

# Does compulsory schooling interact with genetic predisposition to impact cognition? Evidence from the ELSA study

## Introduction

Cognitive function in older age is the result of a dynamic process throughout the life course based on a combination of genetic, biological, social and environmental factors. It has been increasingly accepted that the aetiology of most common diseases involves not only discrete genetic and environmental factors, but also interactions between genetic susceptibility and environmental exposures. (Tucker-Drob and Briley 2014). Gene-environment interaction ( $G \times E$ ) processes impacting cognitive function likely play out over the entire life course, with special vulnerability during early-life (Scarr and McCartney 1983, Reynolds, Finkel et al. 2014). The availability of genetic data in large population surveys has resulted in an explosion of research on gene-environment interactions. Understanding the effects of critical social and environmental exposures in sensitive periods on later life cognition and how these vary by underlying genetic susceptibility can help inform targeted interventions going forward. For the “E” part in  $G \times E$ , the environment is not randomly assigned in most cases, and may be confounded by other non-genetic variables, and could be correlated with the genetic variant in question, which is called gene-environment correlation (rGE). This study will incorporate quasi-experimental designs into the  $G \times E$  framework to leverage exogenous environmental variation to reduce the influence of gene-environment correlation and strengthen the ability to demonstrate causal inferences. Some studies also suggested that education can moderate the relationship between APOE4 and cognition (Seeman, Huang et al. 2005, McArdle and Prescott 2010) or dementia (Arenaza-Urquijo, Gonneaud et al. 2015). However, the evidence on the interaction effect between APOE4, education, and sex on cognition especially for different cognitive domains is still scarce. Further research needs to improve causal inference for the interaction effect of APOE4 and educational attainment on cognition (Smith, Kho et al. 2018).

Therefore, this study aims to examine the causal effects of education on cognitive function and how the impact might vary by genetic susceptibility combined with a quasi-experimental design, to improve causal inference for the gene-environment interaction that shapes cognitive decline. This study exploits the reform of compulsory schooling in England in 1947, which raised the minimum school-leaving age from 14 to 15 for individuals born after a specific cut-off in March 1933, which have been shown to have strong impacts on educational attainment. We used a fuzzy regression discontinuity design and compared individuals born before and after the cut-off to identify the causal effect of the policy-induced additional year of education change on later life cognition, including memory and executive function, and how this interacted with genetic risks measured by the APOE4 status.

## Methods

### Data

This study will leverage all available pooled waves from wave 1 up to wave 5 (2002-2003 to 2010–2011) and use repeated measures of the same individuals of the English Longitudinal Study of Ageing (ELSA) (Andrew Steptoe, Elizabeth Breeze, James Banks, & James Nazroo, 2013). These data include consistent measurement of cognitive function, including memory and executive function. I also use the ELSA Special License data which includes the “month-

of-birth” variable and the Genetic data. More details of the ELSA Genetic data have been described elsewhere (<https://www.elsa-project.ac.uk/genetics>). This study will use the year- and month- of-birth variables to construct the month-year birth cohort. Given that the relevant compulsory schooling changes depend on birth cohorts, this study can then identify the effects using the month -year birth as the assignment variable.

The apolipoprotein E (APOE4) genotype were based on the two single nucleotide polymorphisms (SNPs) for APOE, rs429358 and rs7412 that comprise the  $\epsilon 2$ ,  $\epsilon 3$  and  $\epsilon 4$  alleles. APOE4 carrier status was determined based on the presence or absence of one or more APOE  $\epsilon 4$  alleles (APOE4). In the sample of 7181 individuals, 25.3% are APOE4 carriers. The cognitive function module in the ELSA contains memory, executive function, speed of processing and numerical ability domains. This study focuses on memory and executive function outcomes, which are both consistently measured from wave 1 to wave 5.

### Analytical strategy

This study exploited the variation in the minimum school leaving age from 14 to 15 from March 1947 in England. The Education Act 1944 raised the minimum school-leaving age from 14 to 15 years old in England, Scotland and Wales, and this took effect from April 1, 1947, which means that students born before April 1, 1933 could drop out at age 14, whilst those born after that date could not leave until they turned 15, generating a discontinuity in the relationship between education and the date of birth at the April 1, 1933 cut-off point.

