

# Economics and Genetics (FEB13089)

Erasmus School of Economics – Bachelor (Block 2)

## Individual assignment

For this course, there is no written exam. Instead, this assignment is used to assess whether you individually master the concepts and methods introduced in this course. This assignment determines 70% of your final grade. The assignment consists of several steps, which are closely linked to the lectures and tutorials. *Importantly, in the tutorials you practice with the methods you need to use to complete this assignment satisfactorily.*

The ultimate form of the assignment is a report of approximately 3750 words (+/- 500 words; excluding footnotes, bibliography, figures, tables, and appendix). The report answers the research question: ***Are there genes influencing your personal income, and is it possible and desirable to identify these genes?*** The report contains the following parts (*note that tutorial exercise sets contain more concrete information about the analyses that need to be conducted*):

- Section 1: Introduction. Introduce the research question and its relevance. Shortly describe (based on at least 5 relevant studies) earlier scientific research on this topic to motivate the relevance of the research question. Hint: Use scholar.google.com to find earlier studies. [+/- 750 words]
- Section 2: Twin study. Provide new evidence for the heritability of personal income using a classical twin study (Tutorial 1). Describe the main intuition behind the classical twin study and discuss your findings. Use at least 1 scientifically formatted table to report the estimation results in this section. [+/- 500 words]
- Section 3: GREML. Provide new evidence for the heritability of personal income using GREML (Tutorial 3). Describe the main intuition behind GREML and the most important differences with the classical twin study. Discuss your findings and use at least 1 scientifically formatted table to report the estimation results in this section. [+/- 500 words]
- Section 4: Feasibility of GWAS on personal income. Use power calculations to assess under what statistical conditions (e.g., the expected  $R^2$  of SNP) a GWAS on personal income is feasible. Use reasonable assumptions (e.g., based on earlier genetic associations reported in scientific papers) in your calculations, and use at least 1 scientifically formatted table to report the results. Run two times a GWAS on personal income, one for females and one for males. Use at least 2 scientifically formatted figures (QQ-plots and Manhattan plots) to report the results. Given your power calculations, discuss whether you are surprised by the GWAS results. [+/- 500 words]
- Section 5: Desirability of a GWAS on personal income. Using your knowledge about the genetic architecture of personal income from sections 2-4, describe from two different perspectives whether it is desirable to predict someone's personal income based on genetic information. The first perspective is the individual his or herself, the second perspective you should choose yourself (e.g., the perspective of banks, insurance companies, the government, etc.). Discuss if these two perspectives stand in contrast with each other. [+/- 750 words]
- Section 6: Conclusion. Summarize your results and describe how they answer the research question. Also sketch two interesting directions (provide concrete applications) for further research which could be followed if robust associations between genetic variants and personal

income are identified. The first direction should relate to Mendelian randomization (Lecture 5) and the second direction should relate to GxE interaction analysis (Lecture 5). Discuss what valuable knowledge can be obtained when following these two research directions. [+/- 750 words]

- Reference list.
- Appendix. Report here details about your analyses which are too specific to report in the main text. Also, provide your analysis code here.

## Notes and tips

- Please number sections, subsections, and pages.
- Tables and figures have a title and are numbered. Make sure there is a reference to each table/figure in the text.
- Tables and figures must be stand-alone readable and self-explanatory (i.e., the reader can grasp the message of the presented evidence without having to read the text) and easy to understand. Make use of notes, explanations and clear heading to achieve this.
- The reference list should be accurate and complete. References should be in alphabetical order and written down following APA style.

Deadline = Thursday 9 December (submit before 23:59 through Canvas)