the index of other determinants of \( Y \): \( \frac{\text{Cov}(P,\epsilon)}{\text{Var}(\epsilon)} \) \( \frac{\text{Cov}(P,X'\gamma)}{\text{Var}(X'\gamma)} \). Altonji
et al. (2005) justify the equal selection assumption arguing that for large data sets used for
different purposes, the available information can be thought as a random subset of the de-
terminants of a particular outcome under study. Following this approach we can identify a lower bound for the effects of Catholic schooling. In practice, we estimate a bivariate probit model and maximize the likelihood imposing $\rho = \frac{\text{Cov}(X'\beta, X'\gamma)}{\text{Var}(X'\gamma)}$. The estimate of $\alpha$ implies a large and negative effect of parochial schooling on grade repetition. Under the assumption of equality of selection on observables and unobservables, the strong and positive (negative) correlation between observable determinants of student outcomes (grade repetition) and Catholic schooling results in a strong and positive correlation with the unobservables, implying a large positive bias in the OLS bias. In other words, correcting for the bias using Altonji et al. (2005) method predicts an even more negative effect of Catholic schooling on grade repetition than the one found using our IV. Using a more informal approach, we estimate that if selection on unobservables was less than half as strong (about 40%) as that found on a limited set of observables, the effect of Catholic schooling would be explained away. Overall, this sensitivity analysis confirms that the OLS estimates are entirely driven by selection bias and that if anything Catholic schooling increases the likelihood of grade repetition.

Note that this is an extreme assumption as datasets are designed to answer particular questions and researchers do not choose their controls randomly and therefore selection on unobservables is likely to be less than selection on observables. However, for large data sets as the US census the actual selection on unobservables may be closer to the one implied by the equal selection assumption than when using smaller longitudinal surveys containing a rich set of individual characteristics (e.g., NLSY79, NELS88).

Altonji et al. (2005) show that if the bias in a probit is close to the bias in OLS then

$$\text{plim } \hat{\alpha} = \alpha + \frac{\text{Cov}(\hat{P}, \epsilon)}{\text{Var}(\hat{P})} = \alpha + \frac{\text{Var}(P)}{\text{Var}(\hat{P})[E(\epsilon|P = 1) - E(\epsilon|P = 0)]}$$

where $\hat{P}$ is the residual from a regression of $P$ on the set of observable controls $X$. Under the assumption that observables and unobservables determinants of student outcomes have the same relationship with Catholic schooling

$$\frac{E(\epsilon|P = 1) - E(\epsilon|P = 0)}{\text{Var}(\epsilon)} = \frac{E(X'\gamma|P = 1) - E(X'\gamma|P = 0)}{\text{Var}(X'\gamma)}.$$  

Therefore,

$$\text{plim } \hat{\alpha} = \alpha + \frac{\text{Cov}(\hat{P}, \epsilon)}{\text{Var}(\hat{P})} = \alpha + \frac{E(X'\gamma|P = 1) - E(X'\gamma|P = 0)}{\text{Var}(X'\gamma)}$$

The ratio between the unconstrained estimate of $\alpha$ and the estimated selection bias can then be used to measure how strong should be the selection on unobserved characteristics relatively to the selection on observables to explain alone the entire effects of parochial schooling.
4.2.1 The Effects Across Socio-Demographic Groups

Previous studies found larger positive effects of Catholic schooling on minority students. In Table 6 we report the 2SLS estimates by race, ethnicity and poverty level. Column 1 replicates the estimate of column 4 in Table 3. In column 2 we restrict the sample to whites. The 2SLS coefficient is still non significantly different from zero, but the estimate is more precisely estimated. Focusing on non-Hispanic whites the coefficient becomes significant and suggests that parochial schooling increases by 20 percentage points the likelihood of repeating the grade. The sign of the coefficient becomes negative when we look at minorities. While the large variance does not allow to make any strong inference, the direction of the effect appears to be consistent with previous studies on Catholic schooling and minorities. The coefficient is positive and significant when we analyze children of families above the median of the poverty level (i.e., of higher socio-economic status), while the effect is less precisely estimated for children of families with lower socio-economic status.