Table 1 shows the distribution of the full-time education leaving age by sex in our sample for the cohorts born five years either side of the cut-off date for the 1947 reform. The most obvious large change in educational attainment across the reform dates is from the age of 14 to 15, especially for males. The change in educational attainment for females is slightly different with a big increase in the proportion of women leaving school between 16 and 18.

Table 1 Distribution of age of leaving full-time education by sex and date of birth (individuals born five years either side of the cut-off date of April 1, 1933) (%)

| Age of leaving school       | Females                   |                          | Males                     |                          |
|-----------------------------|---------------------------|--------------------------|---------------------------|--------------------------|
|                             | Born before April 1, 1933 | Born after April 1, 1933 | Born before April 1, 1933 | Born after April 1, 1933 |
| Left school at or before 14 | 57.6                      | 8.1                      | 61.7                      | 8.7                      |
| Left school at 15           | 11.7                      | 46.9                     | 6.9                       | 50.6                     |
| Left school between 16-18   | 23.7                      | 32.9                     | 24.0                      | 26.7                     |
| Left school at or over 19   | 7.0                       | 12.0                     | 7.4                       | 14.0                     |
| <b>Total</b>                | 100.0                     | 100.0                    | 100.0                     | 100.0                    |

Figure 1 visually shows the discontinuity on educational outcomes with birth cohort by sex for individuals born five years either side of the cut-off date. Before the cut-off date of April 1, 1933 about 60% of the individuals left full-time education by age 14, whilst after the cut-off date this fraction dropped to below 10%. The graph demonstrates the essence of the fuzzy

RDD we adopt to estimate the effects of educational attainment, since the discontinuous relationship between month of birth and the fraction of individuals left full-time education by age 14 emerges clearly.

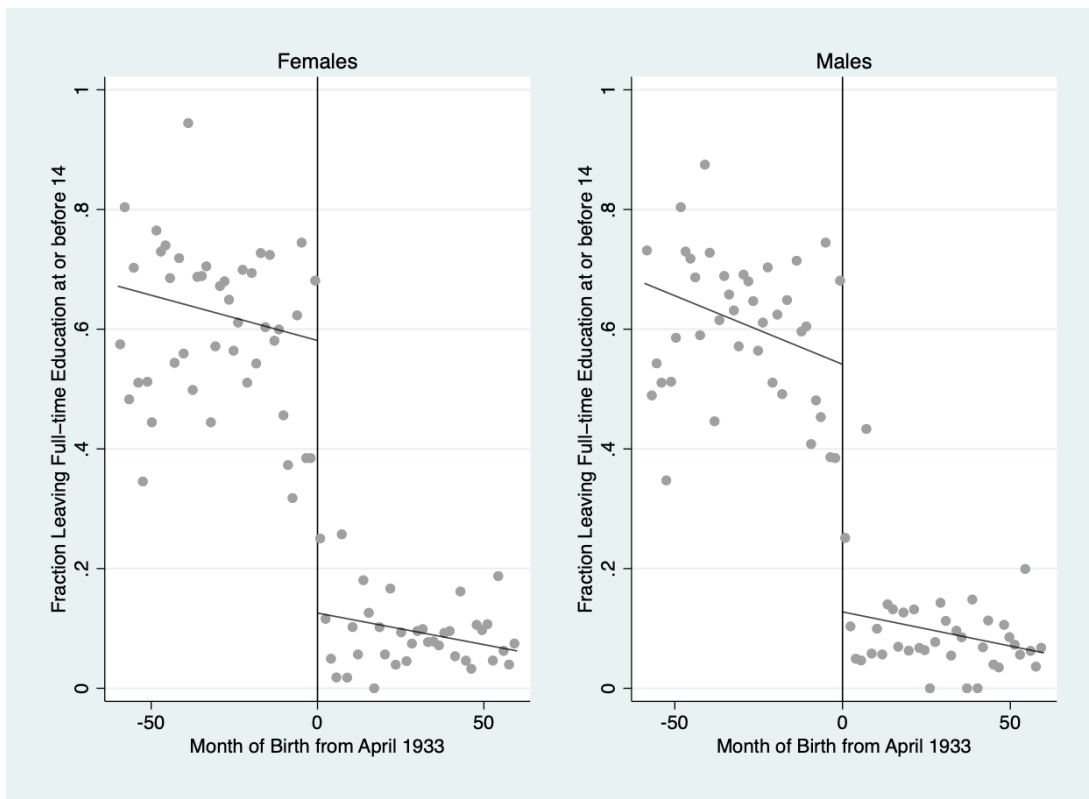


Figure 1 Fraction leaving school by age 14 by month of birth for males and females

