

Referee report: “The Compelling Effects of Compulsory Schooling: Evidence from Canada” – Philip Oreopoulos. 2003-447

This paper investigates the effects of compulsory schooling on various adult outcomes. The author uses historical changes to compulsory schooling laws in Canada as natural experiments to identify the causal estimates of the effect of compulsory schooling on these outcomes.

The paper shows among other things that: (i) compulsory schooling has a positive effect on average educational attainment; (ii) students compelled to take an extra year of schooling experience an average of 12.3% increase in annual income, are also more likely to speak two languages, work, and are less likely to be below the poverty line, unemployed, and in a manual occupation; (iii) these results suggest that compulsory attendance laws generate substantial welfare gains, unlikely to be offset by the costs incurred by the students compelled to stay in school.

General assessment

As acknowledged by the author, the identification strategy used in this paper has already been implemented in other studies in order to provide causal estimates of the pecuniary and non-pecuniary returns to education: Angrist and Krueger (1991), Acemoglu and Angrist (1992), Harmon and Walker (1995) Lochner and Moretti (2001), Lleras-Muney (2002) and Dee (2003). The author himself has largely contributed to this literature with papers such as Milligan et al. (2003), Oreopoulos (2003) and Oreopoulos and al. (2003).

Although he claims that his estimates of the effect of compulsory schooling are presented in a framework for discussing potential policy implications rather than in the usual framework of the returns to education, only a few lines and one table in the paper are devoted to the estimation of the impact of compulsory schooling on different outcomes than earnings. Moreover, the section that analyses a social planner’s perspective on the effects of compulsory schooling is only partial, since it mainly comprises the estimation of the financial gains associated with these laws, without providing a clear assessment of the direct and indirect costs faced by the individuals compelled to attend school for another year. By admitting that “there is only one benefit we can extract from the above results, which is the financial gain for cohorts directly affected by changes in compulsory schooling” (p. 21) and that “these costs cannot be easily measured [...] it is impossible to tell from this data” (p. 22), the author himself casts doubts about the feasibility of the cost-benefit exercise carried out in section 6.

Hence, in view of the copious literature on the estimation of the returns to education, this paper does not provide a radically new insight on the effect of compulsory schooling laws on pecuniary and non-pecuniary outcomes, other than by using Canadian data rather than the usual US and UK data. Furthermore, the potential policy implications of compulsory schooling laws have already been discussed in more detail by the author in another working paper (“Do Dropouts Drop out too Soon? Evidence from Changes in School Leaving Laws” (2003)), to which he refers in section 6 of the current paper.

Concerns about the identification strategy

The identification strategy adopted by the author is to use the difference in the timing of the changes of compulsory schooling laws across Canadian provinces in order to generate exogenous variation in educational attainment for estimating the effect of compulsory schooling on earnings and other social economic outcomes.

The key equation in this paper is the one that relates educational attainment to compulsory schooling laws:

$$EDUC_{pcy} = \gamma CL_{pc} + \beta X_{pc} + e_p + e_c + e_y + e_{pcy} \quad (1)$$

where $EDUC_{pcy}$ is the average educational attainment level for the group born in province p , from birth cohort c and census year y ; CL_{pc} is a vector of provincial compulsory schooling laws (essentially a series of dummy variables indicating the minimum school leaving age) and child labour laws; X_{pc} is a vector of provincial controls, e_p , e_c and e_y are fixed effects for province, birth cohort, and census year, and e_{pcy} is the error term.

My main concern is that although this equation includes controls for province, birth cohort and census year, the coefficients of the schooling laws dummy variables cannot be interpreted as measuring the *causal effect* of compulsory schooling on educational attainment without further investigation into the validity of the instruments and the reliability of the first stage equation used by the author.

In order for compulsory schooling laws to have generated exogenous variations in schooling, it must be the case that they were *binding* for some individuals and that they were effectively implemented. An increase in compulsory attendance for a given province should therefore be associated with a sudden increase in both the average school leaving age and the average educational attainment (last grade completed) in that province. This kind of pattern is far from being obvious in the author's paper: discontinuities at the year when the laws change do not appear visible on figure 2, which displays the average grade attainment by year turned 14 years old (1900-2000). Even if the main effect of changes to the law would be to affect the average school leaving age, we should still expect these laws to have shifted the average grade attainment. The author claims that this absence of large discontinuities could be explained by the fact that increasing the length of time spent in school may not raise education attainment for those retained a grade. However, some doubts can be raised about the validity of this assumption, since pupils retained a grade typically represent only a small fraction of a given class, so discontinuities would only be slightly attenuated when using the average grade attainment rather than the average school leaving age.

