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Civic Returns to Education: Voter Turnout in Ireland

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Abstract: Education is one of the most often cited explanations for voter turnout. However, the international evidence that estimates the causal effect of education on voter turnout is mixed. There is no evidence for such a causal effect in Ireland. Using data from the Irish Longitudinal Study on Ageing (TILDA), and employing the instrumental variable (IV) probit model, we investigate whether education has a causal effect on individuals' political participation in their later lives. We find that individuals with more education are more likely to vote in the general election. The effects are larger for individuals whose parents have only primary education or below, and for individuals growing up in a poor family. The findings provide motivations for increasing targeted public supports in education for students coming from a disadvantaged family.

I INTRODUCTION

There is a large literature on the private returns to education, which reflects the private costs and benefits of education for the individual. The private benefits that have been featured prominently in discussions are labour market status, health and longevity. Numerous studies have confirmed that better-educated individuals tend to earn higher wages, experience less unemployment, and work in more

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prestigious occupations (Card, 1999). Besides life expectancy, education is also associated with various mental and physical health outcomes (Grossman, 2015; Montez and Friedman, 2015).

The literature on social returns to education (i.e. the costs and benefits of education for the whole of a society) is growing. A good understanding of social returns to education is important for both policymakers and researchers. Current education policies are often justified on the basis of at least modest social returns to education, a better understanding of which would produce important inferences for policymaking and assessing the efficiency of public investment in education. Various types of social returns to education have been explored, and one of them involves civic behaviours and attitudes.

Education is one of the most often cited explanations for civic engagement (such as electoral participation). Individuals with more education are more likely to believe in democratic values and to participate in civic duties. It is well documented in the literature that more educated citizens are more likely to vote in elections and have a higher level of political participation. Theoretical explanations posit that education confers participation-enhancing benefits that in and of themselves cause political activity (Kam and Palmer, 2008). As Milligan *et al.* (2004) put it, education can improve political participation either through the enhanced quality of participation by a given subset of citizens or through broader participation among citizenry, the former being important if education equips citizens with the cognitive skills they need to be effective participants in a representative democracy, while the latter is important if education improves citizens' interest and knowledge of political issues, their involvement in the political process and ultimately the effectiveness of their political participation. Friedman (1962) argued for public investment in education on the basis of the improved choices that a better-educated electorate would make.[1]

One challenge in identifying the causality is that education may be acting as a proxy for other factors (family background, innate cognitive ability, personality etc.) that lead to electoral participation. The other challenge lies in the channels through which education can affect voter turnout (Sondheimer and Green, 2010).[2]

Given the fact that the school system is financed almost exclusively from central government funds in Ireland, it is vitally important to analyse whether public

[1] However, alternative mechanisms suggest that additional education might reduce political engagement. Increased education might raise the opportunity cost of an individual's time and effort, thus reducing the amount of time and effort allocated to civic activity. Education might reduce the overall political participation by promoting the awareness of the infinitesimally small probability of influencing actual policy of individual voting (Dee, 2004).

[2] The increased educational attainment does not necessarily translate into increased political participation as the education that students received might impart less awareness of and concern with politics.

investment in education has wider social benefits, in addition to the well-documented private returns. And if it does, the estimation of the magnitude of the social benefits is important for assessing the efficiency, equity and sustainability of public investment in education.

Using data from the Irish Longitudinal Study on Ageing (TILDA), this paper attempts to contribute to the literature with new evidence by identifying the causal effects of education on individuals' political participation in their later lives in Ireland. Baseline probit estimates indicate that an additional year of schooling is associated with a 0.9 percentage point higher probability to vote. To deal with the challenges in inferring causality between education and voter turnout, we employ an instrumental variable (IV) strategy, where we measure the effect of additional schooling due to institutional education reform in Ireland, based on the assumption that the instrumental variable generates possible exogenous variation in individual years of schooling but is unrelated to individuals' voter turnout in their later lives.

In 1967, the secondary education was unexpectedly made free for all school-age individuals nationwide in Ireland, which is referred to as the "free secondary education scheme" reform. Given the fact the fee-paying aspect of the secondary education was a major hurdle for Irish families at that time (Harmon and Callan, 1999, Denny and Harmon, 2000, Denny, 2014), this reform would alleviate the substantial financial burden for Irish families and have significant impact on students' education participation.

Based on the TILDA data, we are able to identify the age cohorts who were (and were not) subject to this reform in 1967, and link this to their political participation 40 years later, to provide the first set of estimates on the long-run causal effect of education on political participation in Ireland. The IV probit estimates show that individuals with more years of education are more likely to vote. We find that an additional year of schooling increases the probability to vote in the general election by 5.5 percentage points.

We then conduct analysis on two restricted samples: individuals with both parents having low level of education or none at all, and individuals who report growing up in a poor family. These individuals are from disadvantaged family backgrounds and are most likely to be affected by educational reform. We find that positive causal effect of education on voter turnout is more evident in these sub-samples.

The rest of this paper is set out in sections. We review the literature in Section II and describe the electoral and education systems in Ireland in Section III. Discussions on the data and methodology are in Section IV. Section V outlines the main empirical results, with Section VI setting out the conclusion.

II LITERATURE REVIEW

In this paper, we set to estimate the causal impact of education on individuals' political participation in their later lives in Ireland. The significance in policymaking and theory has generated a large literature on the relationship between education and voter turnout. The compelling positive correlation between education and political participation is largely based on association analysis,[3] and the international evidence that estimates the causal effect on voter turnout is still mixed.

A number of studies that focused on the causality provide supportive evidence for the argument that education is the cause of electoral participation (Dee, 2004; Milligan *et al*., 2004; Sondheimer and Green, 2010).

Verba and Nie (1972) are among the first to empirically investigate the link between socio-economic status (SES) and political participation using micro-level evidence. They argue that high SES leads individuals to develop a set of "civic" attitudes, leading to electoral participation. Dee (2004) and Milligan *et al*. (2004) are the first two studies conducted by economists. Using an IV approach and the highest level of education completed as the education measurements, Dee (2004) finds that college education has positive and statistically significant causal effects on voter participation and civic engagement in the US. Also using an IV approach, Milligan *et al*. (2004) find a positive and statistically significant causal effect of education on voter turnout for the US but not for the UK, although strong correlation is revealed in both countries. Using natural experimental settings, Sondheimer and Green (2010) find that exogenously induced changes in high school graduation rates have positive significant effects on voter turnout rates in the US. Both of the studies use high school graduation as the key education variable.