There are a number of studies that have explored the causal effect of educational attainment on cognitive function/ health outcomes using changes in compulsory schooling laws (CSLs) and several that exploited the 1947 British School-leaving Age Reform (Banks and Mazzonna 2012) (Clark and Royer 2013). This study extends that literature by exploring how the causal effect of education on cognitive function varies by a person's genetic risks. Since the relevant compulsory schooling changes depended on month-year of birth, a fuzzy regression discontinuity design (RDD) (Imbens and Lemieux 2008, Lemieux and Lee 2009, Lee and Lemieux 2010) will be used to identify the causal effect of the policy-induced additional year of education change and how this interacts with genetic risk for cognitive decline. Specifically, this study will estimate the following two equations:

$$\widehat{E}_{ic} = \alpha_0 + \alpha_1 D_{ic} \times a(G_{ic}) + \alpha_2 D_{ic} + \alpha_3 a(G_{ic}) + f(R_{ic}) + \alpha_4 X_{icw} + \mu_{icw} \quad (1)$$

$$CF_{icw} = \beta_0 + \beta_1 \widehat{E}_{ic} \times b(G_{ic}) + \beta_2 \widehat{E}_{ic} + \beta_3 b(G_{ic}) + g(R_{ic}) + \beta_4 X_{icw} + \omega_{icw} \quad (2)$$

where  $CF_{icw}$  is a measure of cognitive function;  $E_{ic}$  indicates years of schooling for individual  $i$  in birth cohort  $c$ ;  $a(G)_{ic}$  and  $b(G)_{ic}$  represents the individual's genotype, which are linear combinations of the APOE4 carrier status and the first ten principal components ( $PC_1$ - $PC_{10}$ ) of the genetic data to correct for population stratification.

$$a(G_{ic}) = a_0 + a_1 APOE4_i + a_2 PC_i \quad (3)$$

$$b(G_{ic}) = b_0 + b_1 APOE4_i + b_2 PC_i \quad (4)$$

$D_{ic}$  is a dummy variable indicating whether a respondent belongs to a post-reform cohort;  $R_{ic}$  is an respondent's birth month cohort relative to the relevant cut-off (March 1933 for the 1947 reform).  $R_{ic}$  is positive when the respondent is born after the reform and negative when born before the reform; the Function  $f(R_{ic})$  and  $g(R_{ic})$  capture the associations between birth cohort with educational attainment and cognitive outcomes; the vector  $X_{icw}$  contains age, age squared, adult height, year of the survey and month-of-birth dummies and  $\mu_{icw}$  is the residual.  $E_{icw}$  and  $E_{icw} \times b(G_{ic})$  terms are endogenous and  $D_{ic}$  and  $D_{ic} \times a(G_{ic})$  are used as instruments.

To estimate the effect of the reform on schooling, I use local linear regression around the discontinuity choosing the optimal bandwidth in a cross-validation procedure. The strategy substantially reduces the chances that bias will be introduced by using a smaller portion of the sample. To evaluate the effect of the exogenous increase in education on cognitive outcomes, I make use of the 2SLS estimator, using the same bandwidth and polynomial in the treatment and outcome regression, to obtain directly the correct standard errors that are robust and clustered at the individual level.

Moreover, to account for mortality selection in longitudinal social surveys (Domingue, Belsky et al. 2017), the sample of respondents who were genotyped in the genetic data was healthier, better educated and longer-lived as compared with birth-cohort peers in the general ELSA data. The difference between weighted and unweighted estimates may be the consequence of healthy, better educated people living longer than unhealthy, less-educated counterparts. In addition, carriage of the  $\epsilon 4$  allele is reported to be negatively associated with longevity (Garatachea, Emanuele et al. 2014). Thus, inverse probability weighting (IPW) is applied in my analytical data to account for the mortality selection in the genetic sample (Wooldridge 2002, Daza, Hudgens et al. 2017, Domingue, Belsky et al. 2017).

