Genetics, Economic Choices, and Income

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Intro

Know a lot about how environmental circumstances contributes to SES; know much less about genetics' contribution

Research program that ignores genetics cannot provide full picture

Study *causal* relation between genetics, economic choices, and income

Genetic measure: polygenic index for educational attainment (EA PGI)

Identification: one's PGI is random conditional on PGIs of one's parents

Polygenic Index (PGI)

Polygenic index (PGI) is weighted average of one's genotypes:

$$PGI_i = \sum_j x_{i,j}\, w_j$$

Weights w_j come from GWAS (Okbay et al. *forthcoming*)

EA PGI explains 12% of cross-sectional variation in EA

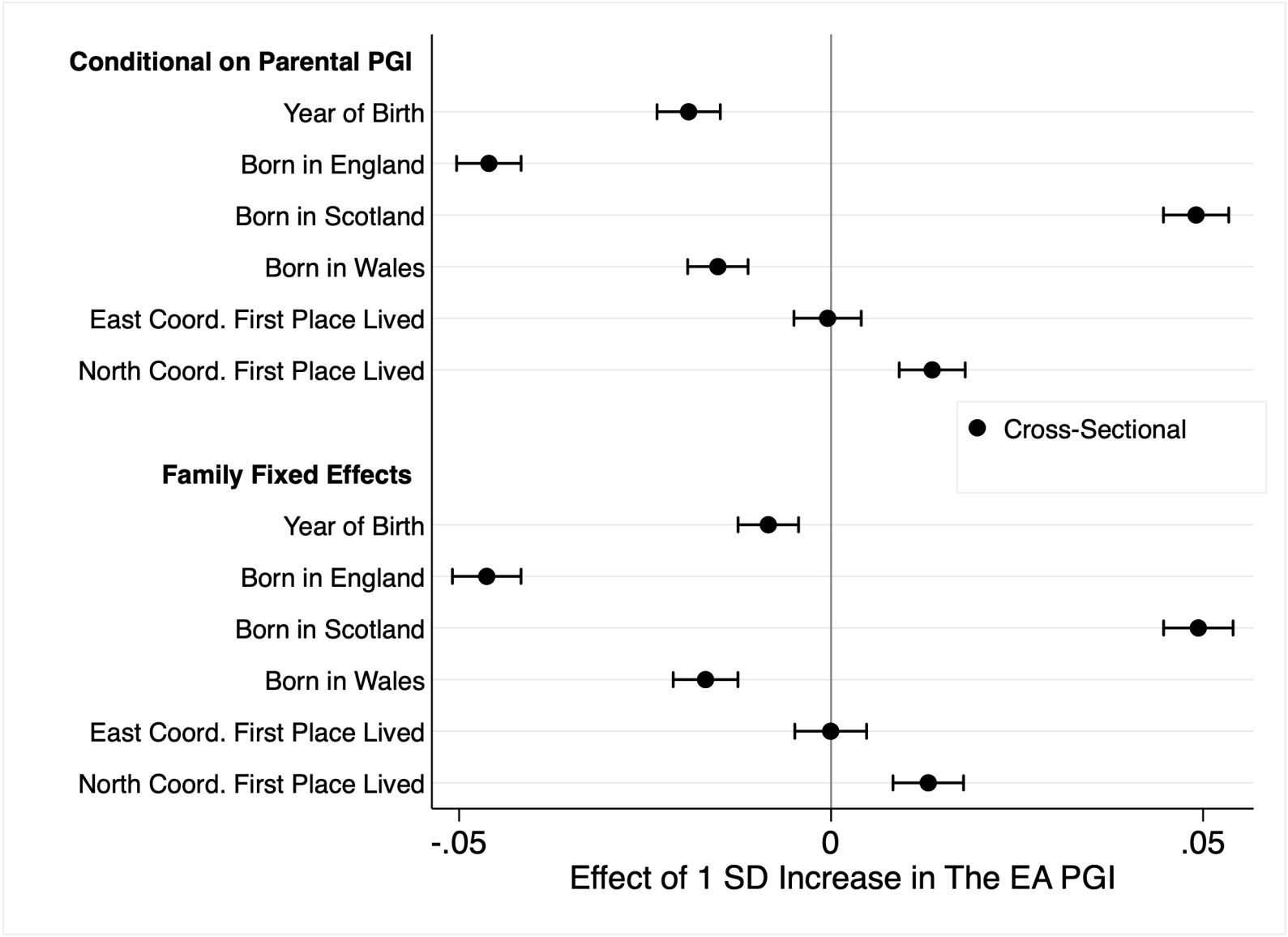
Data & Empirical Strategy

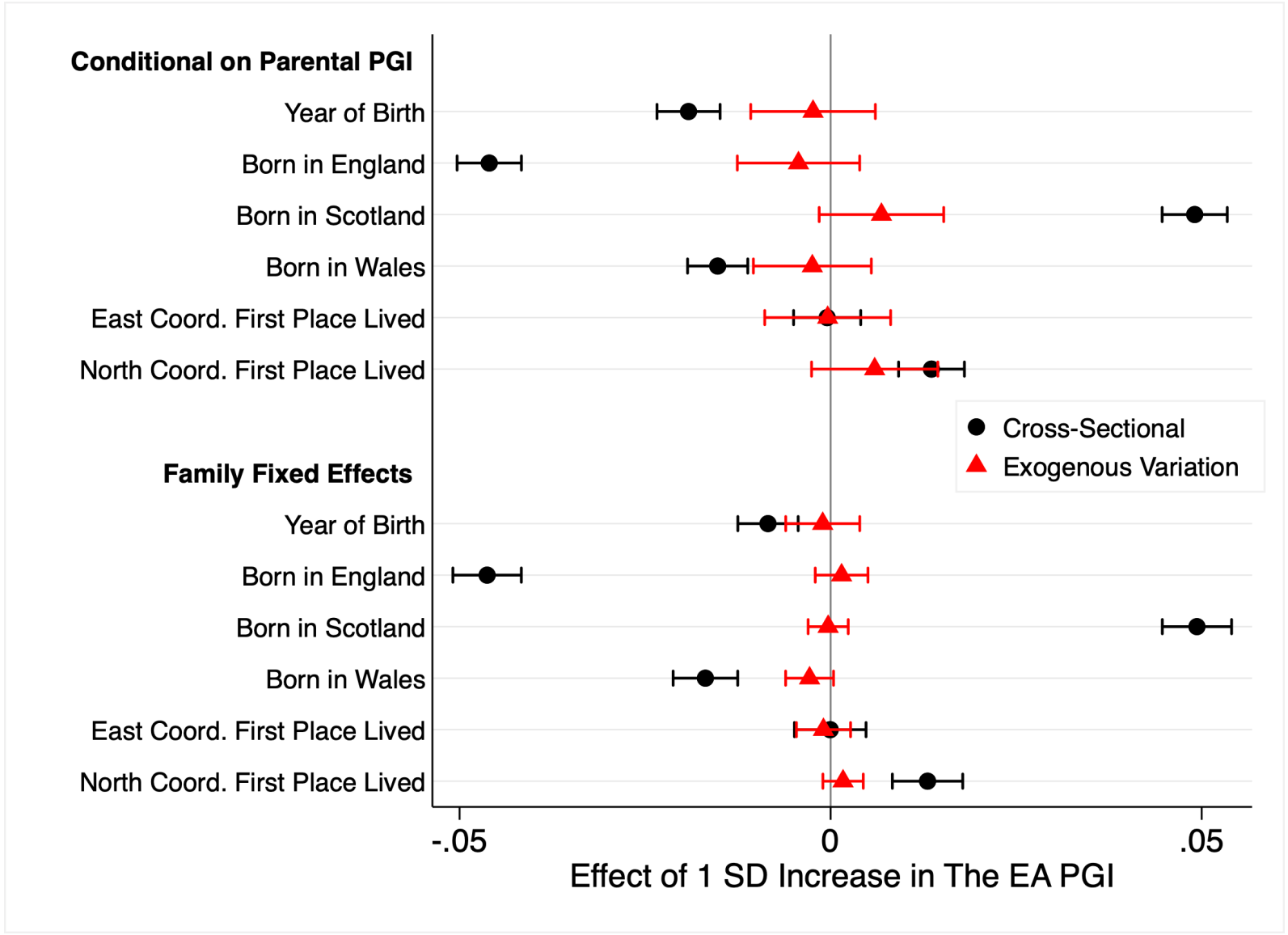
UK Biobank = (N ≈ 44,000)

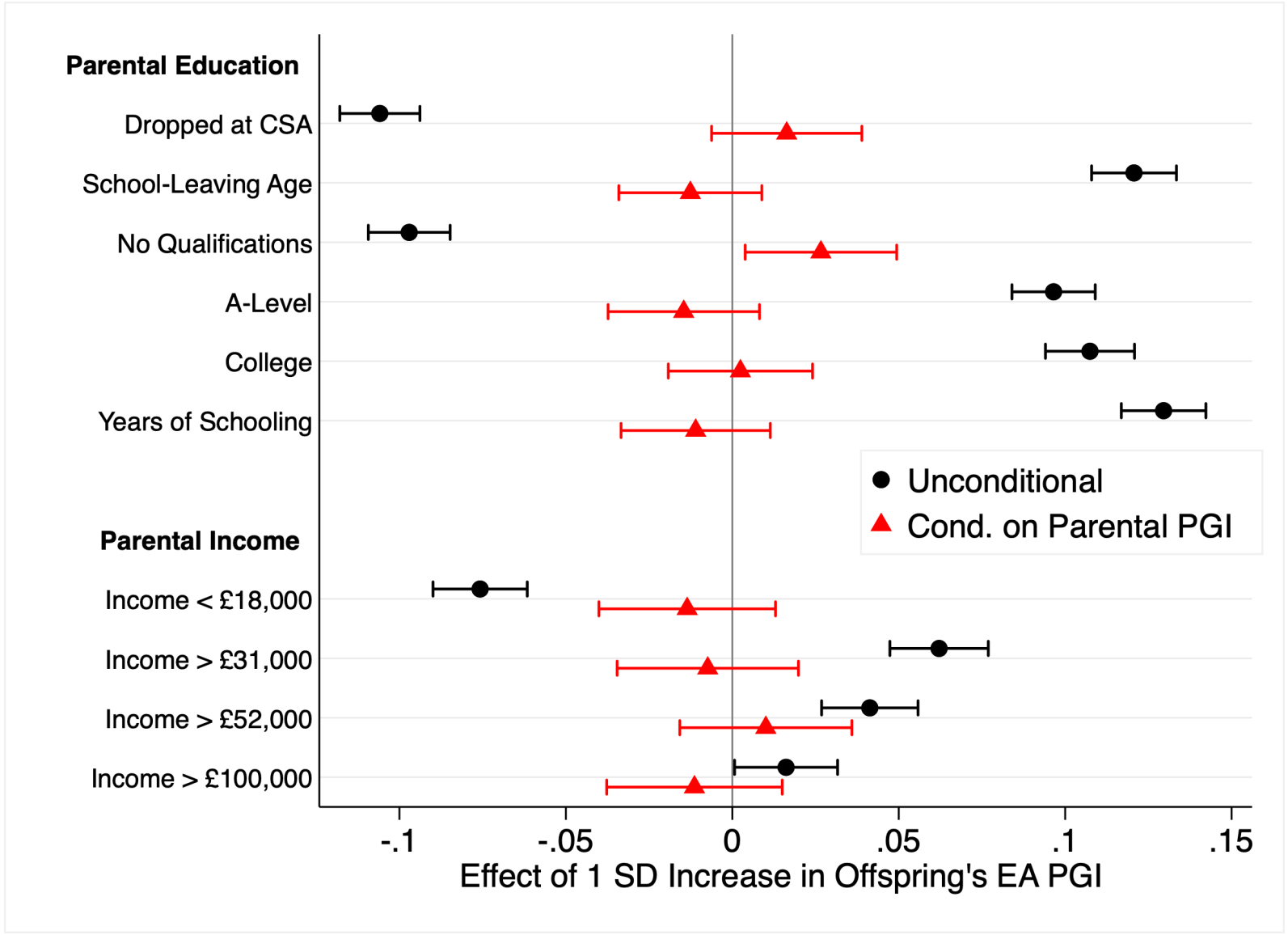
Restrict to participants with European genetic ancestries

$$Y_i = \alpha + \beta PGI_i + \gamma Parental\ PGI_i + u_i \qquad (1)$$

β provides unbiased estimate of causal effect of EA PGI


Conditional on Parental PGI
Year of Birth
Born in England
Born in Scotland
Born in Wales
East Coord. First Place Lived
North Coord. First Place Lived
Cross-Sectional
Family Fixed Effects
Year of Birth
Born in England
Born in Scotland
Born in Wales
East Coord. First Place Lived
North Coord. First Place Lived
-.05
0
.05
Effect of 1 SD Increase in The EA PGI


Conditional on Parental PGI
Year of Birth
Born in England
Born in Scotland
Born in Wales
East Coord. First Place Lived
North Coord. First Place Lived
Family Fixed Effects
Year of Birth
Born in England
Born in Scotland
Born in Wales
East Coord. First Place Lived
North Coord. First Place Lived
Cross-Sectional
Exogenous Variation
-.05
0
.05
Effect of 1 SD Increase in The EA PGI


Parental Education
Dropped at CSA
School-Leaving Age
No Qualifications
A-Level
College
Years of Schooling
Parental Income
Income < £18,000
Income > £31,000
Income > £52,000
Income > £100,000
Unconditional
Cond. on Parental PGI
-.1
-.05
0
.05
.1
.15
Effect of 1 SD Increase in Offspring's EA PGI

Empirical Strategy – Cont.

$$PGI_i = \gamma_0 + \gamma_1 Parental\ PGI_i + \ \varepsilon_i \qquad (2)$$

Empirical Strategy – Cont.

$$PGI_i = \gamma_0 + \gamma_1 Parental\ PGI_i + \hat{\varepsilon}_i$$

Residualized EA PGI

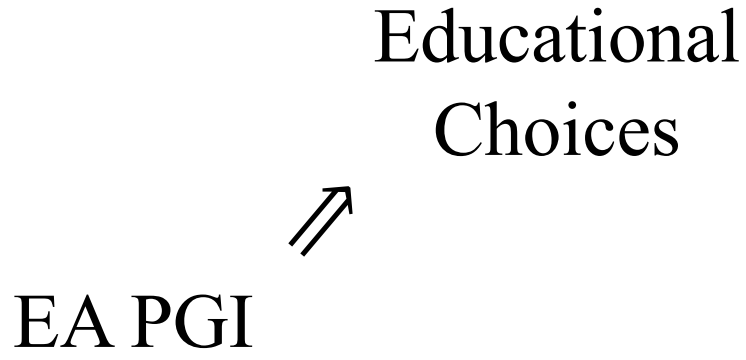
Empirical Strategy – Cont.