However, some other studies find limited or no causal effect of education on voter turnout. In Denny and Doyle (2008) and Kam and Palmer (2008), the effects of education on voter turnout decrease, or even disappear after including other factors.[4] Using compulsory schooling reforms as instrument, Siedler (2010),[5] and Pelkonen (2012)[6] find no supportive evidence for the causal effect of education on

[3] Sondheimer and Green (2010) provide a good review on this.

[4] Denny and Doyle (2008) find that personality and cognitive ability play a far great role than education in determining voter turnout in Britain. Kam and Palmer (2008) find that after matching on pre-adult experiences and influences, the effects of higher education on voter turnout disappear.

[5] Using the German compulsory schooling law as the instrument, Siedler (2010) estimates the effect of schooling on a series of political behaviours, including electoral participation, political awareness, democratic values, political involvement, political group membership, etc. Though significant positive effects were found in the probit estimation, the IV estimates suggest no evidence for positive political returns to schooling in Germany in the post-war period.

[6] Pelkonen (2012) uses an IV strategy (Norwegian staged school reform) to identify the effect of years of schooling on voter turnout. The impact is measured at both individual and municipality level and both sets of results suggest that education has no effect on voter turnout.

voter turnout. Using the draft in the Vietnam War as the instrument for college education, Berinsky and Lenz (2011) find that college education itself may not increase individuals' voter turnout.[7]

Different measures of educational attainments and different estimation strategies are used in the literature. Different results arise for different contexts. In this paper, using the TILDA data, we contribute to the literature in the following ways: firstly, given that the age cohorts in TILDA were subject to the "free secondary education scheme" reform in 1967 and we have information on their voter turnout in the general elections in Ireland 40 years later, we attempt to identify the long-run causal effect of education on voter turnout and add to the literature with evidence which is the first of its kind from Ireland. Secondly, we also have information on individuals' family background (both parents' educational attainments, and family's financial situation when growing up), which enables us to focus on those who come from disadvantaged family backgrounds as they are most likely to be affected by the reform, and test whether the impact of education on voter turnout in later life, identified by the exposure to the reform in childhood, is larger among these individuals.

III THE ELECTORAL AND EDUCATION SYSTEMS IN IRELAND

3.1 Irish Electoral System

There are local elections, European elections, general elections, presidential elections and referendums in Ireland. General elections refer to the elections to Dáil Éireann, the lower house of the Oireachtas (or referred to as Oireachtas Éireann sometimes). General elections are required at least every five years by the Electoral Act 1922. Residents of the State who are Irish citizens or British citizens have the right to vote in the general elections. Voting participation is not compulsory in Ireland, however in order to exercise the voting right, one must be at least 18 years of age, and ensure that his/her name has been entered on the Register of Electors. Figure A1 in the Appendix shows the voter turnout in the general elections in Ireland since 1948.

Since 1922, members of the Irish parliament, Dáil Éireann, have been elected by the system of proportional representation by the single transferable vote (PR-STV). Under the PR-STV system, voters may rank in order all of the candidates listed on the ballot paper, having the choice of candidate between parties, within parties, or even without regard to party. Therefore, there is both intra-party and inter-party electoral competition (Gallagher and Mitchell, 2008).

[7] The cross-time variation in exposure to the risk of draft in the Vietnam War in the late 1960s is used as an instrument for whether an individual received some college education.

Statistics from the Irish Central Statistics Office (CSO) also show that the voter turnout varies in different age groups. The 50+ year-old population have voter turnouts ranging from 85 per cent to 93 per cent for both the 2002 and 2011 general elections, while the 18-24 year-old group have only 50 per cent to 60 per cent of voter turnouts for both elections.[8] The higher voter turnout among the older age cohort under the PR-STV system might enable them to have disproportionately higher representation in the general election.[9]

3.2 Irish Education System

Comprehensive description of the Irish education system can be found at Tussing (1978). This section provides a brief overview on the changes since the 1960s. The Irish education system consists of first-level (primary), second level and third level education, as well as further and adult education. Primary education normally starts at five years of age and ends at 13 years of age, at which point the pupils transfer to second level education. There used to be the Primary Certificate examination, which was abandoned in the late 1960s.[10] The second level education span is predominantly a six-year cycle, taken by ages 13 to 18. It comprises secondary, vocational, community and comprehensive schools. There are two key public examinations in this cycle; the Junior Certificate (age 15/16), and the Leaving Certificate (age 17/18). There used to be Group Certificate and Intermediate Certificate examinations that students at secondary education could take at the age of 15/16. The Group Certificate examination was typically taken by students in vocational schools and the Intermediate Certificate exam was taken by those with a more academic aspect, and typically led to the study for the Leaving Certificate. They were later replaced by a single exam, the Junior Certificate exam. Students typically enter third level education at the age of 18. Third level education is provided mainly by universities, institutes of technology and colleges of education (Department of Education and Science, 2004).

Specifically, the following two reforms are of essential relevance to this analysis. In 1966, the then Minister for Education, Donogh O'Malley unexpectedly announced that all secondary schooling would become free in the following

[8] Quoted from Central Statistical Office Ireland, Quarterly National Household Survey Quarter 2 2011. (www.cso.ie/en/media/csoie/releasespublications/documents/labourmarket/2011/voterq22011.pdf).

[9] For more information on the PR-STV system can be found in the *Guide to Ireland's PR-STV Electoral System* by Department of Environment at (www.environ.ie/sites/default/files/migrated-files/en/Publications/LocalGovernment/Voting/FileDownLoad,1895,en.pdf).

[10] The Primary Certificate exam was a compulsory exam that pupils took at the sixth class in primary school. It was abandoned following the free education scheme in 1967. The abolition of the Primary Certificate exam should not be a concern as the certificate was mainly accepted by employers as evidence of the standard of education of applicants for employment or apprenticeship (CSO, 2000) and the fee-paying aspect to the secondary education was the major hurdle for Irish families (Harmon and Callan, 1999; Denny and Harmon, 2000; Denny, 2014).

academic year. The so-called "free secondary education scheme" came into effect in the academic year of 1967. Prior to the reform, the annual fees per pupil were approximately two weeks wages for an average manual worker (Denny and Harmon, 2000), and the fertility rate was high at that time as well.[11] It is estimated that the secondary school fees could represent up to one-sixth of total household income (Denny and Harmon, 2000). This reform would enormously alleviate the financial burden and significantly influence students' participation in secondary education, especially for students from disadvantaged socioeconomic backgrounds.