4.3 Did the Shock Affect the Quality of Catholic Schools?

A potential threat to the validity of the exogeneity assumption is the fact that the shock to the supply of Catholic sisters might have had an impact not only on the supply of Catholic schools and on the tuition costs, but also on the average quality of surviving Catholic schools. It is reasonable to think that the sudden decline in the number of Catholic sisters affected also the quality of Catholic schools’ personnel. Previous literature suggested that the higher dedication and vocational motivation of Catholic school teachers as one of the mechanisms behind the positive effects of Catholic schooling (Neal, 1997). In addition to the higher motivation, Kim (2011) shows that religious personnel was on average more educated and more experienced. The Notre Dame Survey on American Catholic Schools of 1966 provides aggregate descriptives that confirm the relative higher experience, education and work satisfaction of the religious teachers compared to the lay teachers in Catholic schools. In particular, we know that 49% of Catholic sisters had a master degree compared to only
19% among lay teachers. Furthermore, sisters were often required to attend educational and training programs. Koedel (2008) shows large effects of teacher’s quality and education on student performance when considering graduation outcomes. If we believe that the higher education and motivation of sisters had a significant and positive impact on the student school outcomes, we would expect our reduced-form coefficient to be upward-biased.

We document evidence of a negative association between the share of religious teachers and the likelihood of grade repetition in Catholic schools (see Table 7). Our results show that the ratio of religious teachers to lay teachers in Catholic schools (or the share of Catholic sisters among Catholic school teachers) is negatively associated with the likelihood of grade repetition among student attending Catholic schools (see column 1). In particular, we find that a one standard deviation in the Sister-Lay teachers ratio is associated with a 3 percentage point decline in grade repetition. This is equivalent to a 21% effect with respect to the average grade repetition rate among parochial school enrollees (14.7%). The coefficient becomes non-significant when focusing on non-Hispanic whites (column 3), while is large and significant on minorities (column 4). The point-estimate implies that a one standard deviation increase in the sisters-lay teachers ration is associated with a 57% decrease in the likelihood of repeating the grade of minority students attending parochial schools. Similarly, the coefficient is non-significant when looking at students whose families are above the median poverty level (i.e., of higher socio-economic status, column 5), but negative and significant students of lower socio-economic status (- 23%, column 6). These results are in line with the idea that more qualified and more motivated teachers might be more productive for disadvantaged students (Kim, 2011; Koedel, 2008) and would help explain the positive results found by Neal (1997) when looking at the effect of Catholic school for urban minorities.

Exploring the effects of the Second Vatican Council on the quality of teachers in Catholic schools goes well beyond the main purpose of this paper and would require more micro-level data on teachers and school characteristics (see Kim (2011)). However, it is important to discuss how this might affect the validity of our identification strategy. As our prior
is that the higher quality of Catholic sisters had a significant and positive impact on the student school outcomes, we should expect our reduced-form coefficient to be upward-biased. Therefore, since we find a null or negative effect we will interpret our IV estimates as plausibly identifying a lower bound on the Catholic school effects on grade repetition.

4.3.1 Other Educational Outcomes

In Table 8, we investigate the reduced-form relationship between the average number of Catholic sisters and other measures of educational attainment. Unfortunately not having information on Catholic schooling attendance for those who are not currently enrolled in school, we are not able to estimate the treatment effects of Catholic schooling. Similarly to the approach used in Section 3.3, we compute the average number of nuns available to each individual living in a different diocese during her schooling years. In column 1, we consider the relationship between the exposure to Catholic sisters and the likelihood of enrolment in school at the age of post-compulsory education, i.e., upon attaining the legal dropout age. The coefficient is positive, but highly insignificant. Column 2 considers the effect high-school drop-out. We use the standard definition and consider as drop-outs individuals between age 16 or 24 who did not obtain a high-school diploma and are not enrolled in school. We restrict the sample to individuals who resided in the same MSA for the 5 years preceding the survey. The coefficient is only marginally significant and points at a positive relationship between the number of Catholic sisters available in schooling years and the likelihood of being a high-school drop-out. In column 3 we examine high-school graduation rates of individuals between the age of 18 and 23. Similarly, in column 4 we look at the likelihood of having attended some college for individuals between the age of 18 and 23. We do not find evidence of significant effects on any of these educational outcomes. However, these estimates should be considered with caution as by looking at the outcomes of older cohorts we substantially