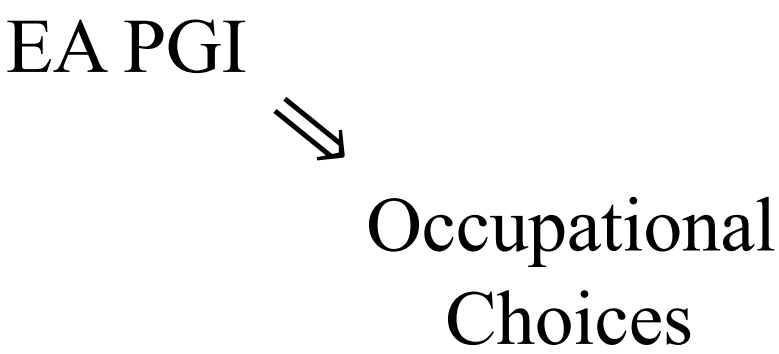
$$PGI_i = \gamma_0 + \gamma_1 Parental\ PGI_i + \hat{\varepsilon}_i$$

Residualized EA PGI

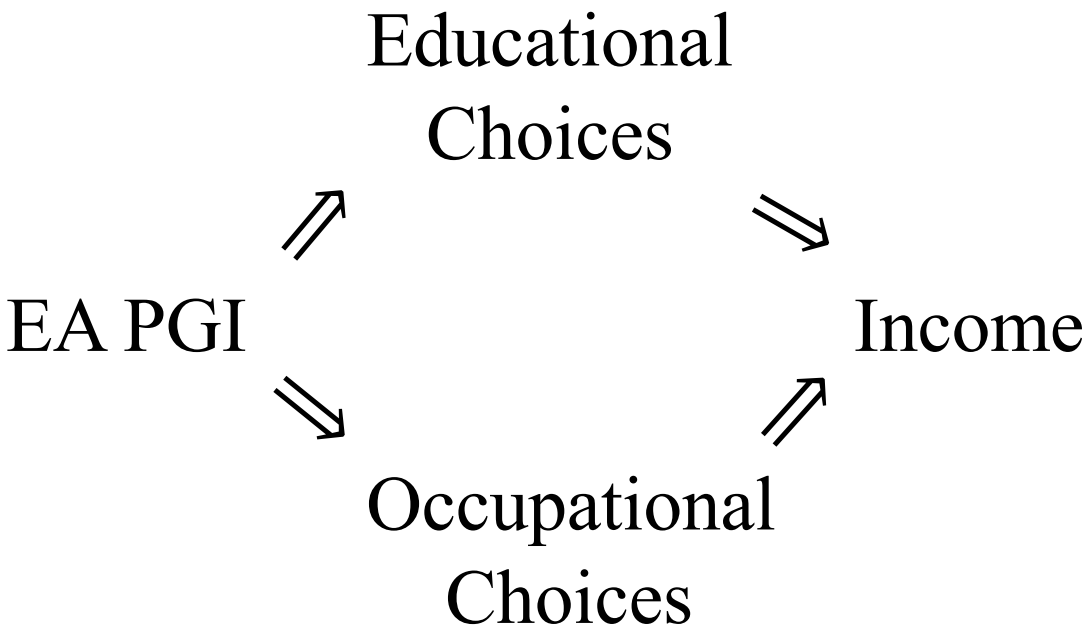
Most outcomes are binary and ε_i is continuous

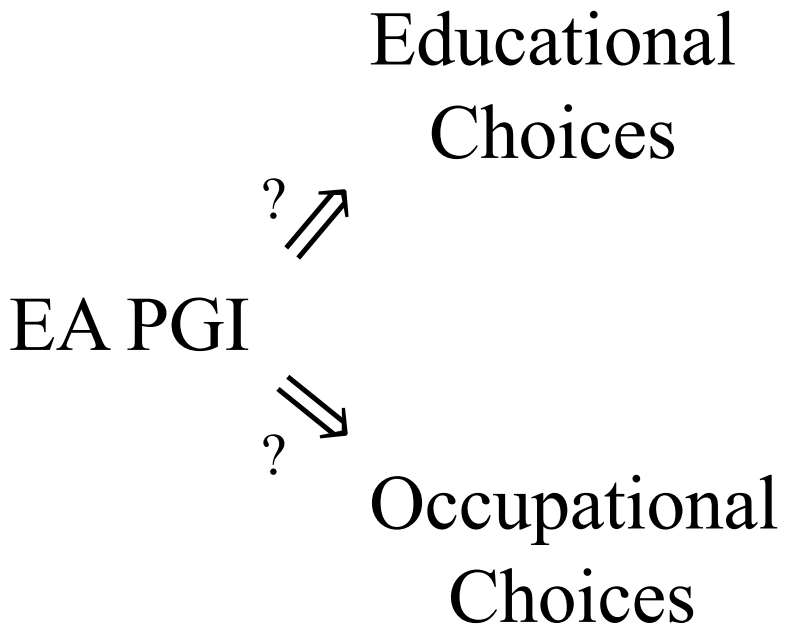
Instead of $\mathrm{E}[Y \mid \varepsilon]$, show $\Pr(\varepsilon \mid Y)$