The School Attendance Act of 1926 required compulsory attendance at school for 6- to 14-year-olds. The Garda (the national police force) were responsible for enforcing this obligation. Under the intensive enforcement of the Act, the attendance rates increased gradually. By the 1960s, the attendance rates had generally risen above 90 per cent (Fahey, 1992). In 1972, the minimum school leaving age was further lifted to the age of 15. However, literature shows that this reform alone appears to have had limited effect on individuals' years of education (Harmon and Callan, 1999).

IV DATA AND METHODOLOGY

4.1 Data

The data used in this analysis come from the Irish Longitudinal Study on Ageing (TILDA). TILDA is a population-based, nationally representative, longitudinal study of 8,504 community-dwelling adults in Ireland aged 50 and older and their partners. The sample was derived from a clustered random sample of all households in the Republic of Ireland. To generate the TILDA sample, all residential postal addresses in the Republic of Ireland were assigned to one of 3,155 geographic clusters. A sample of 640 of these clusters was selected, stratified by socio-economic group and geography to maintain a population representative sample. Clusters were selected with a probability proportional to the number of individuals aged 50 and over in each cluster. Eligible participants (and their partners or spouses of any age) were invited to take part in the survey every two years.

The dataset contains a rich set of variables on the health and socio-economic circumstances of older people. The first wave of data was collected during October 2009 to February 2011. Data were collected via computer-aided personal interviewing (CAPI), and 85 per cent of all participants also completed a self-completion questionnaire (SCQ) which was designed to collect more sensitive information on issues such as relationships, expectations and mood/feelings. The second wave was collected during April 2012 to January 2013, when 87.5 per cent of participants in Wave 1 were successfully followed up.

[11] The total period fertility rate for a woman was around 4 at 1966 (CSO, 2000).

The key voter turnout measure is formed from a question in the SCQ. The question is: "Did you vote in the last general election?". Wave 1 data cover the results of 2007 Irish general election, which took place on 24 May 2007. Wave 2 data cover the results of 2011 Irish general election, which took place on 25 February 2011.[12]

The SCQ was designed to allow TILDA to explore certain areas that were considered particularly sensitive for respondents to answer directly to an interviewer. All participants who complete the CAPI questionnaire are invited to fill in a paper SCQ. The SCQ includes questions or topics of a sensitive nature that are more suitable for completion in writing by the individual respondents. It takes approximately 15-20 minutes to complete. The participant may choose to fill in the questionnaire either while the interviewer is still in the home (i.e. if the interviewer is interviewing a spouse or family member) or at another time and return it by post. With the SCQ, the respondent can avoid direct contact with the interviewer, having enough privacy and time to complete sensitive questions.

The misreporting problem is well known to be prevalent in voter turnout data. There is evidence that survey respondents, especially those with higher level of education, are more likely to overstate their civic participation. One important source of misreporting that could be correlated with schooling is the potential for embarrassment. A respondent might be embarrassed to admit that he/she did not vote in the last general election to the interviewer, leading to untruthful responses. However, the fact that the voting question in TILDA is contained in the SCQ could help to avoid this problem. The fact that the voter turnout statistics (See Figure 1) derived using the TILDA sample are very similar to the official data is also reassuring.

Figure 1 presents data from TILDA on voter turnout in the 2007 and 2011 general elections in Ireland by education level. It is evident that a higher proportion of individuals with high levels of education vote in general elections. The distribution of voter turnout in the TILDA sample is comparable with the data collected by the CSO.

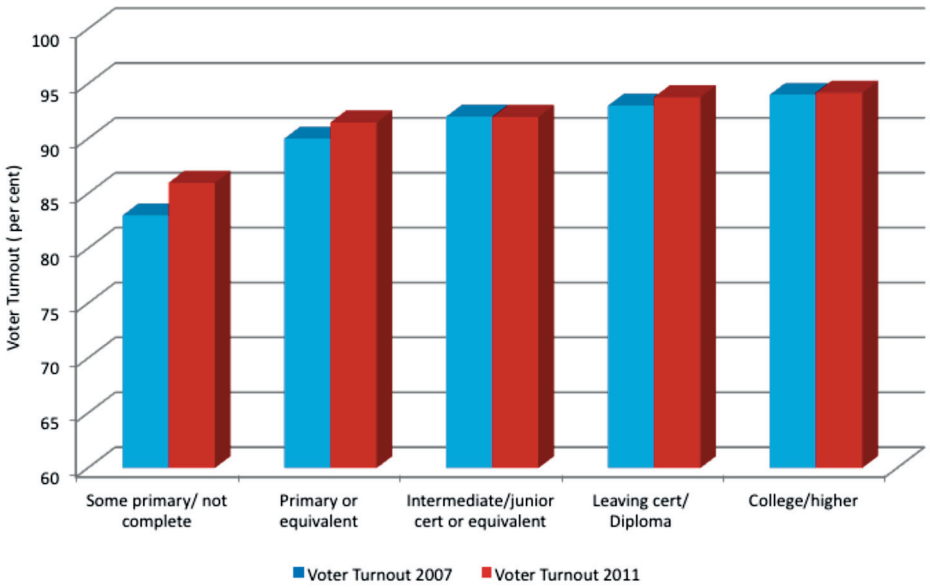
4.2 Methodology

We start with a standard Probit regression. The association between years of schooling and individual voter turnout takes the form:

$$\Pr(P = 1) = \Phi(\Upsilon E_i + BX_i + \xi_i) \quad (1)$$

[12] The CAPI interview of Wave 1 ended on 22 February, 2011, which is three days before the 2011 general election. However, given the probability that the respondents may fill in the SCQ later than the CAPI interview, it is possible that a small number of the very last Wave 1 participants could be answering the Wave 1 question on voter turnout in relation to the 2011 general election. Therefore, we also conduct the analysis excluding those respondents who were interviewed in February 2011, and the results are similar.

Figure 1 Voter Turnouts in the General Elections in Ireland by Education Level



Source: Author's calculations based on data from TILDA.

where the outcome variable is a dummy variable, with 1 indicating that an individual voted in the general election and 0 indicating an individual did not vote in the general election. E_i is individual's years of education.[13] X_i is a vector of control variables, including age at the time of general election, age-squared (divided by 1,000), gender and region. Since the final sample covers the results for two general elections, we also include an indicator for which general election the respondents refer to.[14]

However, the standard probit regression results may be inconsistent since the level of education is not assigned randomly, but might be a conscious choice. It is still possible that both individual's years of schooling and electoral participation are determined by unobserved characteristics that we didn't control for. In a second step, to account for such individual unobserved characteristics that may affect both education and political participation, we employ an IV strategy. We instrument

[13] Since the "age left full time education" is only captured in Wave 2, for those individuals who dropped Wave 2, we only have their information on the "highest educational attainment". For those individuals, we converted the highest educational attainment into approximate years of schooling in a mechanical way, following Pischke and von Wachter (2008).