\footnote{States differ in their compulsory schooling requirement. We follow Angrist and Krueger (1991) in defining the legal dropout age. Its a combination of compulsory schooling laws and school start age.}

\footnote{Note that when further restricting the sample to individuals born in the same state of current residence, results do not change significantly, but the coefficient on high-school drop-out becomes non significant.}
increase the selectivity in the sample and compromise the ability of controlling for parental background.

5 Conclusion

A wide literature has investigated the relationship between Catholic schooling and student outcomes. Most of the previous studies found evidence of positive effects, but the causality of these correlations has long been questioned. This paper proposes a new identification strategy to assess the effects of Catholic schooling on school outcomes. We exploit an exogenous shock to the number of Catholic sisters and show that the positive correlation between Catholic schooling and student outcomes is explained entirely by selection bias. We show that the unexpected shock to the supply of Catholic sisters, induced by the Second Vatican Council, affected the supply of Catholic schools and in turn the likelihood of children to attend a Catholic school. We also provide evidence that our instrumental strategy is less likely to violate the exclusion restriction compared to previous instruments used in the literature. We confirm previous findings of a positive correlation between Catholic schooling and educational outcomes. However, using our instrument to identify the causal effects of Catholic schooling on grade repetition, we find no evidence of positive effects and reject the OLS estimates. If anything, our estimates imply that Catholic schooling increases the likelihood of repeating a grade. These results are similar to those found by Elder and Jepsen (2011) using more recent data on primary schools. To verify the plausibility of our results we also use the techniques of Altonji et al. (2005) and show that even a modest degree of selection on unobservables is sufficient to eliminate and reverse the sign of Catholic schooling. We find no evidence of positive effects when analyzing different measures of educational attainment using reduced-form relationships.
References


Elder, Todd, and Christopher Jepsen (2011) ‘Are Catholic primary schools more effective than public primary schools?’ Mimeo


Lubienski, Christopher, Corinna Crane, and Sarah Thule Lubienski (2009) ‘What do we know about school effectiveness? Academic gains in public and private schools.’ *Phi Delta Kappan* 89(9), 689–685


Figure 1: Human Assets in the American Catholic Church, 1950-1985

Figure 2: The Decline of Elementary Catholic Schools Across US

Figure 3: The Decline of Elementary Catholic Schools Across US

Catholic Teachers and Schools per Catholic (in thousand)

Total Sisters

Sisters Teachers

Parochial Elementary Schools

Parochial High Schools

Figure 4: The Decline of Catholic Sisters Across US States (1966-1980)

Notes - Source: Official Catholic Directory 1966 and 1980. States are classified in 5 categories. The darker the blue the higher the decline in the number of Catholic sisters and parochial schools between 1966 and 1980.
Table 1: Heterogeneity in the Vatican II Shock across US dioceses

<table>
<thead>
<tr>
<th></th>
<th>(1) Sisters per 1,000 Catholics</th>
<th>(2) Sisters Teachers per 1,000 Catholics</th>
<th>(3) Sisters Teachers per 1,000 Catholics</th>
<th>(4) Sisters Teachers per 1,000 Catholics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vatican II</td>
<td>-1.832***</td>
<td>-1.474***</td>
<td>-1.858***</td>
<td>-1.489***</td>
</tr>
<tr>
<td></td>
<td>(0.066)</td>
<td>(0.042)</td>
<td>(0.066)</td>
<td>(0.042)</td>
</tr>
<tr>
<td>Vatican II * conservative diocese</td>
<td>0.218*</td>
<td>0.163**</td>
<td>0.192*</td>
<td>0.147**</td>
</tr>
<tr>
<td></td>
<td>(0.114)</td>
<td>(0.073)</td>
<td>(0.114)</td>
<td>(0.073)</td>
</tr>
<tr>
<td>Vatican II * most conservative diocese</td>
<td></td>
<td></td>
<td>0.913***</td>
<td>0.540***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.281)</td>
<td>(0.179)</td>
</tr>
<tr>
<td>Diocese fixed effect</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.328</td>
<td>0.439</td>
<td>0.332</td>
<td>0.441</td>
</tr>
</tbody>
</table>