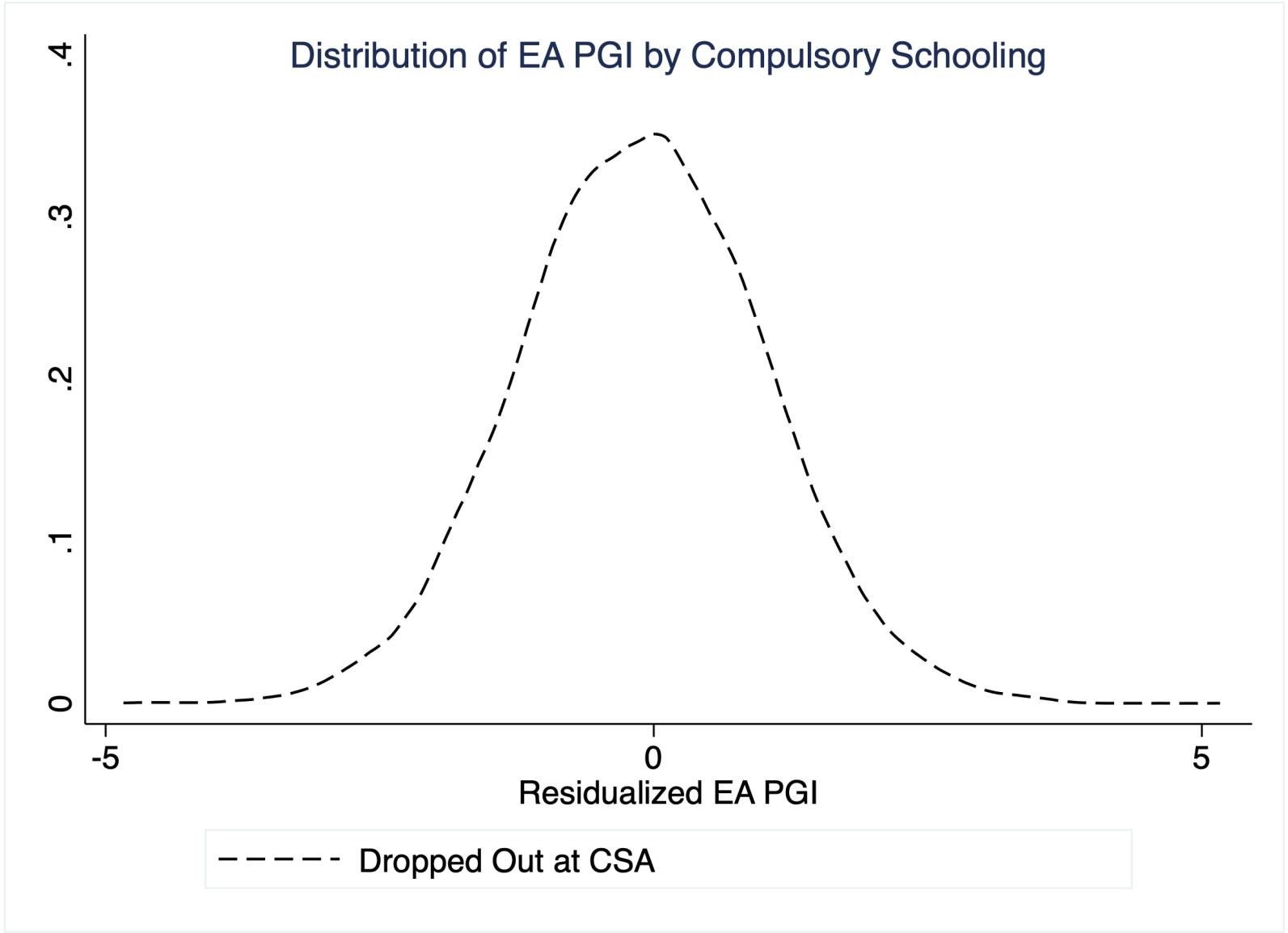

Educational
Choices
EA PGI

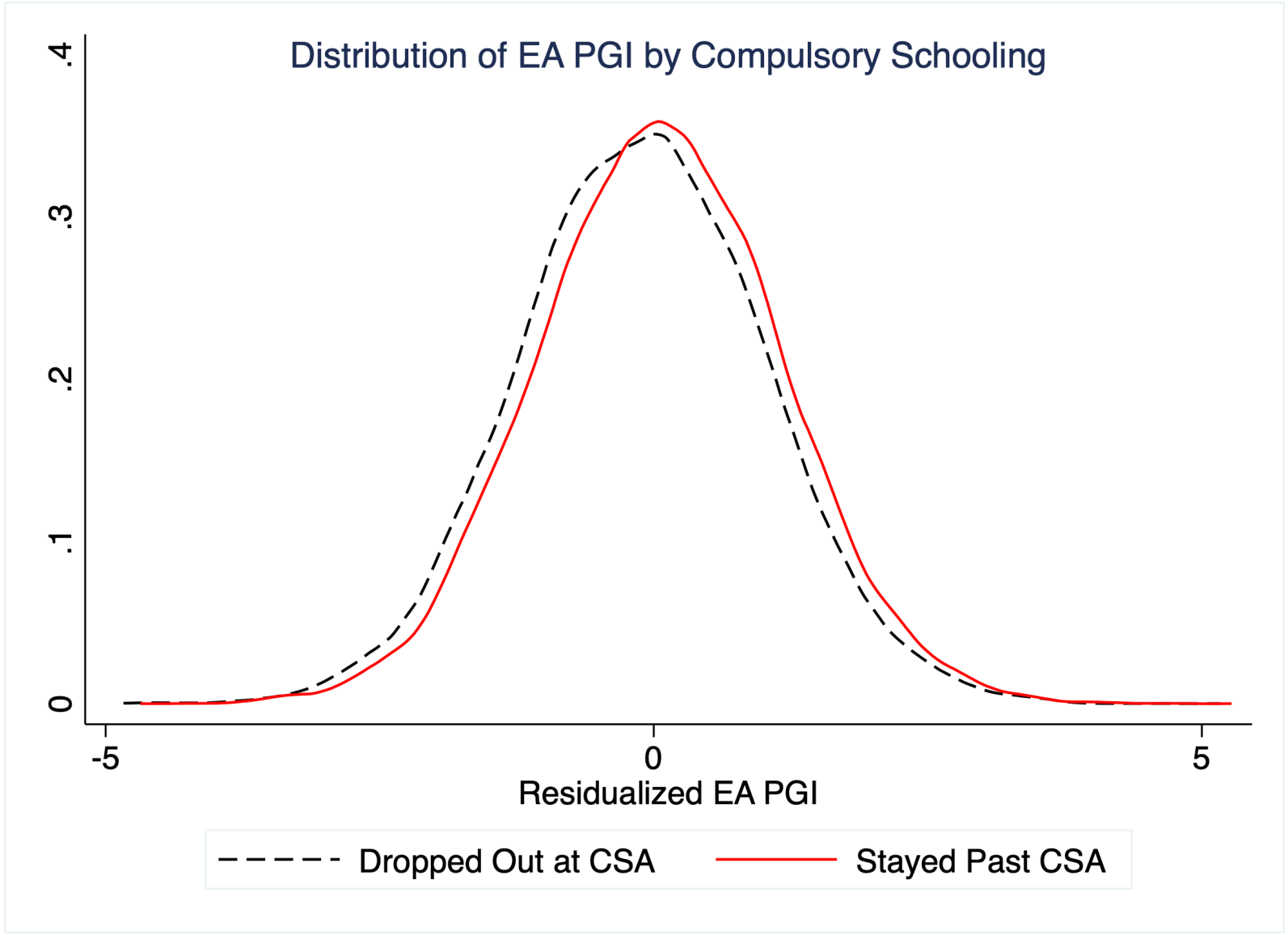

EA PGI
Occupational
Choices

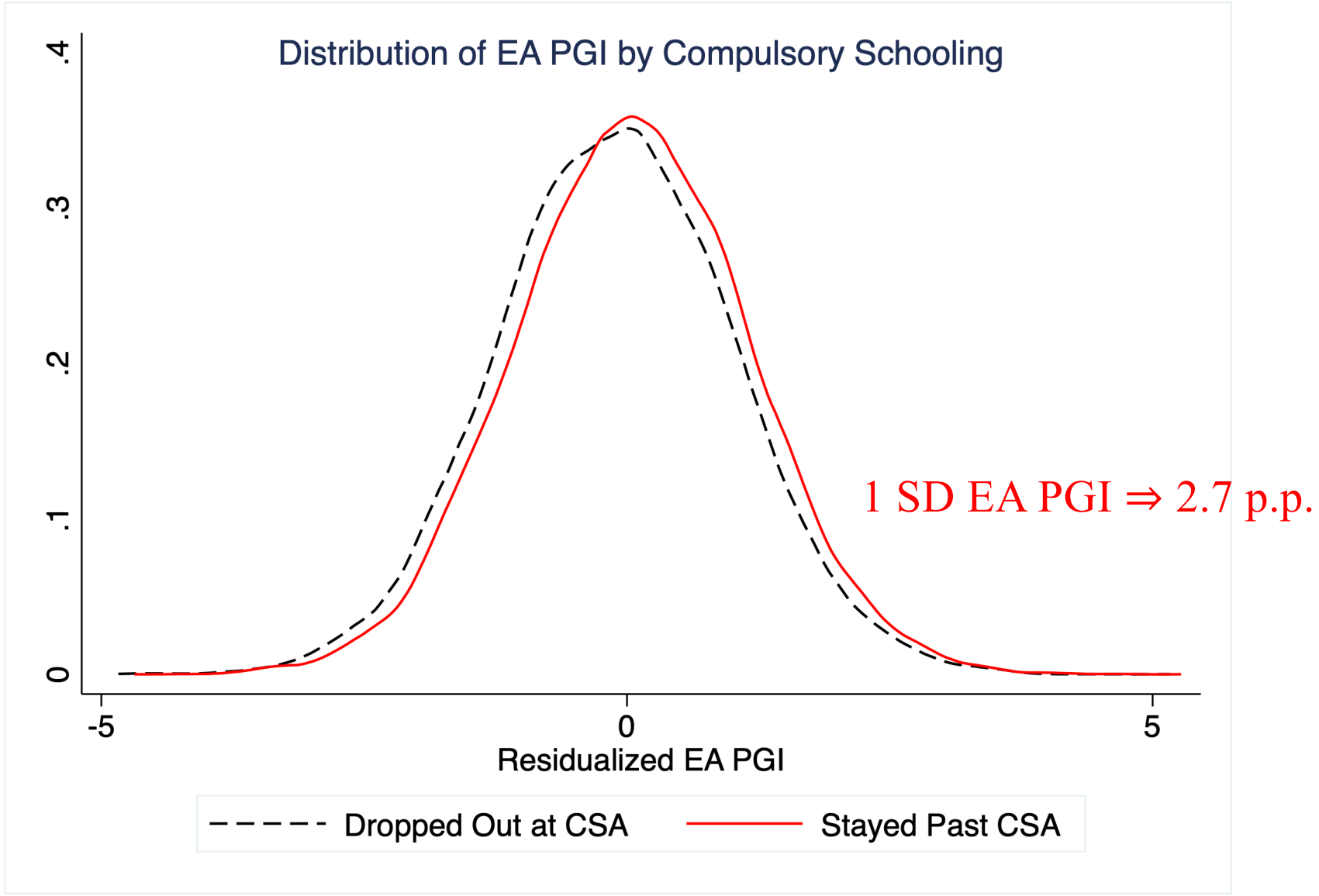
EA PGI $\Longrightarrow$ Income

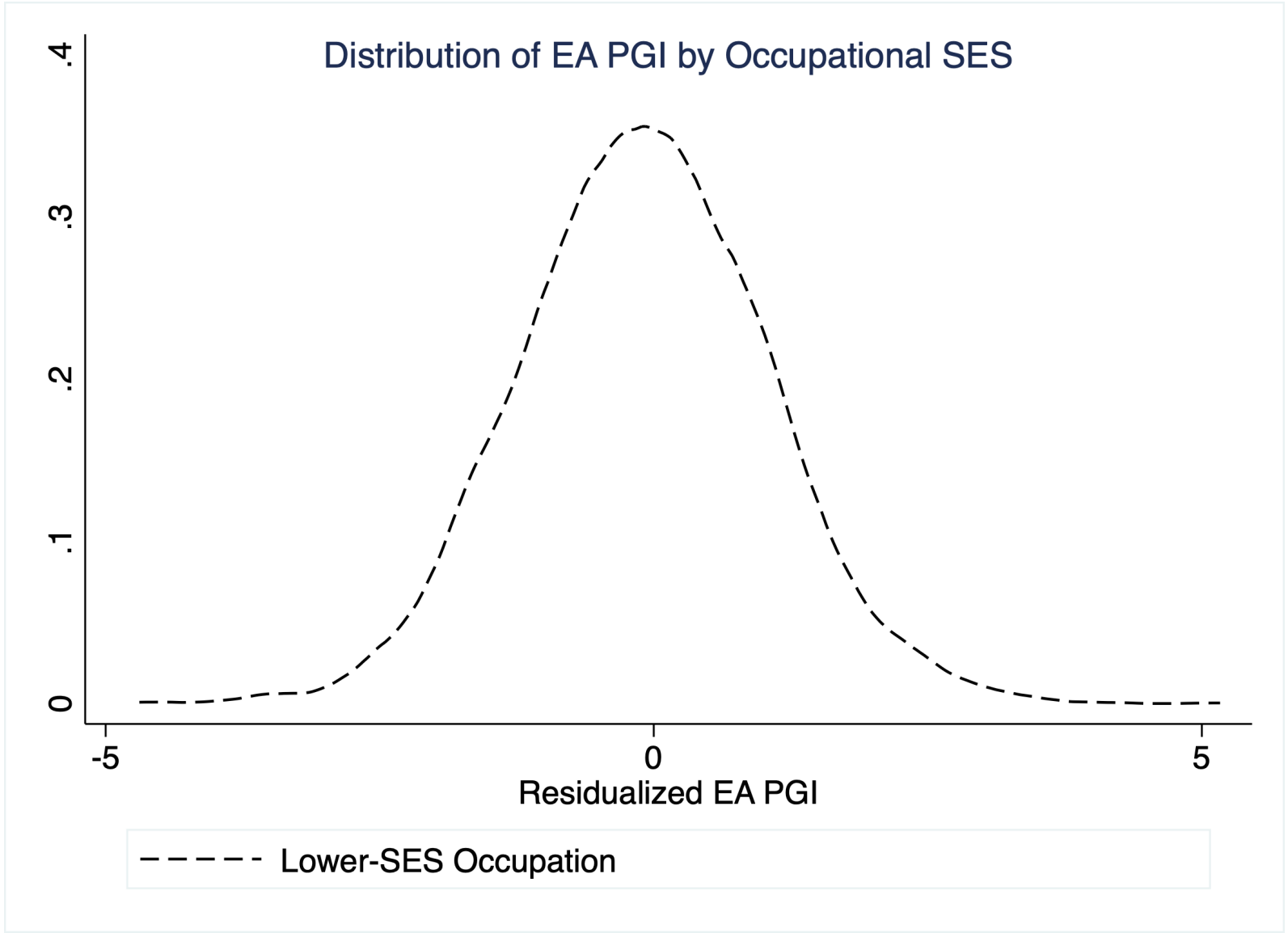

Educational
Choices
EA PGI
Income
Occupational
Choices

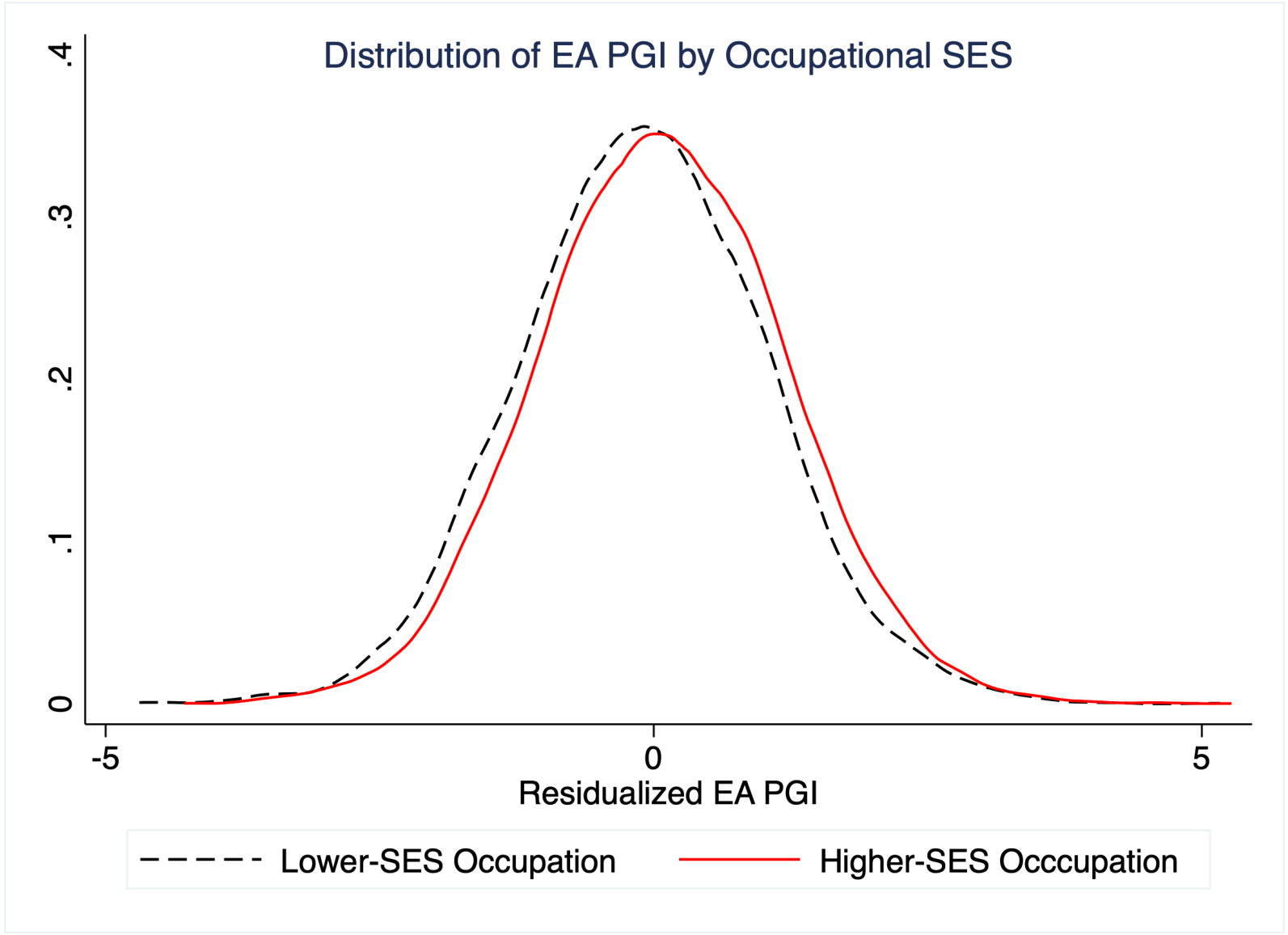

Educational
Choices
?
EA PGI
?
Occupational
Choices

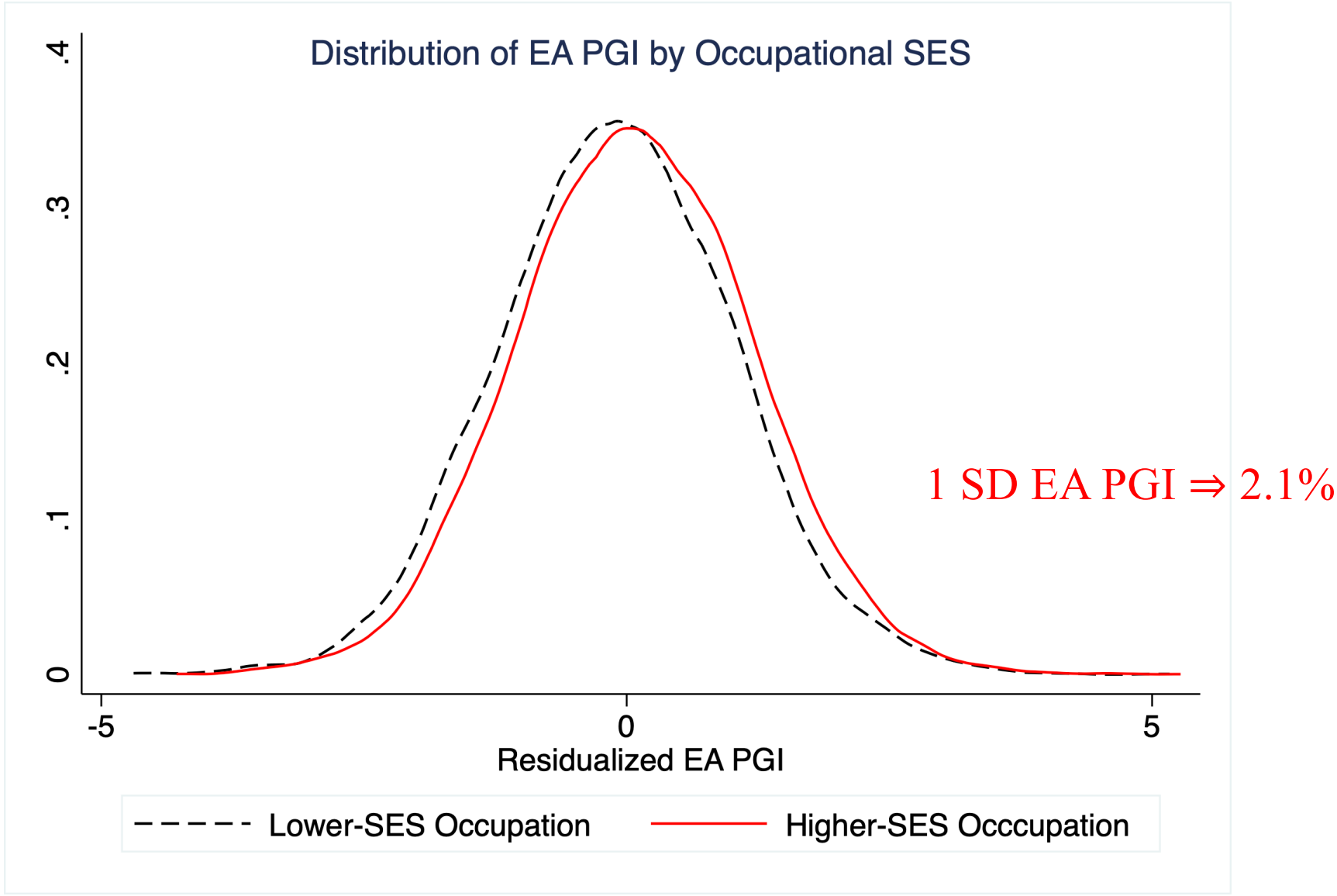

Distribution of EA PGI by Compulsory Schooling
.4
.3
.2
.1
0
-5
0
5
Residualized EA PGI
Dropped Out at CSA