[14] See Oreopoulos (2007); Pischke and von Wachter (2008); Siedler (2010) for a similar set of explanatory variables.

individuals' years of schooling with their exposure to the free secondary education scheme in Ireland in 1967. Such government-led reform has been widely used in the education literature as an instrument in estimating the effect of education on various outcome variables across the economic, health and social domains (Card, 1999; Oreopoulos, 2007; Fan *et al.*, 2015; Grossman, 2015).

The first-stage regression takes the form:

$$E_i = \alpha_0 + \alpha_1 \text{Treated}_i + KX_i + \mu_i \quad (2)$$

where E_i and X_i are the same as defined in Equation (1). Treated_i is the instrument variable derived from individual's exposure to the educational reform. The assumption here is that (ξ_i, μ_i) has a bivariate normal distribution.

To generate the instrument variable, we create a dummy variable (Treated_i) equal to 0 if the year of birth was before 1953, equal to 1 if the year of birth was after 1953 (inclusive).[15]

Individuals who were born in the year 1954 would have turned 13 and started secondary education in 1967. However, the minimum school leaving age at the time of implementation of the free education scheme in 1967 was 14 years old. And it is documented that the attendance rate by compulsory age children (6-14 years old) was above 90 percent in the mid-1960s (Fahey, 1992). Individuals who were born in the year 1953, who would have turned 14 years old in 1967, would be the first cohort to "freely" choose whether to take advantage of the free secondary education scheme by staying in schooling longer or not.

Individuals who were born before the year 1953 would not have been affected by the reform since they already passed the age of starting secondary education, and they were free to leave school as they wished and were unlikely to return to school because of the free education scheme if they had already left. So the effect of the reform on this group is very limited.

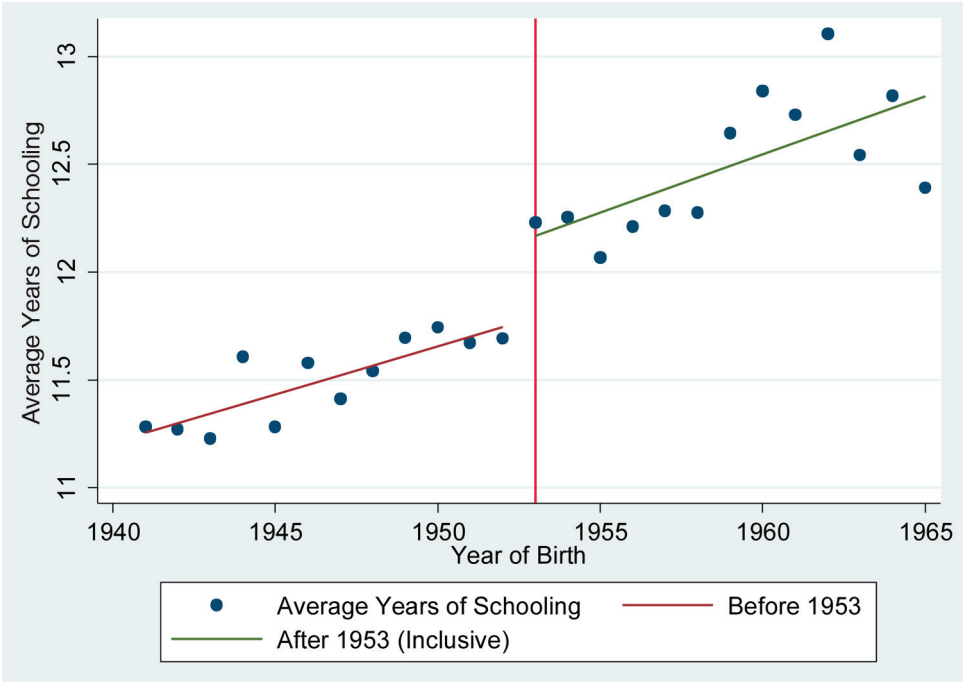
Individuals who were born after 1953 would have been no more than 13 years old in 1967. Their choice of continuing secondary education would have been fully affected by the reform.

The identification assumption is that while the introduction of the free education scheme does affect individuals' years of schooling, the timing of changes in the education reform is orthogonal to the individual characteristics that affect voting. First, the instrument indeed was effective in increasing individuals' years of schooling. Given the fact that the annual fees per pupil at the time of the introduction of the free secondary education scheme were approximately two weeks wages for the average manual worker, with no organised schemes nationally or at

[15] Taking the fact that pupils might start the primary education at either the age of four or five, and though it was a nationwide reform, a small minority of secondary schools continued to charge fees after 1967.

school level for the waiver of the fee, and given the large family sizes prevailing at that time, the removal of the secondary school fee would alleviate the substantial financial burden for Irish families. Tussing (1978) finds that the long-run increase in school participation due to the reform, abstracting from other trends in the data, is about 20 per cent. As a first descriptive evidence, Figure 2 shows the average years of schooling by birth cohort and the fitted values by section. The reference line refers to the year 1953. For the cohorts who were born before 1953, the average number of years of schooling is evidently lower than the cohort who were born after 1953.

Figure 2 Average Years of Schooling by Birth Cohort (Full Sample)



Second, the instrument would only affect individuals' political engagement behaviour through its effect on individuals' education attainment levels. The common concern in the literature is that the timing of the reform would be correlated with other individual characteristics that affect voting. We believe that this is not a severe problem in this study. In contrast to other studies using state policy changes as instruments, simultaneous changes in the educational reform and changes in political attitudes are not necessarily problematic for the instrument in this study, because we examine individuals' voting behaviour four decades after the secondary school education reform.

In practice, we exclude those who were born outside of the Republic of Ireland and came here after school decision has been made. The descriptive statistics are presented in Table 1.