In the vector  $X$ , confounders such as age are typically used as covariates to control for confounding effects. Inclusion of height helps controlling for these unobserved cohort effects that cannot be captured by cohort trends. The cohort affected by the reform was born after March 1933, i.e., in the immediate aftermath of the great depression, and it is unclear if and how the Great Depression has affected childhood environment (and thus education and health) of the cohorts in our analytical sample. For instance, we find some indication in my analytical data that individuals born after the cut-off point are slightly taller than older cohorts. Thus, I control for adult height in the regressions to avoid any bias due to the lack of balance.

In spite potential confounding variables are controlled in the regression, this approach can only control for the additive effects of covariates; it does nothing to control for the potential confounding effects that these covariates might have on the interaction itself (Yzerbyt, Muller et al. 2004, Keller 2014). To properly control for confounding effects in the  $G \times E$  research, I also controlled for all *covariate*  $\times$  *gene* and *covariate*  $\times$  *environment* effects.

## Results

This study included respondents of European ancestries from wave 1 to wave 5 who had information about month and year of birth, full-time education leaving age, the APOE4 status, at least one of memory and executive function scores, and excluded respondents with cognitive pathology including dementia or Alzheimer's disease diagnosis.

Table 3 reports the descriptive statistics of the full analytical sample (28307 observations). The mean of age in this sample is 62.6. 54.9% of the sample is females. APOE4 is presented in 25.3% of the sample. The genetic characteristics are close to the original genetic sample.

Table 3 Descriptive statistics of variables

| <b>Variable</b>                 | <b>Mean / %</b> | <b>SD</b> |
|---------------------------------|-----------------|-----------|
| <b>Gender</b>                   |                 |           |
| Female                          | 54.9            |           |
| Male                            | 45.2            |           |
| <b>APOE4 status</b>             |                 |           |
| Not present                     | 74.7            |           |
| APOEe4 Present                  | 25.3            |           |
| <b>Age</b>                      | 62.6            | 9.3       |
| <b>Age of leaving school</b>    | 15.9            | 1.7       |
| <b>Height</b>                   | 161.8           | 29.0      |
| <b>Memory score</b>             | 10.29           | 3.53      |
| <b>Memory score (std.)</b>      | 0.01            | 0.94      |
| <b>Executive function score</b> | 0.03            | 1.45      |
| <b>N</b>                        | 28307           |           |

The optimal bandwidth is chosen with the cross-validation procedure suggested by Imbens and Lemieux (2008). I perform the procedure three times for both males and females: one for the first stage regression, and two for the two cognitive outcomes. To avoid problem with seasonality in month of birth I apply the procedure only on bandwidths equal to multiples of year of birth, from 12 to 120 months before and after the 1933 cut-off point. As Imbens and Lemieux (2008) suggested to use same bandwidth for both outcome and treatment equation and use the smallest bandwidth selected by the cross-validation procedures, the optimal bandwidth in this analysis is equal to 36 months for males and females (Appendix Table A1). In the following tables of empirical results, we explored the results to bandwidths including 36 and 48 months around the discontinuity.

Table 4 shows the effect of the compulsory school reform on school-leaving age, conditional on three samples of educational attainment and three different bandwidths (36 and 48 months). The first set of rows shows the estimated effect on school leaving age for the full sample. The estimated results of the reform are significant only for females in the full sample

and subsample of those who left full-time education before 19. The third set of rows shows the results for the most “treated” sample, which includes only individuals who left full-time education before the age of 16. This subsample (age left <16) is the most restrictive subsample and contains the biggest concentration of “compliers” who would have left full-time education after 15 if and only if they were born after the cut-off date. Since the local average treatment effect (LATE) is the average of the unit level causal effects for the “compliers”, this sample is the most treated and important subsample in this analysis. We find that the effect of the reform on education is large and statistically significant for both males and females for each bandwidth. The relevance of the instruments is tested in the first-stage regression. F-tests are reported in the last rows of each set.