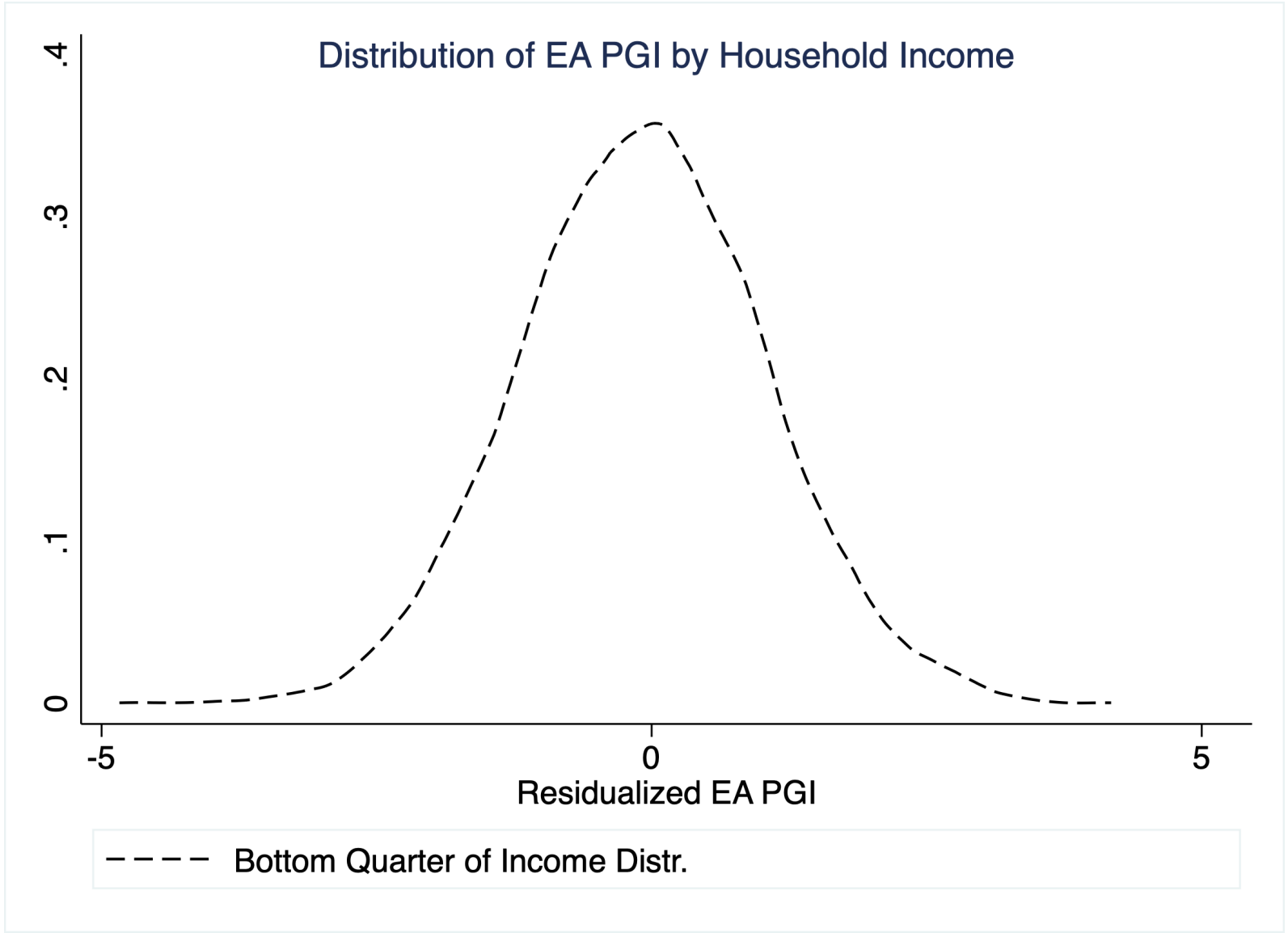

Distribution of EA PGI by Compulsory Schooling
.4
.3
.2
.1
0
-5
0
5
Residualized EA PGI
Dropped Out at CSA
Stayed Past CSA

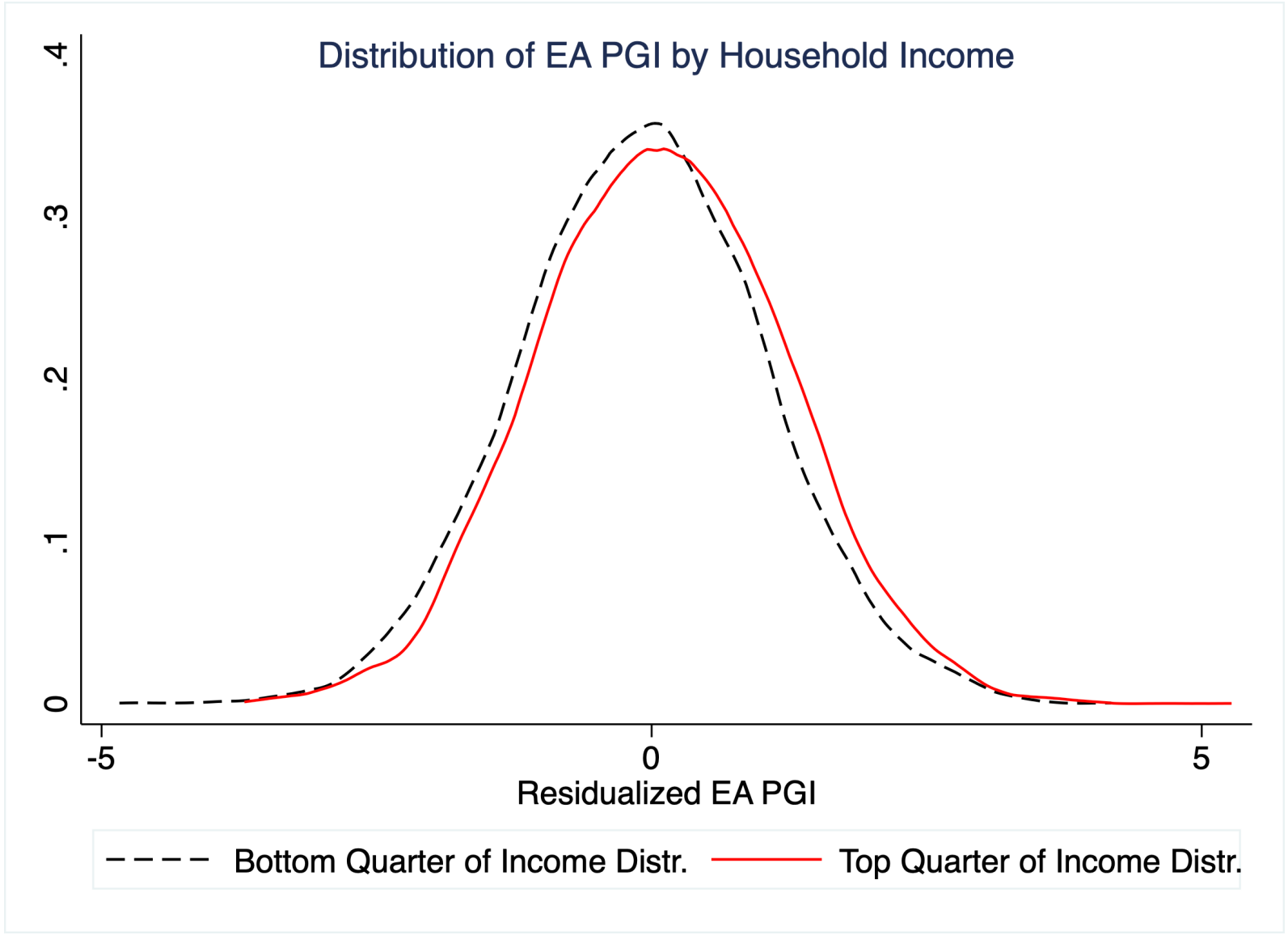

Distribution of EA PGI by Compulsory Schooling
0
.1
.2
.3
.4
-5
0
5
Residualized EA PGI
Dropped Out at CSA
Stayed Past CSA
1 SD EA PGI ⇒ 2.7 p.p.

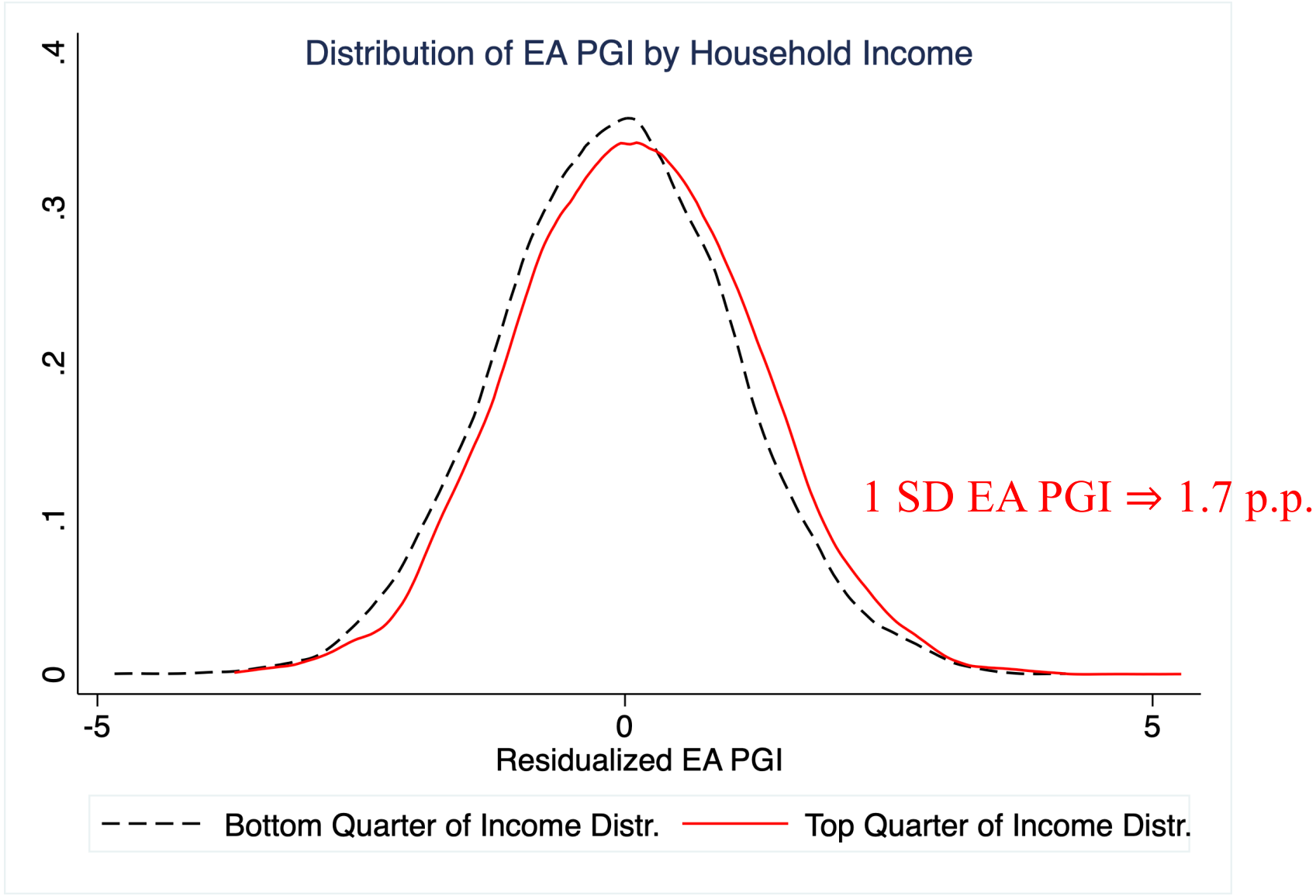

Distribution of EA PGI by Occupational SES
.4
.3
.2
.1
0
-5
0
5
Residualized EA PGI
Lower-SES Occupation


Distribution of EA PGI by Occupational SES
0
.1
.2
.3
.4
-5
0
5
Residualized EA PGI
Lower-SES Occupation
Higher-SES Occcupation

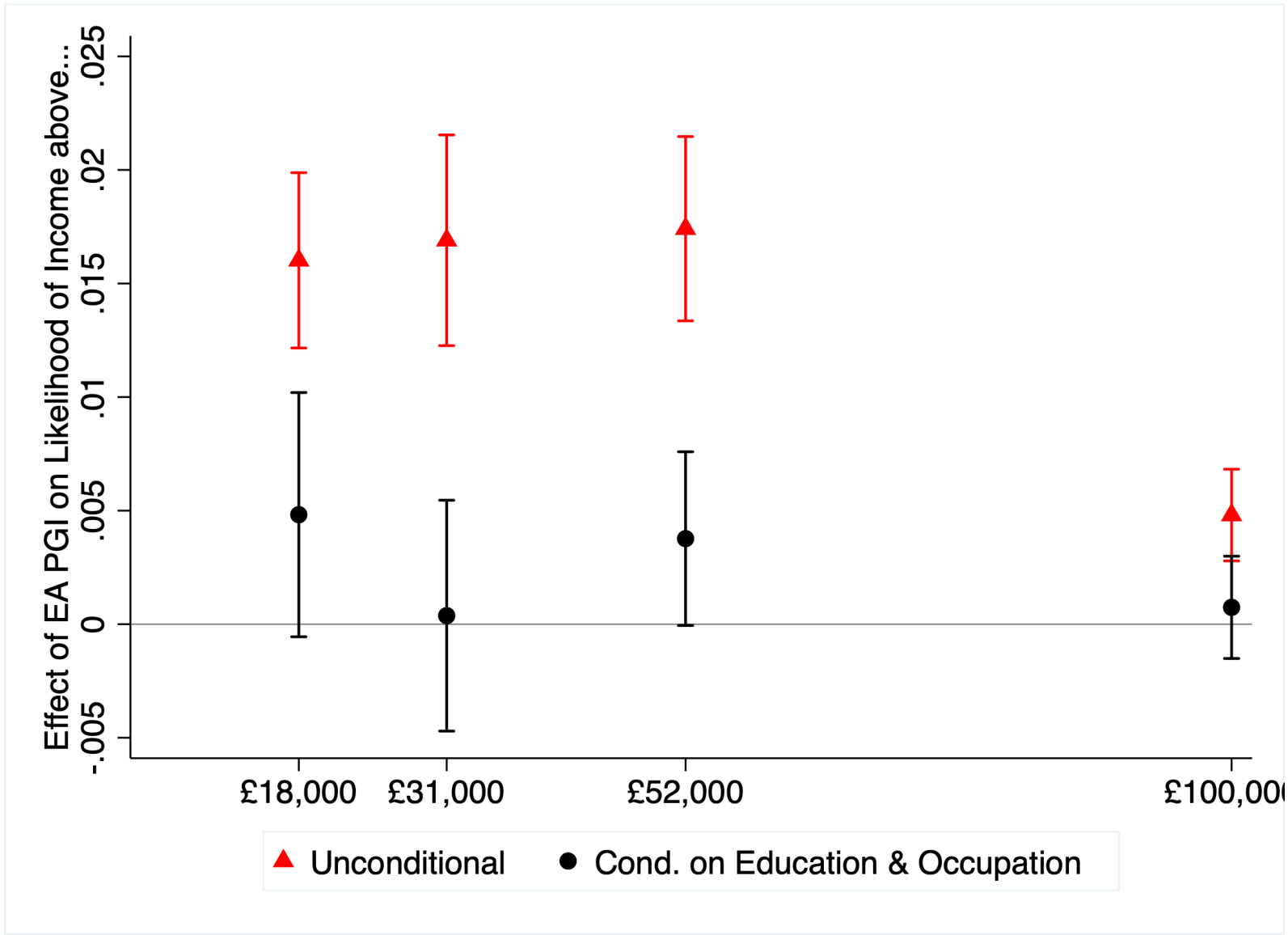

Distribution of EA PGI by Occupational SES
0
.1
.2
.3
.4
-5
0
5
Residualized EA PGI
Lower-SES Occupation
Higher-SES Occcupation
1 SD EA PGI ⇒ 2.1%


Distribution of EA PGI by Household Income
.4
.3
.2
.1
0
-5
0
5
Residualized EA PGI
Bottom Quarter of Income Distr.