Table 1 Descriptive Statistics

		[1] Full Sample		[2] Voted		[3] Did Not Vote	
Variables	*N*	*Mean*	*S. D.*	*Mean*	*S. D.*	*Mean*	*S. D.*
Outcome variable:							
Vote(=1)	8,683	0.94	0.23				
Education measures:							
Years of Education	10,512	11.90	2.83	12.08	2.81	10.99	2.85
Controls:							
Age	10,516	57.41	6.14	57.57	6.20	56.78	5.94
Age-squared/1000	10,516	3.33	0.71	3.35	0.72	3.25	0.68
Female	10,520	0.56	0.49	0.56	0.50	0.56	0.49
Rural	10,515	0.59	0.49	0.59	0.49	0.56	0.49
Wave 1 (=1)	10,520	0.53	0.49	0.52	0.49	0.53	0.49
Wave 2 (=1)	10,520	0.47	0.49	0.48	0.49	0.47	0.49

V RESULTS

5.1 Main Sample

The first-stage regression results (based on Equation (2)) are reported in Table 2. The estimates show that there is a statistically positive significant relationship between the exposure to the free secondary education reform and the years of schooling. On average, compared to those who would not have been affected by the free education scheme, those individuals who would have been affected by the free education scheme tend to have 0.31 more years of schooling. This is in line with Pischke and von Wachter (2005) and Siedler (2010). Pischke and von Wachter (2005) find that one more year of compulsory schooling increases school attainment by 0.17-0.6 year. Siedler (2010) finds that increasing compulsory schooling by one year increases years of schooling by about 0.4-0.5 year. The free secondary education scheme in Ireland had a large and significant impact on education, and it provides a strong instrument for individuals' years of schooling.

Table 3 presents the results for the relationship between years of schooling and voter turnout for the main sample. The dependent variable is a dichotomous variable, equal to 1 if an individual voted in the general election and 0 if an

individual did not vote in the general election. We report the coefficients from the estimation, and also the marginal effects in brackets. Column 1 presents the estimates from standard probit estimation, where individuals' years of schooling are regarded as exogenous. For an individual, the year of schooling is positively associated with higher probability to vote. The marginal effects estimate shows that an additional year of schooling is associated with about 0.9 percentage point higher probability to vote. Column 2 provides the results from the IV-probit estimation, where we use free secondary education reform as the instrument. Individuals with more years of schooling are more likely to vote in the general election. An additional year of schooling increases the probability of voting by approximately 5.5 percentage points.[16] This finding provides supportive evidence for the conventional understanding that educational attainment is a critical determinant of political engagement.

Table 2 The Effect of the Reform on Years of Schooling

Y = Years of Schooling	*[1]*
Treated=1	0.31**
	(0.15)
Age	–0.11
	(0.09)
Age squared /1000	0.51
	(0.82)
Female	0.25***
	(0.08)
Growing up in rural area	–0.21***
	(0.08)
Wave	0.25***
	(0.06)
Constant	16.16***
	(2.83)
Observations	8,672

Note: Robust standard errors, adjusted for clustering at individual level, are reported in parentheses.
* denotes the significance level, with *** P<0.01, ** p<0.05, * P<0.1.

[16] We also perform the analysis using weights to account for the possibility that individuals who completed the SCQ might be different from those who did not. The results are similar.

Table 3 Probit and IV Probit Estimates of the Effect of Schooling on Voter Turnout (Full Sample)

Y= 1 if voted	*[1] Probit Coef [ME]*	*[2] IV-Probit Coef [ME]*
Years of Schooling	0.08***[0.009]	0.28**[0.055]
(S.E.)	(0.01)	(0.14)
Observations	8,672	8,672
Log-likelihood value	–1880.84	–23055.88

Note: "Coef" stands for estimation coefficients, and "ME" stands for marginal effects. All specifications also control for age, age squared, indicators for female, growing up in rural area and each and every general election. Robust standard errors, adjusted for clustering at individual level, are reported in parentheses.
* denotes the significance level, with *** P<0.01, ** p<0.05, * P<0.1.

The magnitude of the effect is smaller than Dee (2004) and Milligan *et al.* (2004). Dee (2004) finds that college entrance increases voter participation by roughly 17 to 22 percentage points. Milligan *et al.* (2004) find that high school graduation leads to an increase on the self-reported probability of voting by about 28.8 to 34.2 percentage points. The differences in magnitudes could be explained by the different contexts of the analyses and the different measures of education attainment. The voter turnout in Ireland is much higher than the US. We use "years of schooling" as the key education variable, while Dee (2004) and Milligan *et al.* (2004) use "college entrance" and "high school graduation" respectively.[17]

The magnitudes of the IV-probit estimates are larger than the standard probit estimates. We believe there are several reasons why the estimates from the standard probit estimation might be downward biased. First, as frequently discussed in the literature, this could reflect an attenuation bias driven by measurement error in reported schooling. Second, this could also reflect the influence of the unobserved characteristics that affect both individuals' years of schooling and their decisions to vote. Third, when using an IV strategy to estimate causal effects, we can only identify the local average treatment effect (LATE) for the compliers (those who change their schooling attainment due to the reform) (Angrist and Pischke, 2009). In this context, the compliers are those who would not attend secondary school if there was no abolition of the secondary school fee. In the Irish context, the compliers are more likely to be found in the lower end of the social class distribution. Therefore, in next section, we also report estimations from two

[17] We use an indicator for completing the Intermediate/Junior/Group Certificate or equivalent as an alternative measure of educational attainment to perform a robustness check in Section 6.2.

restricted samples to examine whether there are heterogeneous civic returns to schooling with higher returns for those individuals who are most likely to be affected by the free education reform.

5.2 Restricted Samples

Table 4 provides further evidence of the relationship between years of schooling and civic behaviours for two restricted samples: individuals with both parents having a low level of education or none at all; and individuals who report growing up in a poor family. On the one hand, those individuals who come from disadvantaged family background are more likely to be affected by the reform, compared to individuals who have a more advantaged family background.[18] On the other hand, the political returns for individuals with disadvantaged family backgrounds could be considerably higher (Siedler, 2010). Parents with higher levels of education might pass on their democratic values and sense of civic duties to their children, so the children might be more likely to vote regardless of how many years of schooling they actually received. In this case, the effect of schooling on voter turnout would be low. On the other hand, for individuals whose parents have a low level of education and low level of democratic values, more years of schooling could have a profound influence on their civic engagement, such as voting participation.[19]

The results in Table 4 confirm the argument. Columns 1 and 2 present the effect of schooling on voter turnout for the individuals whose parents have only primary education or below. Columns 3 and 4 provide the results for the individuals reporting growing up in a poor family. All the estimates point to a positive significant relationship between years of schooling and voter turnout. And the effects are larger in magnitude compared to the results in Table 3, especially with the IV estimates, which allow us to estimate the marginal effect of years of schooling on voter turnout for individuals who are most likely to be affected by the free secondary education reform. The results indicate that there is a larger positive effect of years of schooling on voter turnout for individuals with a disadvantaged family background.