Furthermore, a causal interpretation of the coefficients of provincial compulsory schooling laws in equation (1) is not straightforward: since the equation assumes that birth cohort fixed effects are identical for all the provinces and that any provincial deviation of the evolution of average educational attainment from the estimated national time path will be imputed to the effect of the minimum school leaving age in this province. For instance, in provinces where children are required to attend until 14 years old tend to experience higher growth rates in educational attainment than provinces where the minimal school leaving age is 12 or less (reference

category), the coefficient of the dropout at age 14 dummy in equation (1) would be positive. Does this mean that compulsory schooling has a positive causal impact on educational attainment? At least three features of the regression results displayed in table 1 cast doubts about this inference:

1. The school leaving age in the paper is age 12 or less (or no dropout age). According to figure 1, only two provinces did not impose compulsory schooling after age 12 for individuals aged 14 between 1920 and 1970: New Brunswick (for 1920-1945 cohorts in the sample) and Newfoundland (for 1920-1940 cohorts). A quick look at figure 2 shows that the educational attainment of 1920-1940 cohorts in these two provinces grew less rapidly than in other provinces, where the minimum school leaving age was higher. This in turn implies that longer compulsory attendance will tend to be associated to higher educational attainment in the regression output displayed in table 1. But there could be a variety of reasons why the average educational attainment of individuals who faced a minimum school leaving age of 12 or less grew less rapidly in New Brunswick and Newfoundland than in other provinces: one can think in particular that changes in compulsory schooling laws would tend to be implemented earlier in provinces where the social demand for education is higher: in this case, higher growth rates of educational attainment should be viewed less as a consequence of increased compulsory schooling than as a preliminary to it.
2. In all the different regression specification, a dropout age of 16 is associated with significantly *lower* average educational attainment than a dropout age of 15, whereas theoretically, raising the minimum school leaving age should unambiguously exhibit an increase in average grade attainment, whatever the number of years required before being able to leave school. The author claims that this finding may, in part, be due to enrolment patterns in Quebec after 1950, but nowhere in the paper is this hypothesis explicitly tested. Since this result clearly contradicts the assumptions underlying the author's identification strategy, he should further investigate this issue.
3. The regression displayed in table 2, which compares the estimates of the effects of the compulsory school law variables on different levels of education, was performed by the author to make sure that compulsory attendance laws did not substantially affect educational attainment beyond high school. In contrast with the author's views, I do not find the results of this regression to be particularly striking: under the human capital hypothesis, we should expect compulsory attendance to increase educational attainment for *all* grades situated *below* the grade corresponding to the minimum school leaving age. However, table 2 shows that the dropout age at 14 years old only significantly affected grade 7 attainment, while it should have also affected grades 8 and 9; the dropout age at 15 years old increased all grades attainment below grade 11, while it should not have affected grade 11. Finally, the dropout age at 16 years old only increased grade attainment for grades 7 to 9, while it should have also affected grades 10 and 11.

In order to rule out the possibility that increased compulsory schooling had no causal effect on educational attainment in Canada, the author should provide convincing evidence that the various compulsory schooling law changes generated discontinuities in the distribution of the school leaving ages of those individuals who were forced to stay longer in school than they wished, as he did in his working paper on dropouts (2003), using UK data. I also believe that the

author should try to focus initially on the main discontinuities that changes in compulsory schooling laws introduced in the evolution of average educational attainment: using a difference-in-difference framework would allow him to estimate the returns to education for the two generations surrounding the law change, in a more transparent way.

Other comments

- p. 9: since the town and rural dropout age rarely differed, the author uses the town dropout age only. If the effect of compulsory schooling differs for rural and urban populations, using only the town dropout age could be problematic.
- p. 14: the title of subsection 5.A is “The impact of compulsory schooling on school enrolment and education attainment”, but the impact on school enrolment rates cannot be found in the paper. Since the dependent variable in the regressions displayed in table 1 is grade attainment, I do not understand how the author can assert that “raising the minimum school leaving age to 14, compared to any lower limit is associated with an percentage point increase [sic] to a province’s school enrolment rate” (p. 15).
- Figures 1 and 2: all the x- and y-axes should be labelled and vertical lines separating the decades should be added to facilitate the lecture of the graphics.
- Table 1: the omitted dropout age is 12 or less (or no dropout age) and the school leaving age dummy variables are 14, 15 and 16 years old. However, figure 1 shows that 1920-1940 cohorts born in the province of Prince Edward Island faced a minimum school leaving age of 13, so the reference dropout age should be changed to 13 or less (or no dropout age).
- Add a table indicating the exact timing of compulsory law changes for every Canadian province.
- Problem with the numbering of the tables: table 5 is referred to as table 4 in the text, table 6 is referred to as table 5 and table 8 is referred to as table 6.