Notes - Source: Official Catholic Directory (1955-1985) and voting records of Bishops at Vatican II collected by (Wilde, 2009) from the Vatican Secret Archive (Archivio Segreto Vaticano). The sample is restricted to the 105 dioceses for which we have information on Bishop’s vote at the Second Vatican Council.
Table 2: IVs and Individual Observable Characteristics

<table>
<thead>
<tr>
<th>Variables</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variables Mean</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade repetition</td>
<td>0.18</td>
<td>0.38</td>
<td>-0.002</td>
<td>0.017**</td>
<td>-0.043***</td>
</tr>
<tr>
<td>Enrolled in a parochial school</td>
<td>0.14</td>
<td>0.35</td>
<td>0.063***</td>
<td>0.0101***</td>
<td>1.000***</td>
</tr>
<tr>
<td>Male</td>
<td>0.51</td>
<td>0.50</td>
<td>0.002</td>
<td>0.003</td>
<td>-0.014***</td>
</tr>
<tr>
<td>Black</td>
<td>0.11</td>
<td>0.31</td>
<td>-0.001</td>
<td>0.118**</td>
<td>-0.060***</td>
</tr>
<tr>
<td>Hispanic</td>
<td>0.10</td>
<td>0.29</td>
<td>-0.021</td>
<td>0.102**</td>
<td>-0.013***</td>
</tr>
<tr>
<td>Mother’s education</td>
<td>2.18</td>
<td>0.94</td>
<td>0.023***</td>
<td>-0.053*</td>
<td>0.180***</td>
</tr>
<tr>
<td>Father’s education</td>
<td>2.38</td>
<td>1.11</td>
<td>0.029***</td>
<td>-0.068**</td>
<td>0.220***</td>
</tr>
<tr>
<td>Log (family income)</td>
<td>9.40</td>
<td>0.64</td>
<td>0.068***</td>
<td>-0.078**</td>
<td>0.137***</td>
</tr>
</tbody>
</table>

Notes - Data are drawn from the 1970 and 1980 US Census. The sample is restricted to children 7-15 years old. Standardized coefficients. Data are drawn from the 1970 and 1980 US Census. The sample is restricted to children 7-15 years old. Column 3 includes MSA and cohort fixed effects. Column 4 includes state fixed effects. Standard errors were clustered at the MSA level in column 3 and at the county level in column 4.
### Table 3: Sisters, Catholic Schooling and School Outcomes

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>(1) First Stage</th>
<th>(2) OLS</th>
<th>(3) Reduced-Form</th>
<th>(4) IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sisters (in thousand)</td>
<td>0.023*** (0.006)</td>
<td></td>
<td>0.005 (0.004)</td>
<td></td>
</tr>
<tr>
<td>Enrolled in a parochial school</td>
<td>-0.020*** (0.003)</td>
<td>0.255 (0.167)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>841.958</td>
<td>841.958</td>
<td>841.958</td>
<td>841.958</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.06</td>
<td>0.06</td>
<td>0.06</td>
<td>0.06</td>
</tr>
<tr>
<td>First-stage F (1, 121)</td>
<td>14.84</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean of dependent variable</td>
<td>0.139</td>
<td>0.176</td>
<td>0.176</td>
<td>0.176</td>
</tr>
<tr>
<td>s.d.</td>
<td>0.346</td>
<td>0.381</td>
<td>0.381</td>
<td>0.381</td>
</tr>
</tbody>
</table>