[18] We also conduct analysis on the sub-samples of individuals whose parents' education levels are higher than primary education, and who report growing up in a well-off or average environment. We find that whether being exposed to the reform does not have significant impact on the years of schooling for these individuals.

[19] Figure A.2a in the Appendix presents the average voter turnout by birth cohort for the whole sample. This figure indicates that there is no direct influence of the timing of the reform on individuals' civic participation years later at the whole sample level. Further splitting the whole sample into two sub-samples: individuals who come from disadvantaged family background, measured as growing up in poor families; and individuals who come from non-disadvantaged family background (growing up in non-poor families), and calculating the average voter turnout by birth cohort for each sub-sample gives us the results reported in Figures A2.b and A2.c, respectively. While there is no direct impact in the sub-sample of individuals from non-disadvantaged family background, there is some evidence of the increase of voter turnout before and after the reform in the sub-sample of individuals from disadvantaged family backgrounds.

Table 4 Probit and IV Probit Estimates of the Effect of Schooling on Voter Turnout (Restricted Sample)

	[1]	*[2]*	*[3]*	*[4]*
	Individuals whose parents have only primary education or below		*Individuals reporting growing up in a poor family*	
Y= 1 if voted	Probit Coef [ME]	IV-Probit Coef [ME]	Probit Coef [ME]	IV-Probit Coef [ME]
Years of Schooling (S.E.)	0.08***[0.010] (0.02)	0.37***[0.099] (0.08)	0.10***[0.014] (0.03)	0.33***[0.081] (0.10)
Observations	5,098	5,098	1,735	1,735
Log-likelihood value	–1171.80	–12981.95	–463.90	–4542.82

Note: "Coef" stands for estimation coefficients, and "ME" stands for marginal effects. All specifications also control for age, age squared, indicators for female, growing up in rural area and each and every general election. Robust standard errors, adjusted for clustering at individual level, are reported in parentheses.
* denotes the significance level, with *** P<0.01, ** p<0.05, * P<0.1.

VI ROBUSTNESS CHECKS

6.1 Alternative Functional Forms

To check whether the results are sensitive to functional form assumptions, we also conduct the analysis using linear probability model (LPM) and Logit model. The LPM allows for the linear relationship between education and voter turnout. Logit model assumes the standard logistic distribution of the standard errors. We also estimate the standard two-stage least squares (2SLS) model. Results are presented in Table 5. Panel A contains results from the LPM, logit and probit regressions, while Panel B contains results from the IV estimates. The results from alternative functional forms are largely consistent with the main results reported in Table 3.

6.2 Alternative Education Measure

In the main analysis, education is measured by years of schooling. In this section, we provide an alternative measure of educational attainment. It is an indicator for completing the Intermediate/Junior/Group Certificate or equivalent. This allows us to test whether the free education scheme reform affects a particular education level (i.e. whether the reform has a uniform effect increasing years of schooling by 0.31 years across the population, or it has a particularly strong effect on the likelihood of completing certain level of education?). We run the analysis using this alternative

Table 5 The Effect of Schooling on Voter Turnout (Alternative Functional Forms)

Panel A	*[1]*	*[2]*	*[3]*
Y= 1 if voted	LPM Coef	Logit Coef [ME]	Probit Coef [ME]
Years of Schooling	0.008***	0.17***[0.009]	0.08***[0.009]
(S.E.)	(0.001)	(0.03)	(0.01)
Observations	8,672	8,672	8,672
Panel B			
Y= 1 if voted	2SLS Coef		IV-Probit Coef [ME]
Years of Schooling	0.04		0.28**[0.055]
(S.E.)	(0.04)		(0.14)
Observations	8,672		8,672

Note: "Coef" stands for estimation coefficients, and "ME" stands for marginal effects. All specifications also control for age, age squared, indicators for female, growing up in rural area and each and every general election. Robust standard errors, adjusted for clustering at individual level, are reported in parentheses.
* denotes the significance level of the coefficient, with *** P<0.01, ** p<0.05, * P<0.1.

measure of educational attainment and report the results in Table 6. The probit estimates (Column 1) show that attaining the Intermediate/Junior/Group Certificate or equivalent is associated with higher probability to vote. However, the first stage estimates in the IV-probit estimation (Panel A) shows that the positive relationship between exposure to the reform and obtaining Intermediate/Junior/Group Certificate or equivalent is not statistically significant.[20] One possible explanation is that the current education measure does not distinguish between Intermediate Certificate, Group Certificate, Junior Certificate, and other equivalent qualifications. The effect of the reform on possibilities of obtaining those different qualifications might be heterogeneous. Information on the exact certificates will be collected in future waves, and can be used to further unpick the relationship.

Using the same indicator for educational attainment, we also run the bivariate probit model, with and without the instrument, and report the results in Table A1. The results from the two models are different, providing supportive evidence for the IV strategy.

[20] We also run the analysis using an indicator for completing the Leaving Certificate or equivalent. The results are comparable.

Table 6 The Effect of Schooling on Voter Turnout (Alternative Educational Measure)

Panel A	*[1]*		*[2]*
			IV-Probit
Y= 1 if completing the Intermediate/ Junior/Group Certificate (or equivalent)	**First stage**		
	Coef		
Treated=1	0.03		
(S.E.)	[0.02]		
Panel B			
Y= 1 if voted	**Probit** Coef[ME]		**IV-Probit** Coef[ME]
Completing the Intermediate/Junior/ Group Certificate (or equivalent)	0.39*** [0.04]		2.23** [0.41]
(S.E.)	(0.06)		(0.84)
Observations	8,672	8,672	8,672
Log-likelihood value	–1892.48		–6166.42

Note: "Coef" stands for estimation coefficients, and "ME" stands for marginal effects. All specifications also control for age, age squared, indicators for female, growing up in rural area and each and every general election. Robust standard errors, adjusted for clustering at individual level, are reported in parentheses.
* denotes the significance level, with *** P<0.01, ** p<0.05, * P<0.1.