Table 4 First stage results- effect of the reform on education by the APOE4 status

|                      | Males                 |                       | Females               |                       |
|----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
|                      | Bandwidth h=36 months | Bandwidth h=48 months | Bandwidth h=36 months | Bandwidth h=48 months |
| <b>Full sample</b>   |                       |                       |                       |                       |
| 1947 Reform          | 0.276***              | 0.392***              | 0.395***              | 0.371***              |
|                      | -0.086                | -0.074                | -0.08                 | -0.067                |
| APOE 4 X 1947 Reform | 0.051                 | -0.043                | -0.139                | -0.058                |
|                      | -0.12                 | -0.099                | -0.117                | -0.101                |
| N                    | 2,047                 | 2,752                 | 2,401                 | 3,250                 |
| F-test               | 0.87                  | 0.73                  | 4.4                   | 5.2                   |
| <b>Age&lt;19</b>     |                       |                       |                       |                       |
| 1947 Reform          | 0.264***              | 0.413***              | 0.415***              | 0.395***              |
|                      | -0.089                | -0.078                | -0.083                | -0.069                |
| APOE 4 X 1947 Reform | 0.175                 | 0.007                 | -0.13                 | -0.039                |
|                      | -0.138                | -0.109                | -0.122                | -0.109                |
| N                    | 1773                  | 2374                  | 2085                  | 2817                  |
| F-test               | 2.843                 | 3.9                   | 3.033                 | 23.818                |
| <b>Age&lt;16</b>     |                       |                       |                       |                       |
| 1947 Reform          | 0.624***              | 0.736***              | 0.560***              | 0.602***              |
|                      | -0.088                | -0.077                | -0.103                | -0.081                |
| APOE 4 X 1947 Reform | 0.168                 | 0.03                  | -0.081                | 0.032                 |
|                      | -0.146                | -0.123                | -0.15                 | -0.12                 |
| N                    | 1,299                 | 1,712                 | 1,347                 | 1,913                 |
| F-test               | 48.16                 | 72.28                 | 55.174                | 86.483                |

Notes. \*p = 10%; \*\*p = 5%; \*\*\*p = 1%; Standard errors in parenthesis are robust to heteroscedasticity and clustered at the individual level.

The next step is to explore the 2SLS effect of an additional year of schooling at age 15 on cognitive function by the APOE4 status. In this step I only report the results for the subsample of <16 years because the F-tests reported in Table 4 show weak instrument problems in the full sample and the subsample of <19 years. Table 5 presents the effect of education interacted with the APOE4 status, on memory and executive function. After incorporating the APOE4 status, there is no evidence of an interaction of the APOE4

status and education on memory for either males or females. The results in the last panel show a significant and sustained interaction effect of the APOE4 status and education on executive function for females when the bandwidth is 36 or 48 months.

Table 5 Two-stage least squares effect of an additional year of schooling at age 15 on cognitive function by the APOE4 status

| Age<16  | Males                    |                          | Females                  |                          |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
|   | Bandwidth<br>h=36 months | Bandwidth<br>h=48 months | Bandwidth<br>h=36 months | Bandwidth<br>h=48 months |
| <b>Memory</b>   |                          |                          |                          |                          |
| Education   | 0.345<br>(0.434)         | 0.431<br>(0.375)         | -0.067<br>(0.525)        | 0.047<br>(0.430)         |
| APOE4 (Noncarrier) X Education<br>(With 1 additional year of schooling) | 0.511<br>(0.424)         | 0.087<br>(0.387)         | 0.285<br>(0.518)         | 0.186<br>(0.442)         |
| APOE4   | 135.159<br>(135.508)     | -82.919<br>(85.970)      | 72.125<br>(123.516)      | 75.427<br>(67.281)       |
| N   | 1,332                    | 1,767                    | 1,409                    | 2,005                    |
| <b>Executive Function</b>   |                          |                          |                          |                          |
| Education   | 0.577<br>(0.635)         | 0.354<br>(0.479)         | -1.623**<br>(0.665)      | -0.972*<br>(0.505)       |
| APOE4 (Noncarrier) X Education<br>(With 1 additional year of schooling) | -0.464<br>(0.624)        | -0.291<br>(0.519)        | <b>1.306*</b><br>(0.689) | <b>1.018*</b><br>(0.564) |
| APOE4   | -219.474<br>(224.389)    | -109.175<br>(119.039)    | 92.369<br>(184.089)      | 121.527<br>(92.881)      |
| N   | 1,332                    | 1,767                    | 1,409                    | 2,005                    |

Notes. \*p = 10%; \*\*p = 5%; \*\*\*p = 1%; Standard errors in parenthesis are robust to heteroscedasticity and clustered at the individual level.