Distribution of EA PGI by Household Income
.4
.3
.2
.1
0
-5
0
5
Residualized EA PGI
Bottom Quarter of Income Distr.
Top Quarter of Income Distr.


Distribution of EA PGI by Household Income
.4
.3
.2
.1
0
-5
0
5
Residualized EA PGI
1 SD EA PGI ⇒ 1.7 p.p.
Bottom Quarter of Income Distr.
Top Quarter of Income Distr.

Effect of EA PGI on Likelihood of Income above...
-.005
0
.005
.01
.015
.02
.025
£18,000
£31,000
£52,000
£100,000
Unconditional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0
.005
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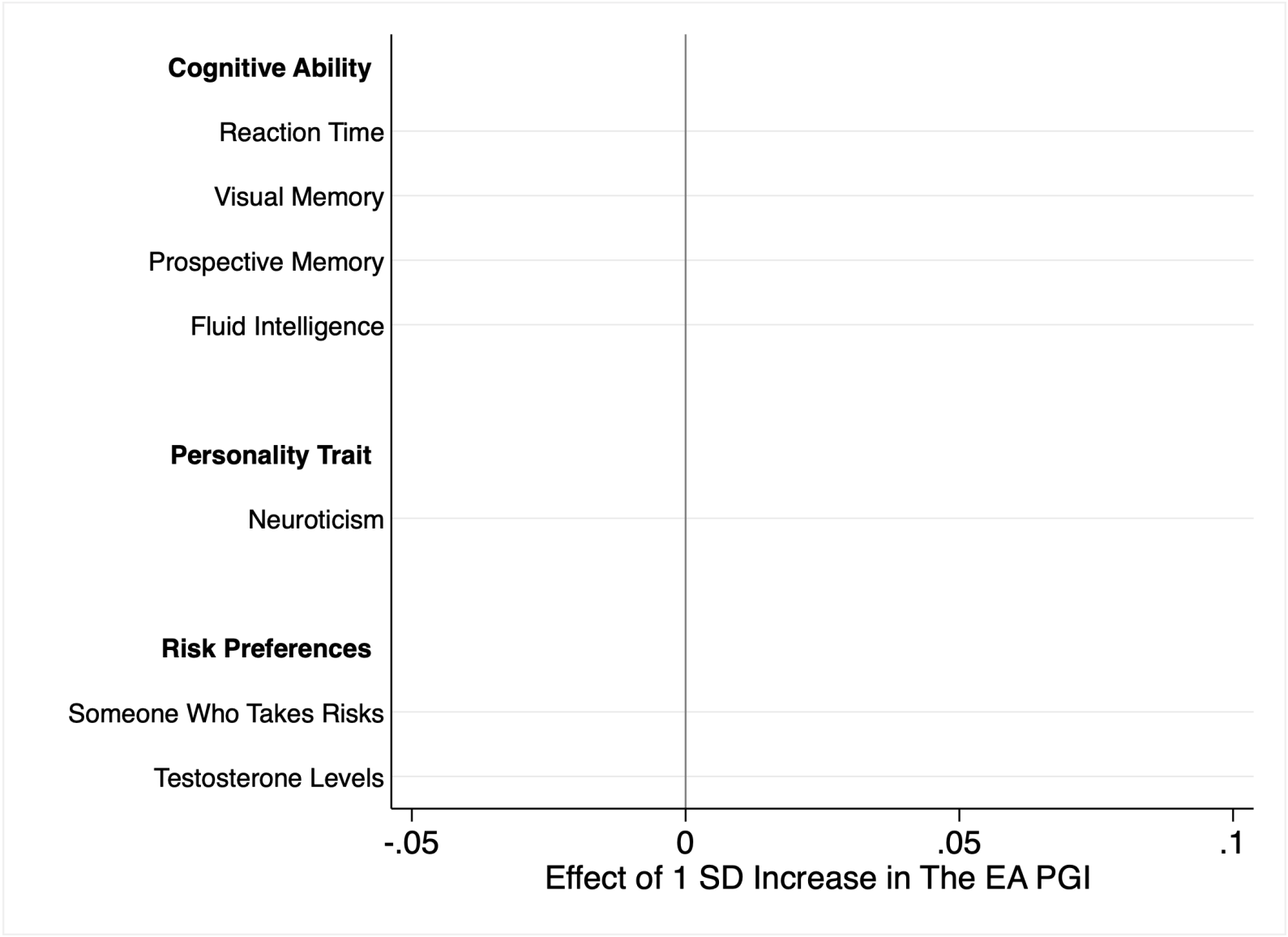
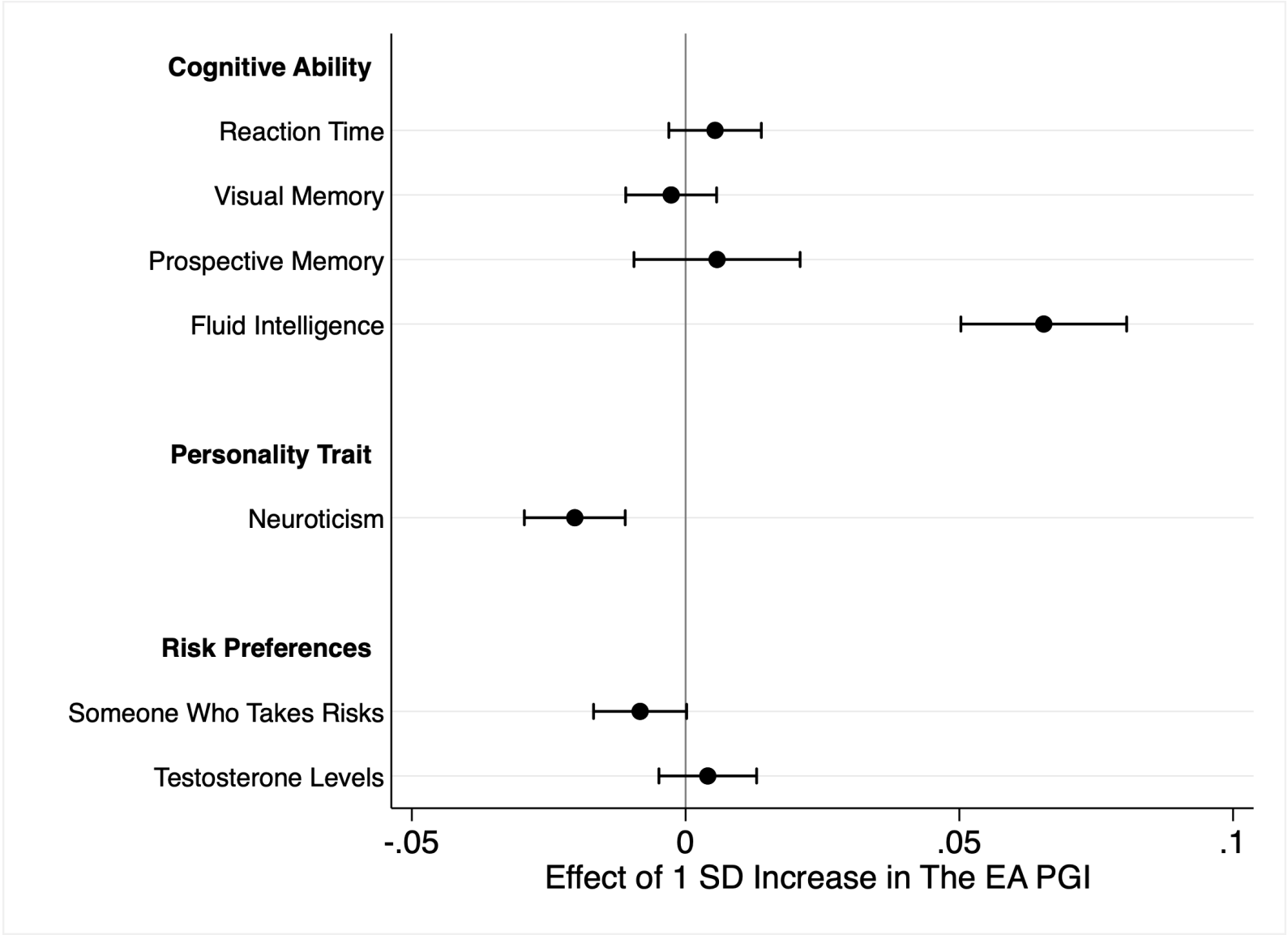
Unconditional
Cond. on Education & Occupation