6.3 Placebo Test

We exclude individuals who were born outside of the Republic of Ireland and came here after the school decision was made in our main analysis as they were not exposed to the free education scheme. Though the sample size is very small, we run a placebo test to see whether we can find a significant effect of education, via the instrument, on voter turnout in this sub-sample. If a significant effect can be found, the validity of an IV strategy is questionable in this case. Figure 3 below shows the average years of schooling by birth cohort for this sample. There is no evident effect of the free education scheme on years of schooling for this sample.

Table 7 below presents the IV probit estimates for this sub-sample. The first-stage results, reported in Column 1, indicate that the free education scheme in Ireland did not affect these individuals' years of schooling, which makes sense as their education choices have been made before they came to Ireland. Column 2 reports the IV-probit results, indicating that there is no significant effect of education, modelled by the exposure to the free education scheme, on voter turnout for this sub-sample. The results strengthen the validity of the IV estimates.

Figure 3 Average Years of Schooling by Birth Cohort (Placebo Sample)

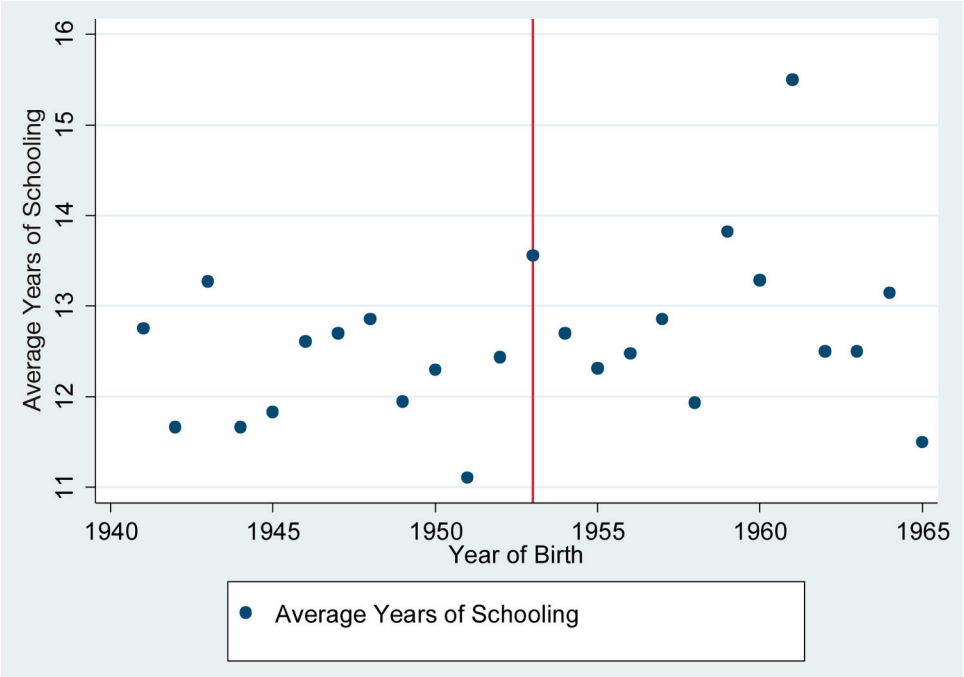


Table 7 IV probit Estimates from the Placebo Test

Y= 1 if voted	*[1]*	*[2]*
	First stage Y= Years of Schooling Coef	IV-Probit Y= 1 if voted Coef [ME]
Instrument: Treated=1	0.74	
(S.E.)	(0.63)	
Years of Schooling		0.06 [0.02]
(S.E.)		(0.35)
Observations	324	324
Log-likelihood value		–1000.94

Note: "Coef" stands for estimation coefficients, and "ME" stands for marginal effects. All specifications also control for age, age squared, indicators for female, growing up in rural area and each and every general election. Robust standard errors, adjusted for clustering at individual level, are reported in parentheses.
* denotes the significance level, with *** P<0.01, ** p<0.05, * P<0.1.

VII CONCLUSION

Education is one of the most often cited explanations for electoral participation. The association between education and voter turnout is well documented. However, the international evidence that focuses on the causal link is still mixed. Using data from the Irish Longitudinal Study on Ageing (TILDA), this paper attempts to identify the causal effects of education on individuals' political participation in their later lives, contributing to the literature with new evidence from Ireland.

The school system in Ireland is financed almost exclusively from central government funds, therefore it is vital to analyse whether public investment in education has wider social benefits, in particular civic benefits. And if it does, what is the magnitude of the benefits. It is important for assessing the efficiency, equity and sustainability of public investment in education.

Baseline probit estimates indicate that an additional year of schooling is associated with a 0.9 percentage point higher probability to vote. To better infer the causality, we perform the IV probit model, where we measure the effect of additional schooling by institutional education reform in Ireland, based on the assumption that the instrumental variable generated possible exogenous variation in individual years of schooling but is unrelated to individuals' civic outcomes in adulthood. The IV probit estimates show that individuals with more schooling are more likely to vote in the Irish general election. This study has found that an additional year of schooling increases the probability of voting by approximately 5.5 percentage points.

Given that individuals from disadvantaged family backgrounds are more likely to be affected by the reform, we also conduct the analysis on two restricted samples: individuals with both parents having a low level of education or none at all; and individuals who report growing up in a poor family. We find that positive causal effect of education on voter turnout is larger in these sub-samples of individuals that report disadvantage in their family during childhood.

The increased voter turnout in 2007 and 2011, due to the additional years of schooling induced by the reform, is an unanticipated benefit from the "free education scheme" reform more than 40 years ago. This reform in 1967 did not only provide more education opportunities for students back then, but also has a long-run effect on those students' political participation during their adulthood. In particular, the benefits are larger for students who come from disadvantaged family backgrounds as their years of schooling increased significantly because of the reform, and the increased years of schooling had a profound influence on their civic engagement, such as voting participation four decades later. The findings in this paper provide evidence that targeted supports for education in disadvantaged families can have long-term social benefits.