The modification effect of the APOE4 status on the impact of education on executive function at the optimal bandwidth (36 months) for females is demonstrated in Figure 2. I plot the interaction effect using the Excel template (Dawson) using procedures by Aiken and West (Aiken, West et al. 1991), and Dawson (Dawson 2014). The X-axis is the APOE4 status, and the Y-axis is the executive function score, which is constructed by summing the two standardized scores of verbal fluency and letter cancellation. The solid line represents APOE4 non-carrier, and the dash line represents APOE4 carrier. There is a significant decrease in the executive function score with an additional year of schooling at age 15 among APOE4 carriers at the 10% level.

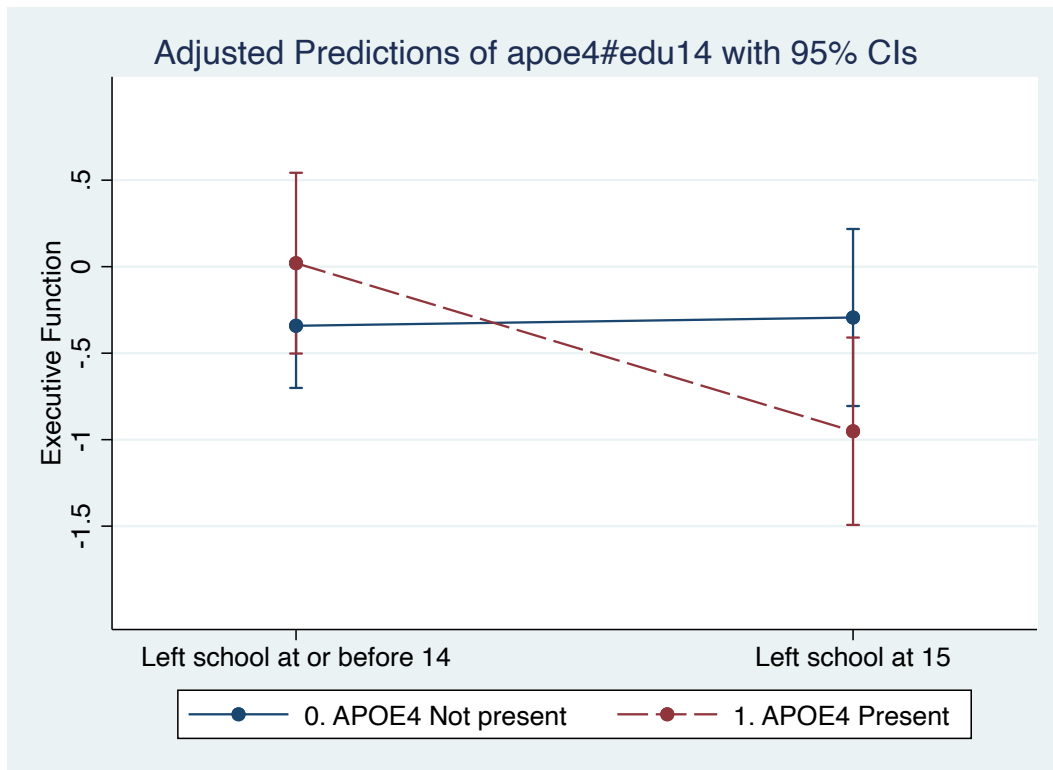


Figure 2 Effect of an additional year of schooling at age 15 on executive function by the APOE4 status for females (bandwidth = 48 months)