**Notes** - Data are drawn from the 1970 and 1980 US Census. The sample is restricted to children 7-15 years old. All estimates include controls for a set of child’s characteristics (gender, race, Hispanic ethnicity, birth quarter, age dummies), family background (maternal and paternal age dummies, maternal and paternal education (4-groups), family income), MSA and cohort fixed effects, and a set of MSA time varying characteristics (female labor force participation, and teachers’ education). Standard errors are clustered at the MSA level.
Table 4: Sisters, Catholic Schooling and School Outcomes, 4 Largest Dioceses

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>(1) First Stage</th>
<th>(2) OLS</th>
<th>(3) Reduced-Form</th>
<th>(4) IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sisters (in thousand)</td>
<td>0.0670** (0.025)</td>
<td>0.007 (0.005)</td>
<td>0.107* (0.065)</td>
<td></td>
</tr>
<tr>
<td>Enrolled in a parochial school</td>
<td>-0.022*** (0.004)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>117.376</td>
<td>117.376</td>
<td>117.376</td>
<td>117.376</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.078</td>
<td>0.086</td>
<td>0.077</td>
<td>-</td>
</tr>
<tr>
<td>First-stage F (1, 7)</td>
<td>7.17</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean of dependent variable</td>
<td>0.209</td>
<td>0.173</td>
<td>0.173</td>
<td>0.173</td>
</tr>
<tr>
<td>s.d.</td>
<td>0.406</td>
<td>0.378</td>
<td>0.378</td>
<td>0.378</td>
</tr>
</tbody>
</table>

Notes - Data are drawn from the 1970 and 1980 US Census. The sample is restricted to children 7-15 years old living in counties belonging to the 4 largest U.S. dioceses: Chicago, Detroit, New York, and Los Angeles. All estimates include controls for a set of child’s characteristics (gender, race, Hispanic ethnicity, birth quarter, age dummies), family background (maternal and paternal age dummies, maternal and paternal education (4-groups), family income), county and cohort fixed effects, and a set of county time varying characteristics (female labor force participation, teachers’education and Catholic population). Standard errors are clustered at the county level.
Table 5: Effects of Catholic Schooling on Grade Repetition Accounting for Selection on Observables

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
<th>(8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \rho )</td>
<td>0</td>
<td>-0.05</td>
<td>-0.1</td>
<td>-0.2</td>
<td>-0.3</td>
<td>-0.4</td>
<td>-0.5</td>
<td>-0.727</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.000)</td>
</tr>
<tr>
<td>Enrolled in parochial school</td>
<td>-0.023</td>
<td>0.006</td>
<td>0.022</td>
<td>0.070</td>
<td>0.119</td>
<td>0.171</td>
<td>0.224</td>
<td>0.358</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.001)</td>
</tr>
</tbody>
</table>

Notes - Data are drawn from the 1970 and 1980 US Census. The sample is restricted to children 7-15 years old. These are estimates from a bivariate probit models imposing the various restrictions. All estimates include child’s characteristics (gender, race, Hispanic ethnicity, birth quarter, age dummies), family background (maternal and paternal age dummies, maternal and paternal education (4-groups), family income). The outcome variable is grade repetition.
Table 6: Catholic Schooling and Grade Repetition, by Socio-Demographic Groups

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All</td>
<td>Whites</td>
<td>Non-Hispanic Whites</td>
<td>Minorities</td>
<td>Below median poverty level</td>
<td>Above median poverty level</td>
</tr>
<tr>
<td>Enrolled in a parochial school</td>
<td>0.253</td>
<td>0.170</td>
<td>0.213**</td>
<td>-0.0509</td>
<td>0.304**</td>
<td>0.255</td>
</tr>
<tr>
<td></td>
<td>(0.167)</td>
<td>(0.108)</td>
<td>(0.093)</td>
<td>(0.321)</td>
<td>(0.143)</td>
<td>(0.316)</td>
</tr>
<tr>
<td>Observations</td>
<td>841,958</td>
<td>751,302</td>
<td>671,872</td>
<td>170,086</td>
<td>414,058</td>
<td>427,900</td>
</tr>
<tr>
<td>Mean of dependent Variable</td>
<td>0.176</td>
<td>0.173</td>
<td>0.163</td>
<td>0.227</td>
<td>0.138</td>
<td>0.213</td>
</tr>
<tr>
<td>s.d.</td>
<td>0.381</td>
<td>0.378</td>
<td>0.369</td>
<td>0.419</td>
<td>0.345</td>
<td>0.409</td>
</tr>
</tbody>
</table>