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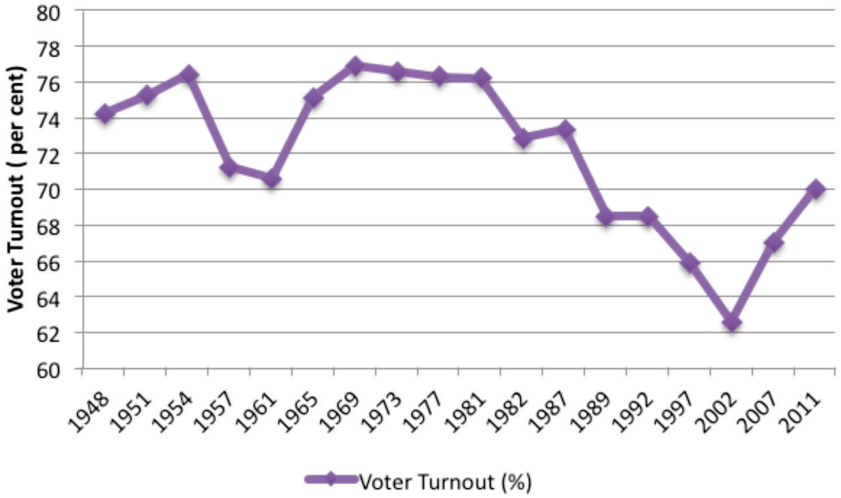
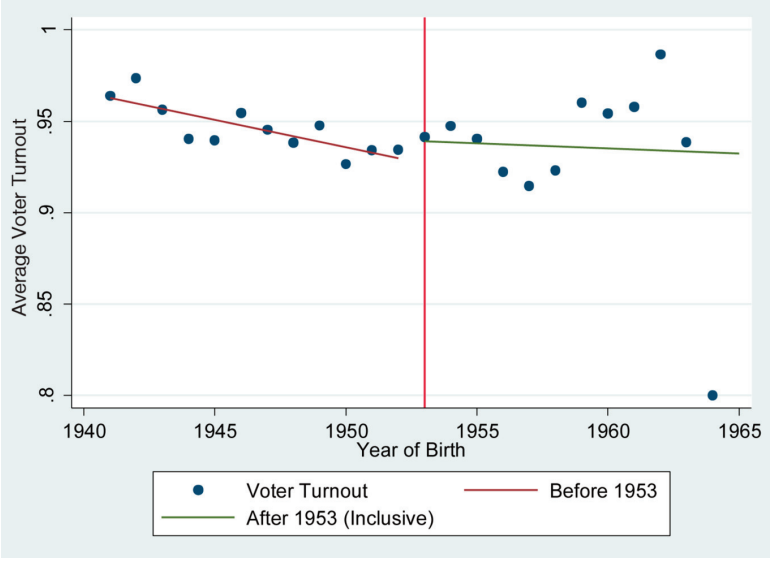
APPENDIX

Figure A1: Voter Turnout in the General Elections in Ireland (1948-2011)



Source: Author's calculation based on data from International Institute for Democracy and Electoral Assistance.

Figure A2.a: Average Voter Turnout by Birth Cohort (Full Sample)



Note: The average voter turnout for the birth cohort 1964 is 80 per cent, lower than the sample average. We conduct sensitivity analysis excluding this cohort, and the results are similar.

Figure A2.b Average Voter Turnout by Birth Cohort (Individuals from Disadvantaged Family Background)

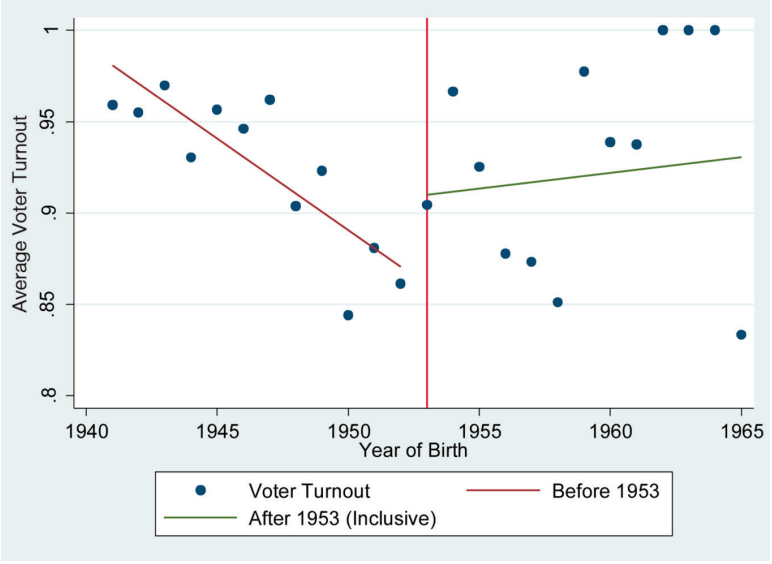


Figure A2.c Average Voter Turnout by Birth Cohort (Individuals from Non-disadvantaged Family Background)

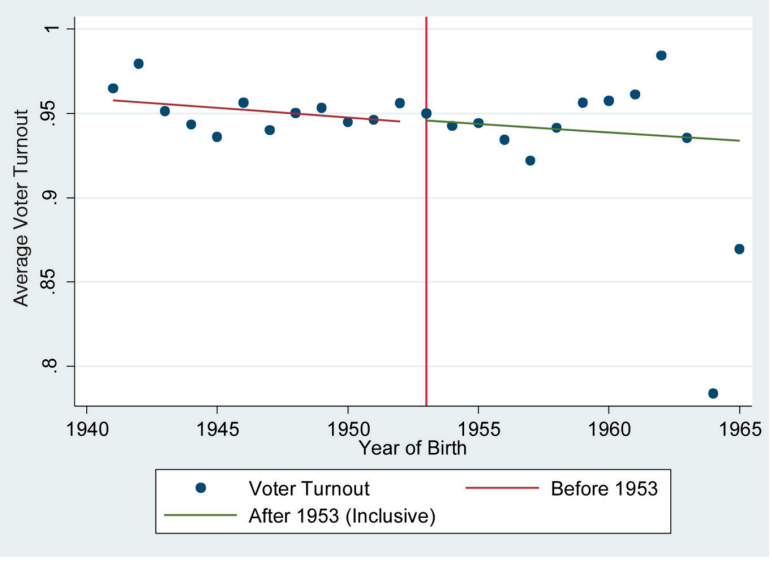


Table A1 The Effect of Schooling on Voter Turnout (Bivariate Probit Estimates)

Y= 1 if voted	*[1]*	*[2]*
	Probit Coef[ME]	IV-Probit Coef[ME]
Completing the Intermediate/Junior/ Group Certificate (or equivalent)	0.34*** [0.04]	–0.42 [–0.06]
(S.E.)	(0.06)	(0.26)
Observations	8,675	8,675
Log-likelihood value	–1905.14	–6247.22

Note: "Coef" stands for estimation coefficients, and "ME" stands for marginal effects. Robust standard errors, adjusted for clustering at individual level, are reported in parentheses.
* denotes the significance level, with *** P<0.01, ** p<0.05, * P<0.1.