Even though our identification is not strictly RDD, this essay follows some of the recommendations for RDD. In RDD, data manipulation near the cut-off point by sorting behaviour or anticipation effects are examined by the McCrary test (McCrary 2008). However, because the running variable in this analysis is time specifications, the discontinuity of this type of running variable is not testable. If the RDD results are just mechanical correlations, or only affected by other unobservable factors, it is possible to produce the RDD results at other points. In this regard, this study conducted the placebo test for educational attainment to move the discontinuity point to 12, 24, 36, 48 and 60 months on both sides of the April 1, 1933 cut-off point. I also put the April 1, 1933 cut-off point for comparison. Figure A1 (Appendix) shows the placebo test results of the discontinuity points to 12, 24, 36 and 48 months on both sides of the April 1, 1933 cut-off point. The results are generally not significant at other points as the cut-off point, indicating that that the result of the April 1, 1933 cut-off point is robust. Moreover, this study investigated the sensitivity of our results to using alternative bandwidths in the main texts and exclusion of inverse probability weights (IPW) (Appendix Table A2).

## Discussion

This essay investigated the impact of education on cognitive function and how this interacts with genetic risk. Endogenous measures of environment and low statistical power are believed to be the main challenges for the  $G \times E$  analyses (Duncan and Keller 2011, Hewitt 2012). This study improved previous  $G \times E$  studies by combining a quasi-experimental design with genetic susceptibility using a large, nationally representative cohort of individuals from the same ancestry in the ELSA. I used a fuzzy regression discontinuity

design and exploited the reform of compulsory schooling in England in 1947 to identify the causal effect of the policy-induced additional year of education change on later life cognition and how this interacted with a person's genetic risks measured by the APOE4 status.

Our findings suggest a possible gene-environment interaction between APOE4 and education on cognitive function in later life. For females, while APOE4 noncarriers are unaffected by educational attainment, APOE4 carriers are sensitive to the additional year of schooling. Female APOE4 carriers with the additional year of schooling have lower executive function scores than the less-educated female APOE4 carriers. The consistency of interactions across the main results and sensitivity analyses suggest that the observed results are not due to chance.

One previous study in the Korean general population (Shin, Kweon et al. 2014) demonstrated that the diverse effect of the APOE4 allele on cognitive function depends on age and education, showing that the APOE4 carriers with no-formal education had significantly better cognitive performance than those with formal education in the 45–54 age group while those with no-formal education had worse cognitive performance in the 65–74 age group. The better cognitive performance in the younger group was primarily attributable to executive function (Gharbi-Meliani, Dugravot et al. 2021). Our finding could therefore be explained by the theory of antagonistic pleiotropy (Albin 1993, Schultz, Lyons et al. 2008, Taylor, Boyd et al. 2017), which means that the APOE4 may act differently in different age groups. However, this essay did not provide sufficient evidence to substantiate this phenomenon due to the choice of bandwidth.

There are several limitations in this study. First, this essay used a sample of older individuals who were genotyped in 2013-2014, the results may be subject to mortality selection. To reduce the potential of mortality selection, I applied inverse probability weighting. Second, the sample size in this study tends to be small, resulting in low statistical power and limited to reveal small interaction effects. A larger sample size and replication of the current findings are needed in further to ultimately elucidate how education interacts with genetic susceptibility for cognitive function. Another limitation of this study is that I only included European ancestries. On the genetic side, the findings using genetic data constructed from European ancestry GWAS cannot be generalized to other ancestral populations (Carlson, Matise et al. 2013, Martin, Gignoux et al. 2017). On the environmental side, since race can shape individual educational attainment outcomes (Merolla 2013, Merolla 2018), limiting our analysis to European ancestries restricts the scope of potential education effects that can be observed.

In conclusion, this study has implications for the literature on social determinants of cognitive function in older age. The findings show that education not only affects cognitive function, but it also enlarges the role played by genetic factors. Future work in this area needs to investigate the generalizability of the findings and increase understandings of the effects of social policies on cognitive function that precede disease arising from genetic background to inform new opportunities for effective intervention.