Cognitive Ability
Reaction Time
Visual Memory
Prospective Memory
Fluid Intelligence
Personality Trait
Neuroticism
Risk Preferences
Someone Who Takes Risks
Testosterone Levels
-.05
0
.05
.1
Effect of 1 SD Increase in The EA PGI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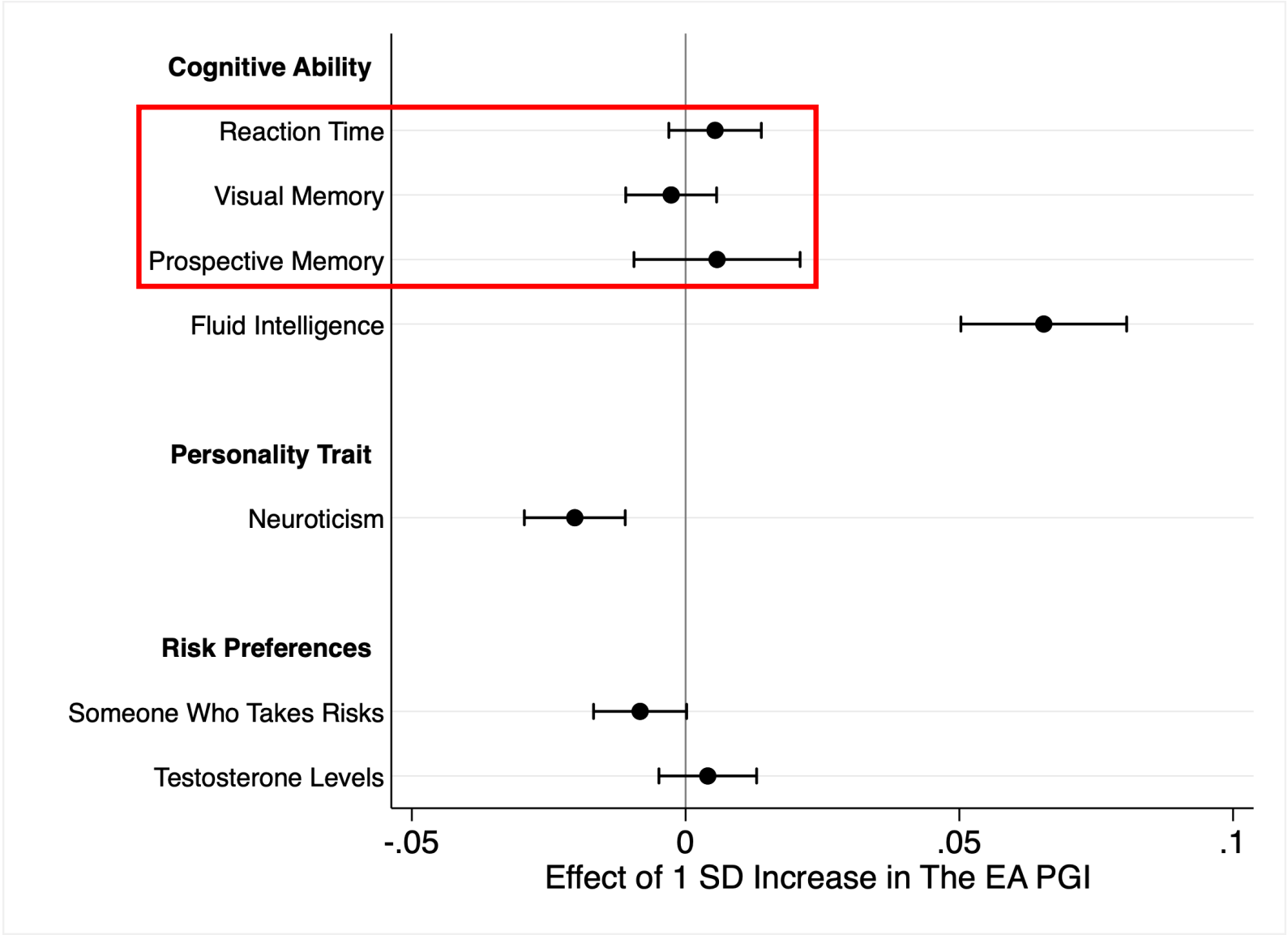
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.05
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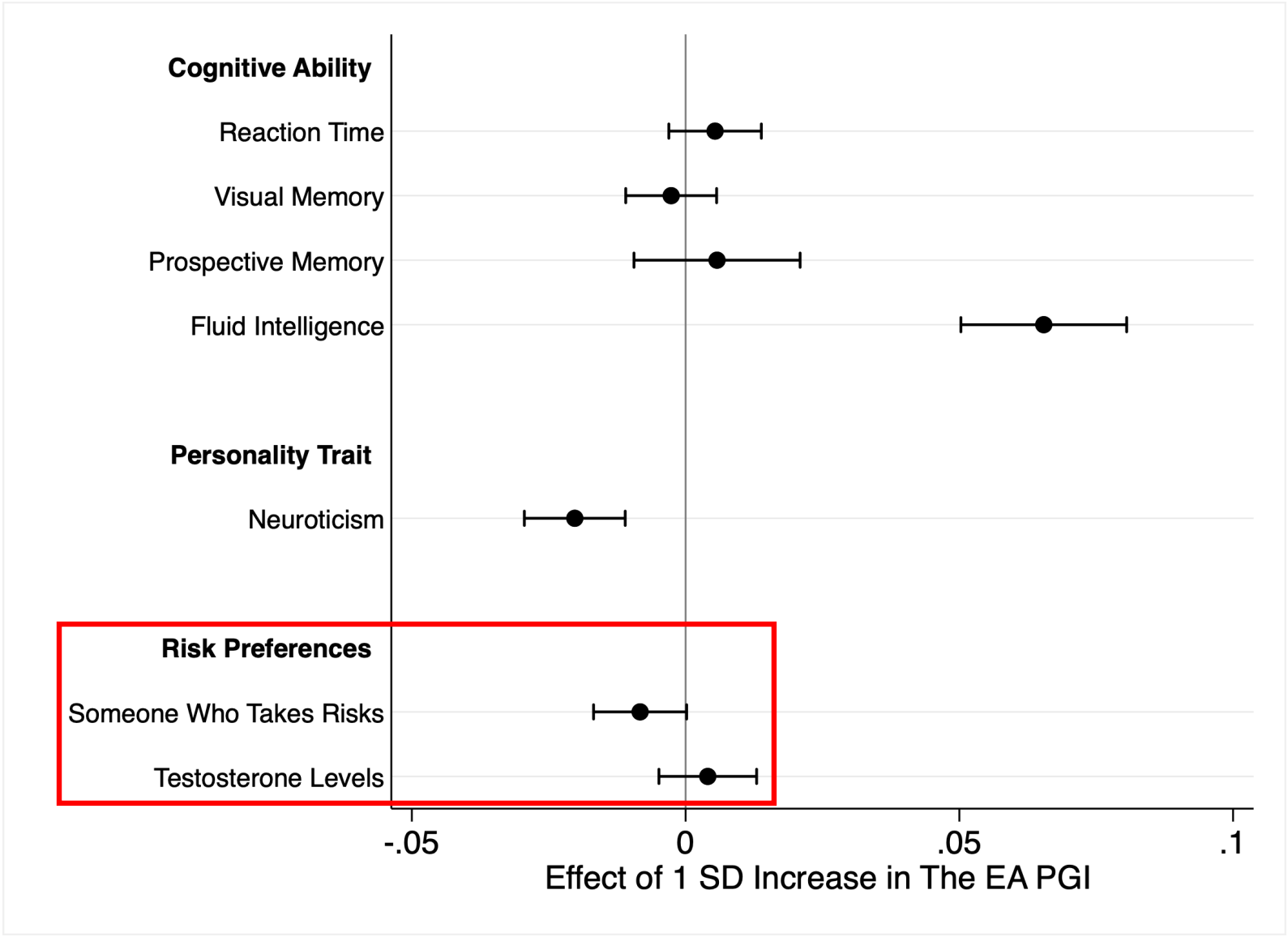
Effect of 1 SD Increase in The EA PGI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Neuroticism