Notes - Data are drawn from the 1970 and 1980 US Census. All estimates include controls for a set of individual's characteristics (gender, race, Hispanic ethnicity, birth quarter, age dummies), MSA and cohort fixed effects, and a set of MSA time varying characteristics (female labor force participation, teachers' education and Catholic population). Minorities include blacks and Hispanics. Standard errors are clustered at the MSA level.
Table 7: Sisters-Lay Teachers Ratio and Grade Repetition

<table>
<thead>
<tr>
<th></th>
<th>(1) All</th>
<th>(2) Whites</th>
<th>(3) Non-Hispanic Whites</th>
<th>(4) Minorities</th>
<th>(5) Below median poverty level</th>
<th>(6) Above median poverty level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sisters-Lay Teachers Ratio</td>
<td>-0.030** (0.015)</td>
<td>-0.027* (0.015)</td>
<td>-0.022 (0.015)</td>
<td>-0.111*** (0.027)</td>
<td>-0.020 (0.018)</td>
<td>-0.041*** (0.015)</td>
</tr>
<tr>
<td>Observations</td>
<td>117,148</td>
<td>110,578</td>
<td>100,803</td>
<td>16,345</td>
<td>64,217</td>
<td>52,931</td>
</tr>
<tr>
<td>Mean of dependent variable</td>
<td>0.147</td>
<td>0.144</td>
<td>0.137</td>
<td>0.192</td>
<td>0.125</td>
<td>0.168</td>
</tr>
<tr>
<td>s.d.</td>
<td>0.345</td>
<td>0.344</td>
<td>0.338</td>
<td>0.384</td>
<td>0.328</td>
<td>0.364</td>
</tr>
</tbody>
</table>

Notes - Data are drawn from the 1970 and 1980 US Census. The sample is restricted to children 7-15 years old. All estimates include controls for a set of child’s characteristics (gender, race, Hispanic ethnicity, birth quarter, age dummies), family background (maternal and paternal age dummies, maternal and paternal education (4-groups), family income), MSA and cohort fixed effects, and a set of MSA time varying characteristics (female labor force participation, teachers’ education, and Catholic population). Minorities include blacks and Hispanics. Standard errors are clustered at the MSA level.
Table 8: Other Outcomes - Reduced Form Analysis

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>(1) Dropout at post-compulsory age</th>
<th>(2) HS dropout (age 16-24)</th>
<th>(3) HS graduation (age 18-23)</th>
<th>(4) Some College (age 18-23)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sisters (in thousands)</td>
<td>0.008 (0.006)</td>
<td>0.007* (0.004)</td>
<td>0.001 (0.007)</td>
<td>-0.011 (0.011)</td>
</tr>
<tr>
<td>Observations</td>
<td>100, 161</td>
<td>340,612</td>
<td>253,128</td>
<td>253,128</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.102</td>
<td>0.036</td>
<td>0.180</td>
<td>0.168</td>
</tr>
<tr>
<td>Mean of dependent Variable</td>
<td>0.105</td>
<td>0.150</td>
<td>0.754</td>
<td>0.323</td>
</tr>
<tr>
<td>s.d.</td>
<td>0.306</td>
<td>0.357</td>
<td>0.431</td>
<td>0.468</td>
</tr>
</tbody>
</table>

Notes - Data are drawn from the 1970 and 1980 US Census. All estimates include controls for a set of individual’s characteristics (gender, race, Hispanic ethnicity, birth quarter, age dummies), MSA and cohort fixed effects, and a set of MSA time varying characteristics (female labor force participation, teachers’ education and Catholic population). Columns 2-4 further restrict the sample to individuals who were residing in the same metropolitan area 5 years before the Census. Standard errors are clustered at the MSA level.
Appendix

Figure 5: Extract from the Official Catholic Directory, 1965