## Appendix

Table A1 Optimal bandwidth in the cross-validation procedure

|         | Educational Attainment | Memory | Executive Function |
|---------|------------------------|--------|--------------------|
| Males   | 49                     | 37     | 49                 |
| Females | 48                     | 73     | 45                 |

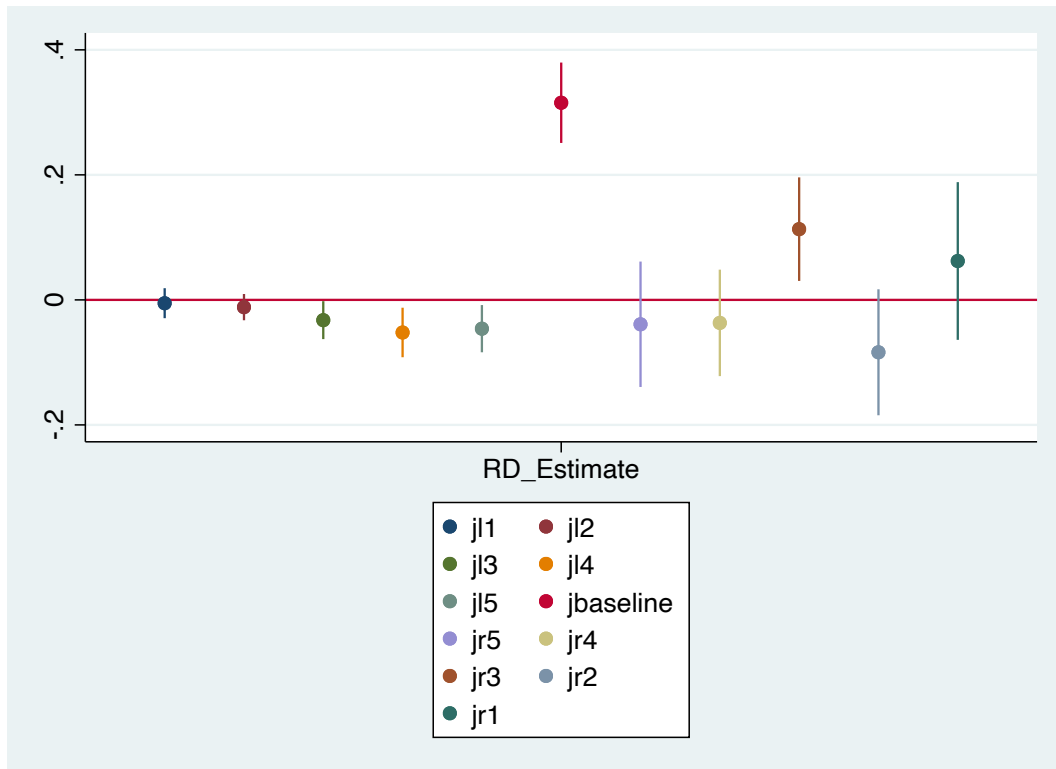


Figure A1 Placebo tests

Table A2 2SLS estimates of the effect of an additional year of schooling at age 15 on cognitive function by the APOE4 status, UNWEIGHTED

| Age<16  | Males                    |                          | Females                  |                          |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
|   | Bandwidth<br>h=36 months | Bandwidth<br>h=48 months | Bandwidth<br>h=36 months | Bandwidth<br>h=48 months |
| <b>Memory</b>   |                          |                          |                          |                          |
| Education   | 0.207<br>(0.308)         | 0.378<br>(0.292)         | -0.099<br>(0.501)        | 0.004<br>(0.414)         |
| APOE4 (Noncarrier) X Education<br>(With 1 additional year of schooling) | 0.331<br>(0.310)         | -0.048<br>(0.303)        | 0.248<br>(0.488)         | 0.094<br>(0.416)         |

|   |           |           |           |          |
|---|-----------|-----------|-----------|----------|
| APOE4   | 192.288*  | -36.927   | 83.571    | 45.912   |
|   | (103.467) | (78.828)  | (122.784) | (66.315) |
| N   | 1,332     | 1,767     | 1,409     | 2,005    |
| <b>Executive Function</b>   |           |           |           |          |
| Education   | 0.427     | 0.309     | -1.605**  | -0.913*  |
|   | (0.538)   | (0.429)   | (0.659)   | (0.495)  |
| APOE4 (Noncarrier) X Education<br>(With 1 additional year of schooling) | -0.435    | -0.377    | 1.261*    | 0.810*   |
|   | (0.535)   | (0.450)   | (0.662)   | (0.539)  |
| APOE4   | -89.762   | -56.733   | 146.171   | 107.151  |
|   | (210.467) | (114.999) | (185.526) | (93.264) |
| N   | 1,332     | 1,767     | 1,409     | 2,005    |

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