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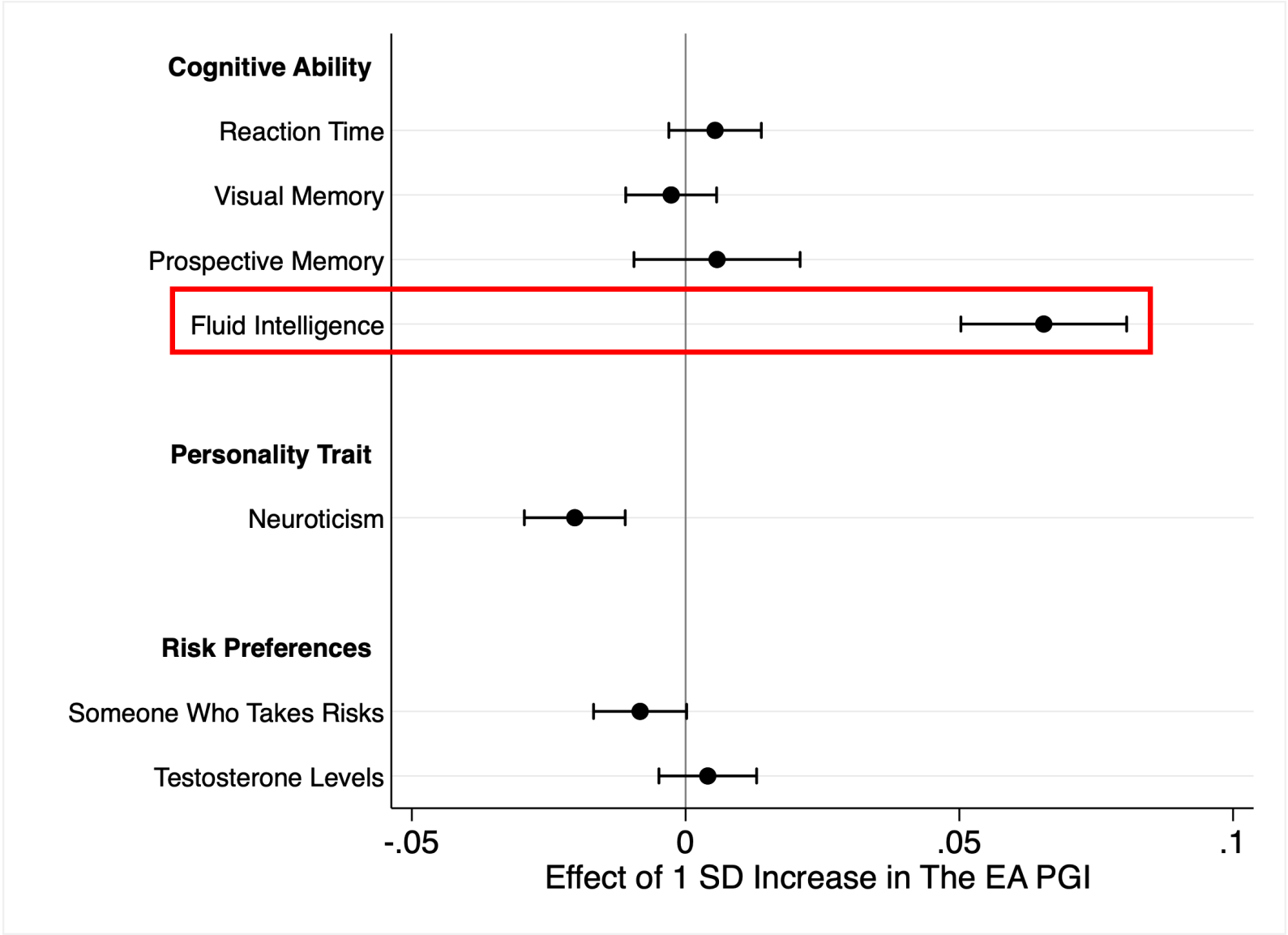
Someone Who Takes Risks
Testosterone Levels
-.05
0
.05
.1
Effect of 1 SD Increase in The EA PGI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Neuroticism
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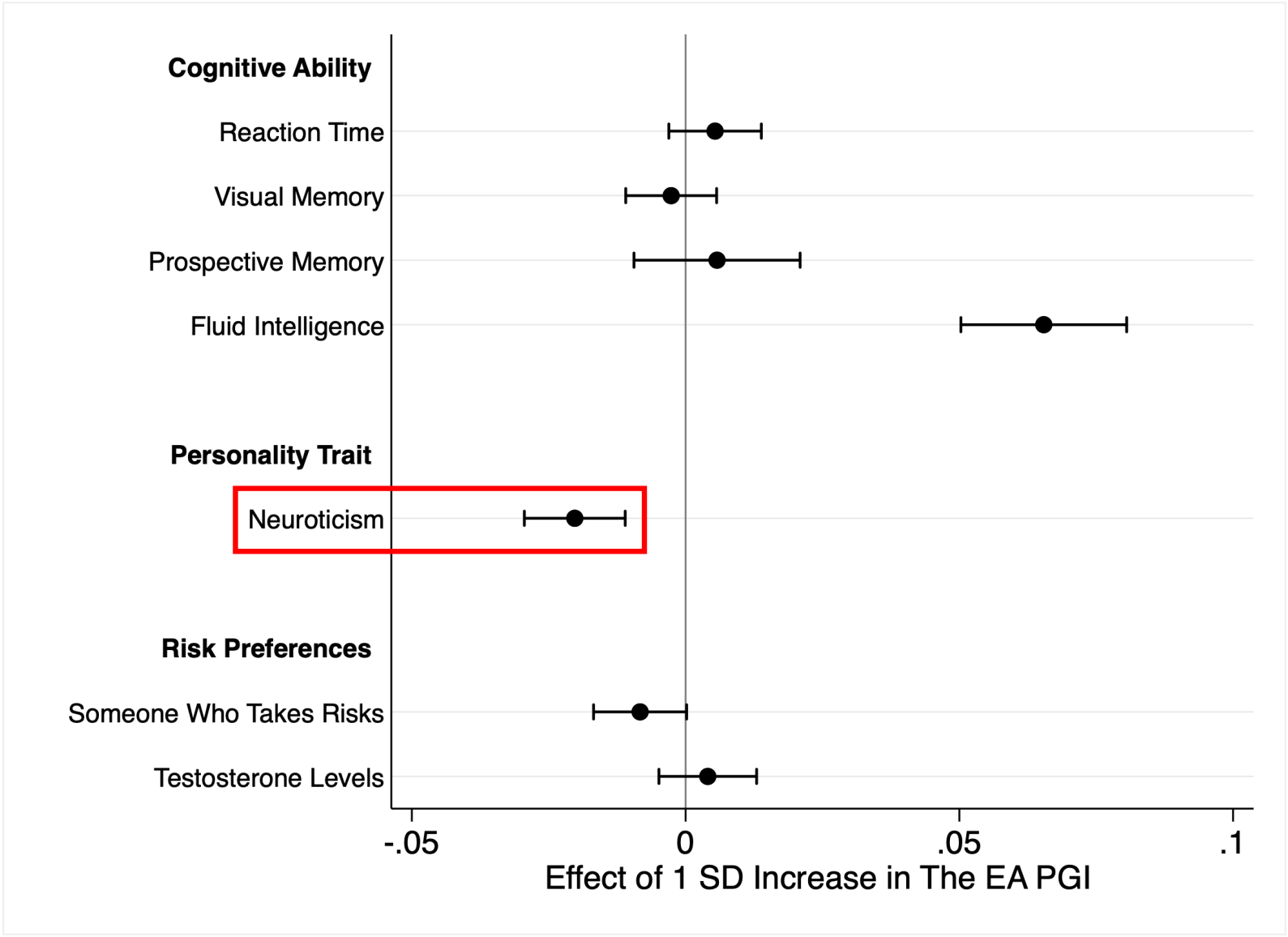
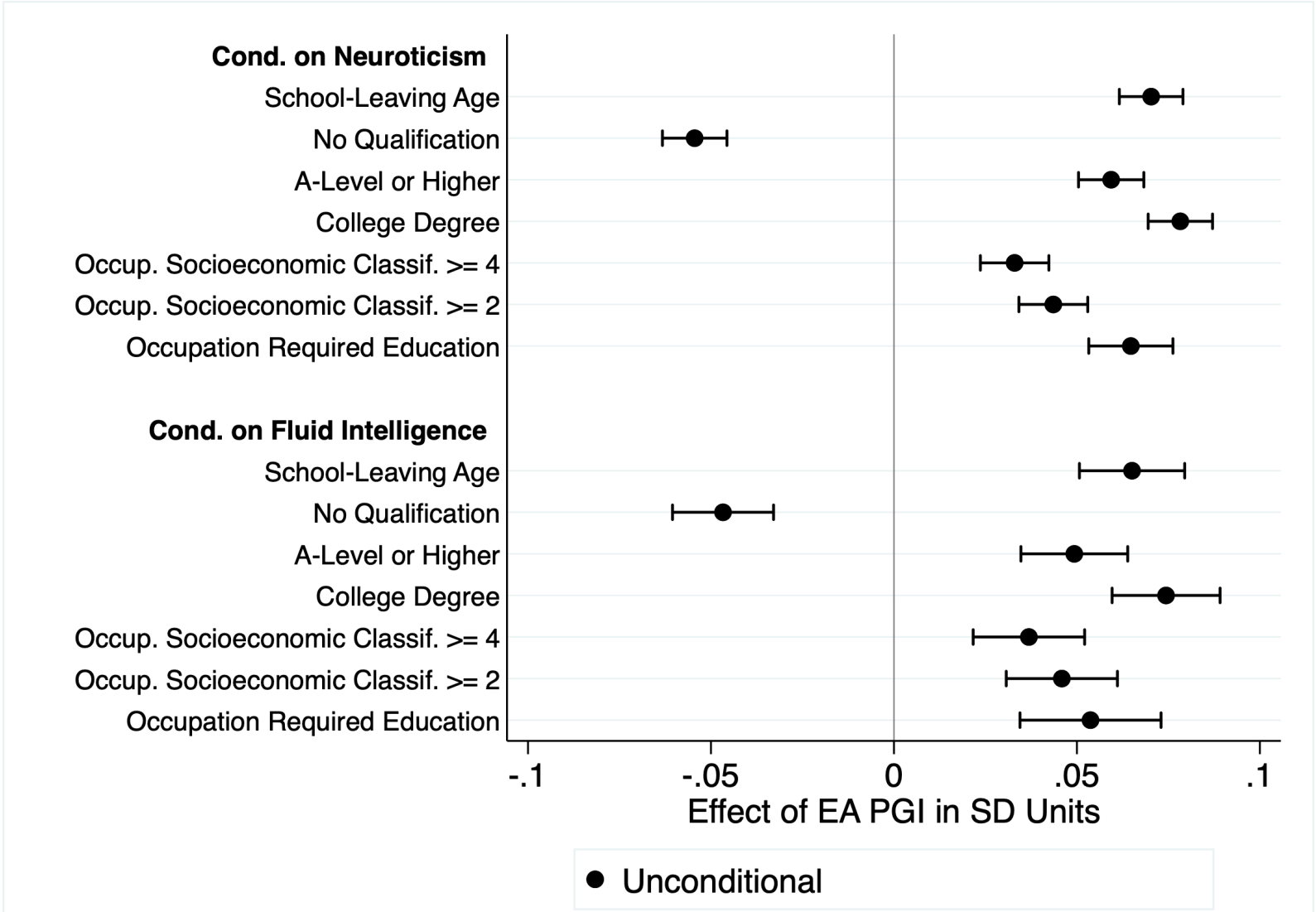
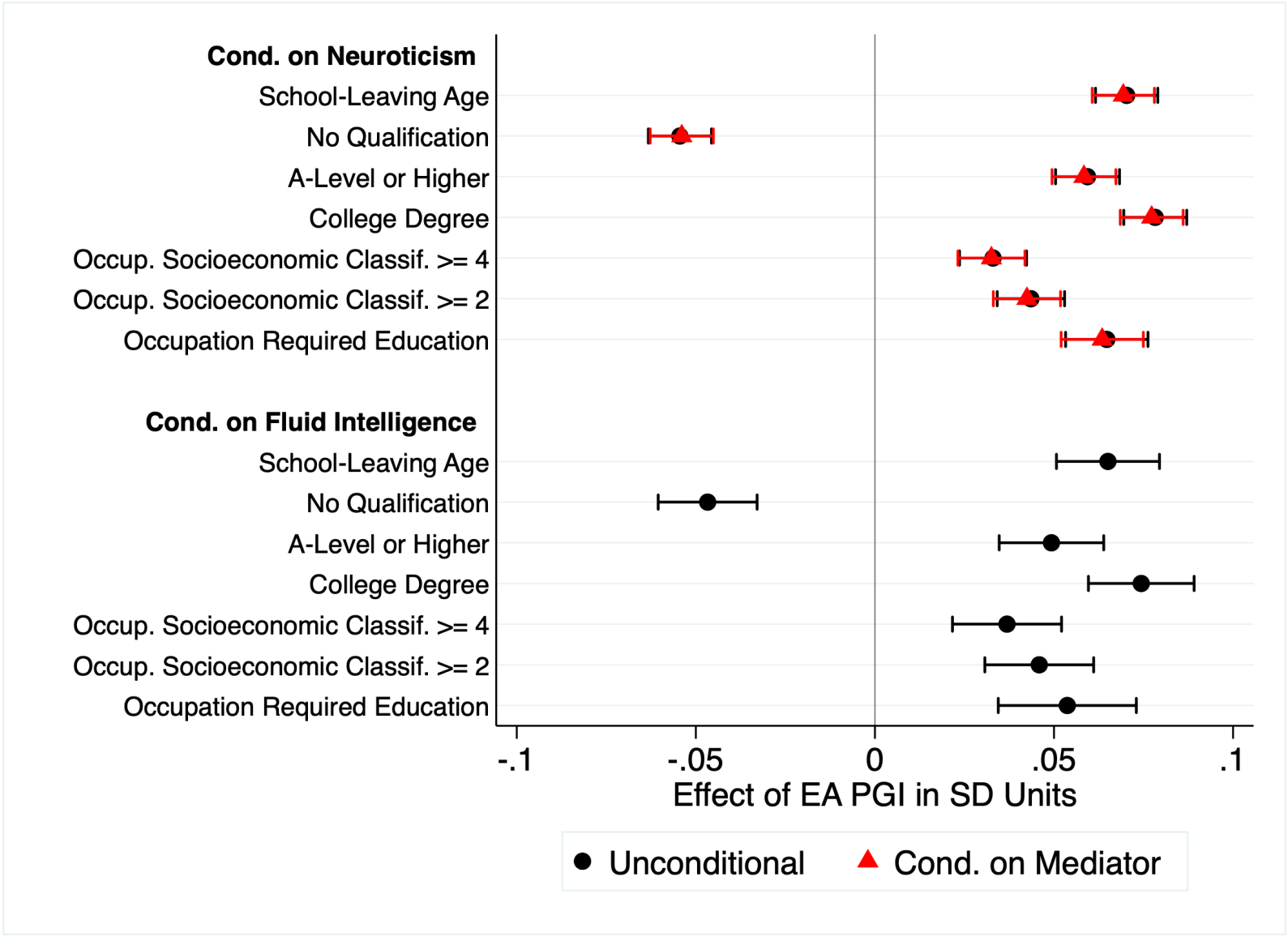
Someone Who Takes Risks
Testosterone Levels
-.05
0
.05
.1
Effect of 1 SD Increase in The EA PGI


Cognitive Ability
Reaction Time
Visual Memory
Prospective Memory
Fluid Intelligence
Personality Trait
Neuroticism
Risk Preferences
Someone Who Takes Risks
Testosterone Levels
-.05
0
.05
.1
Effect of 1 SD Increase in The EA PGI


Cond. on Neuroticism
School-Leaving Age
No Qualification
A-Level or Higher
College Degree
Occup. Socioeconomic Classif. >= 4
Occup. Socioeconomic Classif. >= 2
Occupation Required Education
Cond. on Fluid Intelligence
School-Leaving Age
No Qualification
A-Level or Higher
College Degree
Occup. Socioeconomic Classif. >= 4
Occup. Socioeconomic Classif. >= 2
Occupation Required Education
-.1
-.05
0
.05
.1
Effect of EA PGI in SD Units
Unconditional


Cond. on Neuroticism
School-Leaving Age
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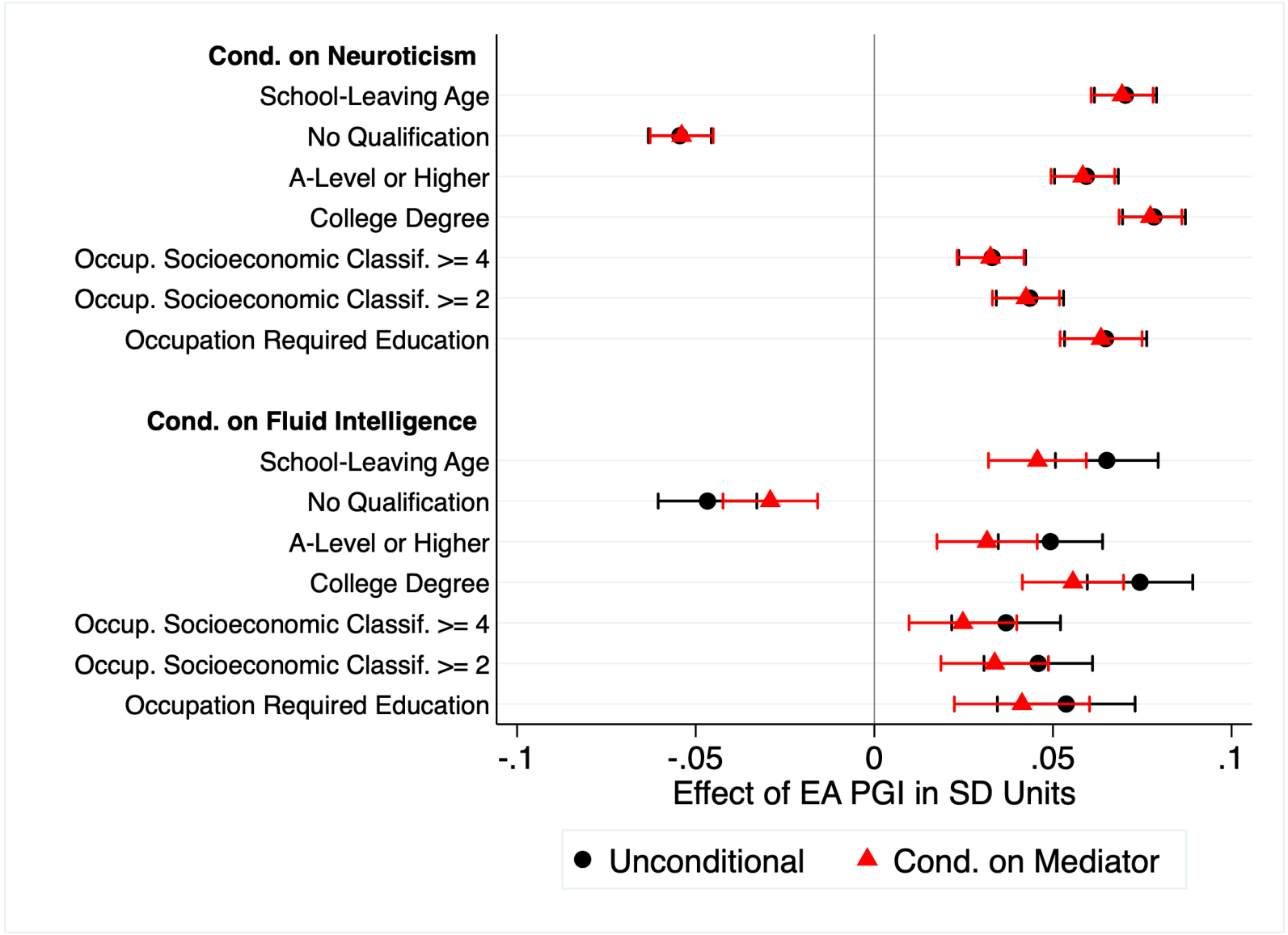
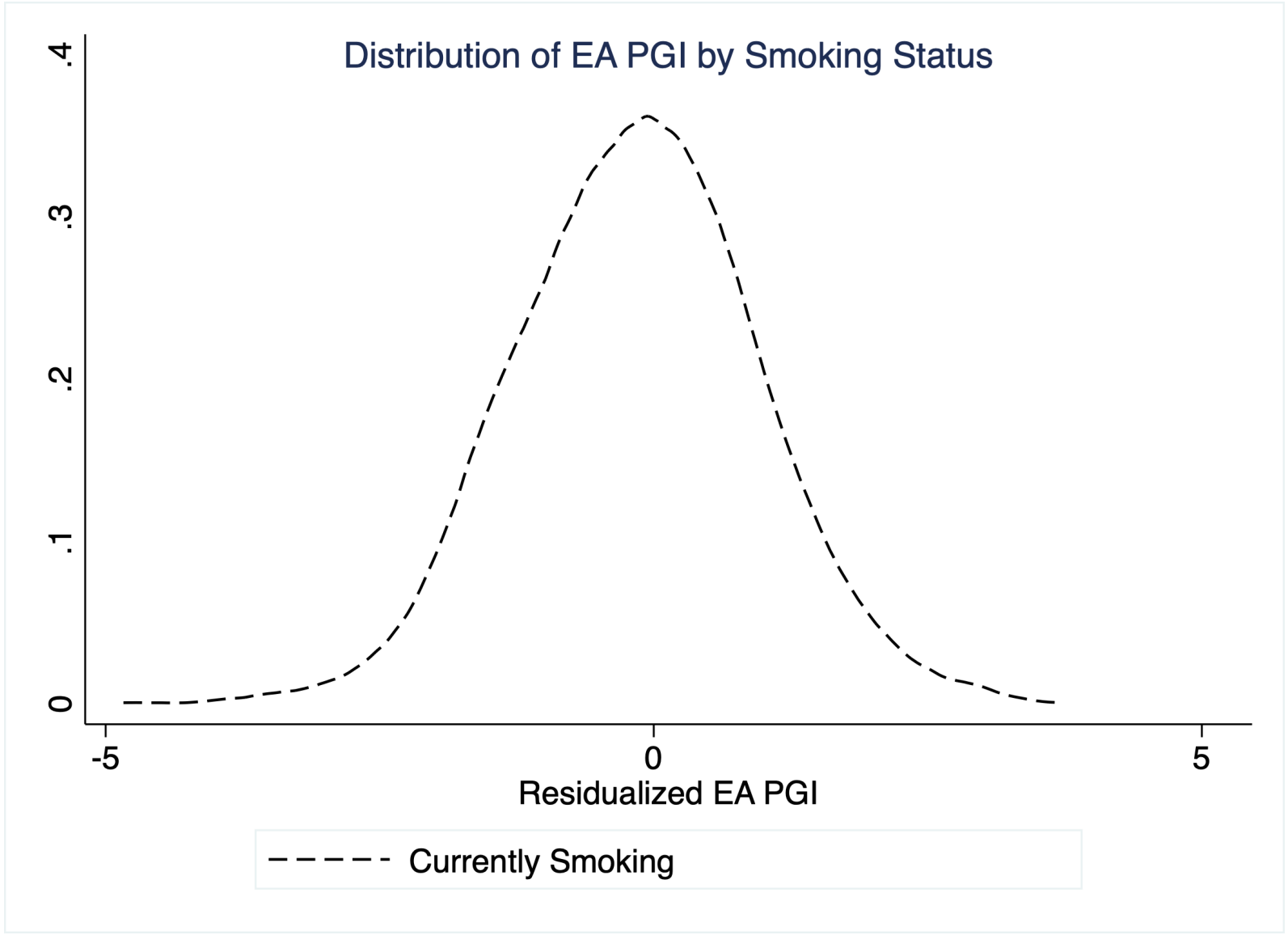
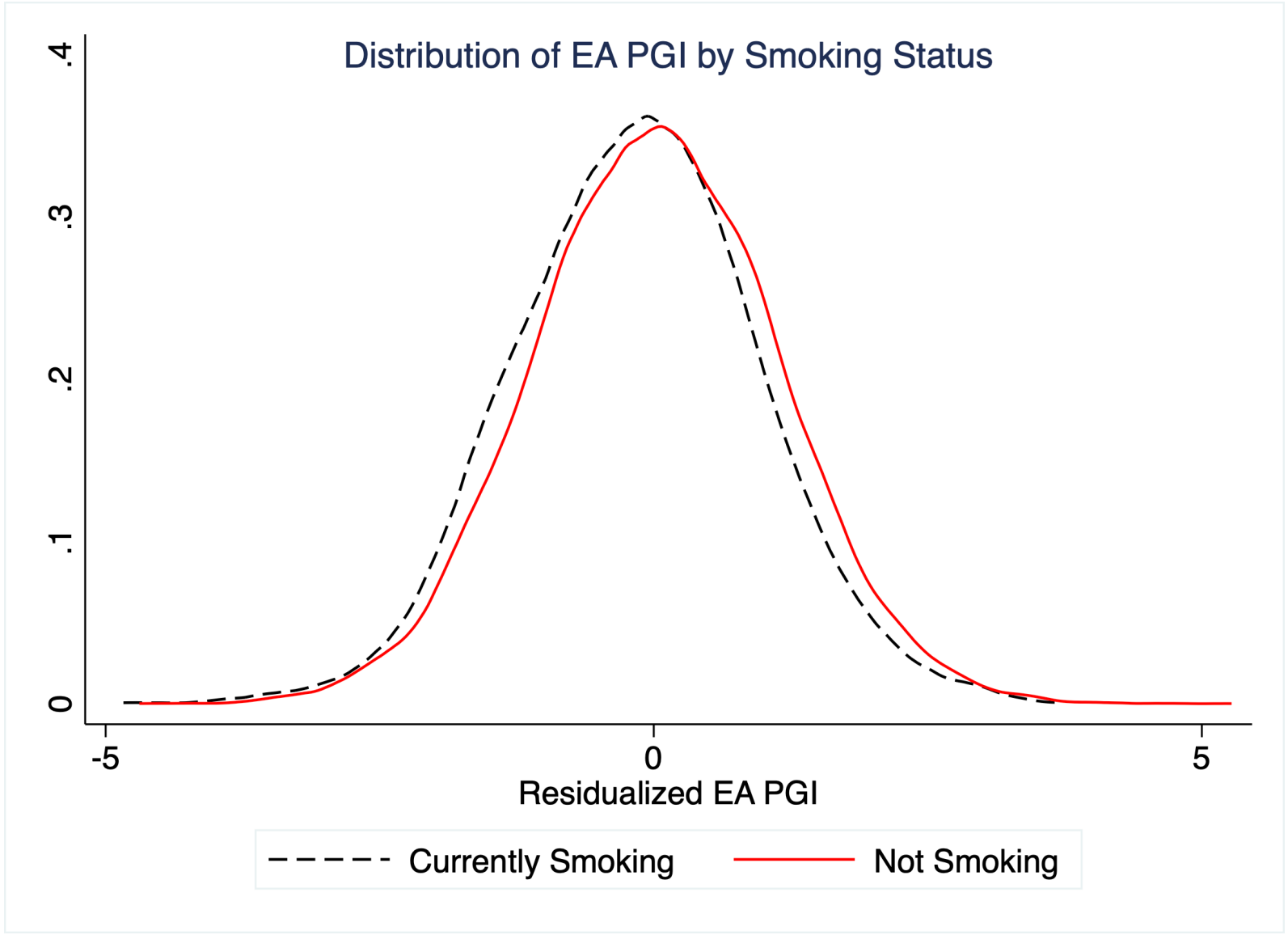
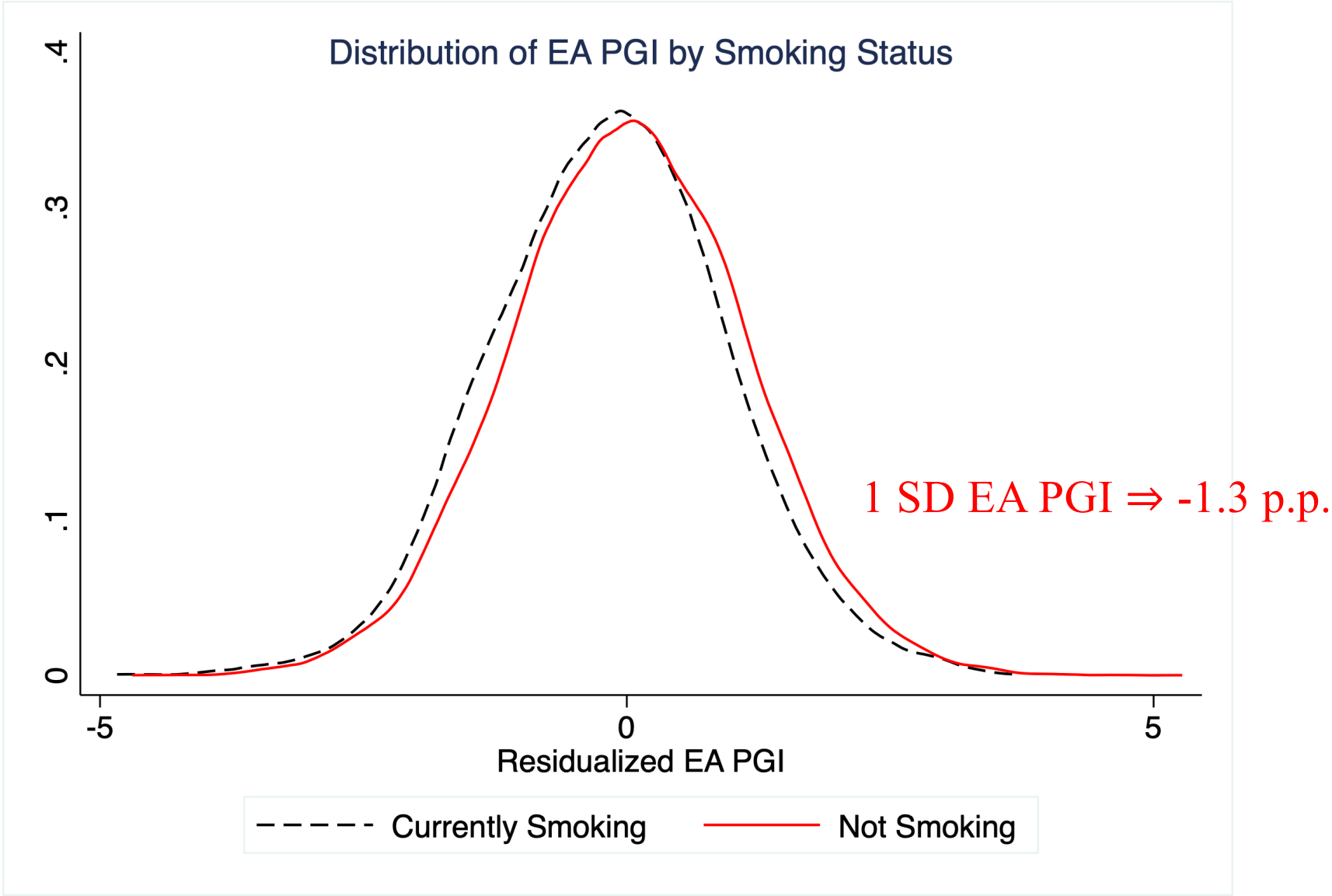
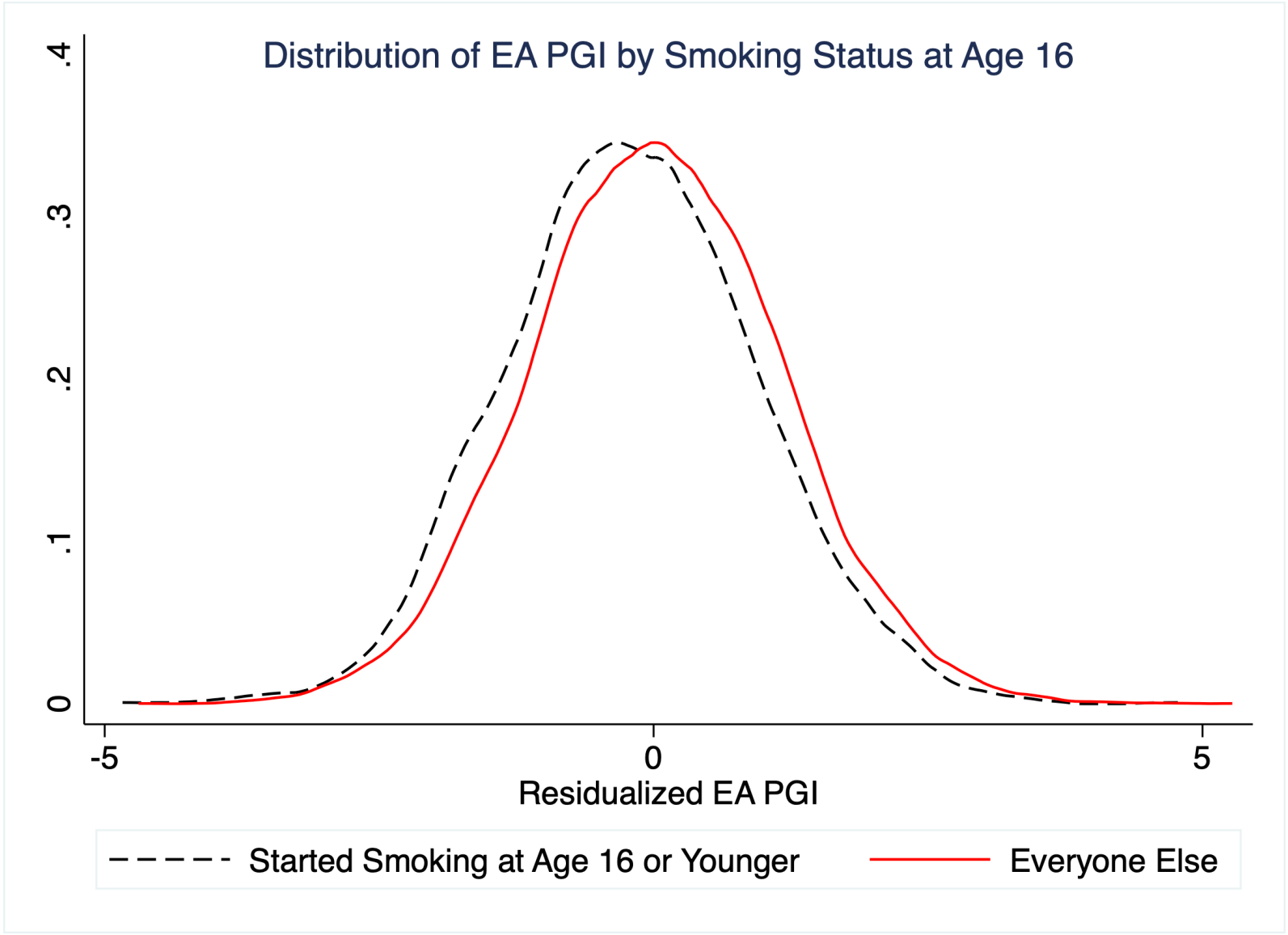
A-Level or Higher
College Degree
Occup. Socioeconomic Classif. >= 4
Occup. Socioeconomic Classif. >= 2
Occupation Required Education
Cond. on Fluid Intelligence
School-Leaving Age
No Qualification
A-Level or Higher
College Degree
Occup. Socioeconomic Classif. >= 4
Occup. Socioeconomic Classif. >= 2
Occupation Required Education
-.1
-.05
0
.05
.1
Effect of EA PGI in SD Units
Unconditional
Cond. on Mediator


Cond. on Neuroticism
School-Leaving Age
No Qualification
A-Level or Higher
College Degree
Occup. Socioeconomic Classif. >= 4
Occup. Socioeconomic Classif. >= 2
Occupation Required Education
Cond. on Fluid Intelligence
School-Leaving Age
No Qualification
A-Level or Higher
College Degree
Occup. Socioeconomic Classif. >= 4
Occup. Socioeconomic Classif. >= 2
Occupation Required Education
-.1
-.05
0
.05
.1
Effect of EA PGI in SD Units
Unconditional
Cond. on Mediator


Distribution of EA PGI by Smoking Status
.4
.3
.2
.1
0
-5
0
5
Residualized EA PGI
Currently Smoking


Distribution of EA PGI by Smoking Status
0
.1
.2
.3
.4
-5
0
5
Residualized EA PGI
Currently Smoking
Not Smoking


Distribution of EA PGI by Smoking Status
0
.1
.2
.3
.4
-5
0
5
Residualized EA PGI
Currently Smoking
Not Smoking
1 SD EA PGI ⇒ -1.3 p.p.


Distribution of EA PGI by Smoking Status at Age 16
0
.1
.2
.3
.4
-5
0
5
Residualized EA PGI
Started Smoking at Age 16 or Younger
Everyone Else

Literature

1. Importance of genetics & family environment for intergenerational transmission of SES

Taubman 1976; Behrman & Taubman 1989; Bowles and Gintis 2002; Björklund et al. 2006; Sacerdote 2007, 2011; Black et al. 2020; Fagereng et al. 2021

Barth et al. 2020; Papageorge & Thom 2020; Ronda et al. forthcoming; Kweon et al. 2020; Houmark et al. 2020; Muslimova et al. 2020; Barcellos et al. 2021; Burik et al. 2021; Buser et al. 2021

Literature – Cont.

2. Determinants of decision-making

Callen et al. 2014; Callen 2015; Cameron & Shah 2015; Carvalho et al. 2016a; Kim et al. 2018; Hanaoka et al. 2018; Banks et al. 2019; Rao 2019; Akesaka 2019

Shah et al. 2012; Mani et al. 2013; Mullainathan & Shafir 2013; Fehr & Haushofer 2014; Carvalho et al. 2016b; Schilbach et al. 2016; Schilbach 2019; Dean 2019; Bessone et al. 2021; Kaur et al. 2021

Cesarini et al. 2008, 2009, 2010, 2012

Conclusion

Genetics affects educational and occupational choices and income

These choices mediate the relationship between the EA PGI and income

Suggestive evidence that fluid intelligence and present focus explain the effects of genetics on economic choices

Genetic effects are economically meaningful

Conclusion – Cont.

Effects of genetics on economic choices do not reflect fixed, biological relationships; they change with environmental conditions

"...claiming that genetic differences between people are meaningless does not make the power of the genome go away. Rather, failing to recognize the genetic lottery as a systemic force that creates inequalities does exactly what eugenic ideology would want—permits those genetically associated inequalities to persist as "natural" rather than being critically examined."

(Harden 2021)