

Jan 28th, 2010
CHPPP workshop

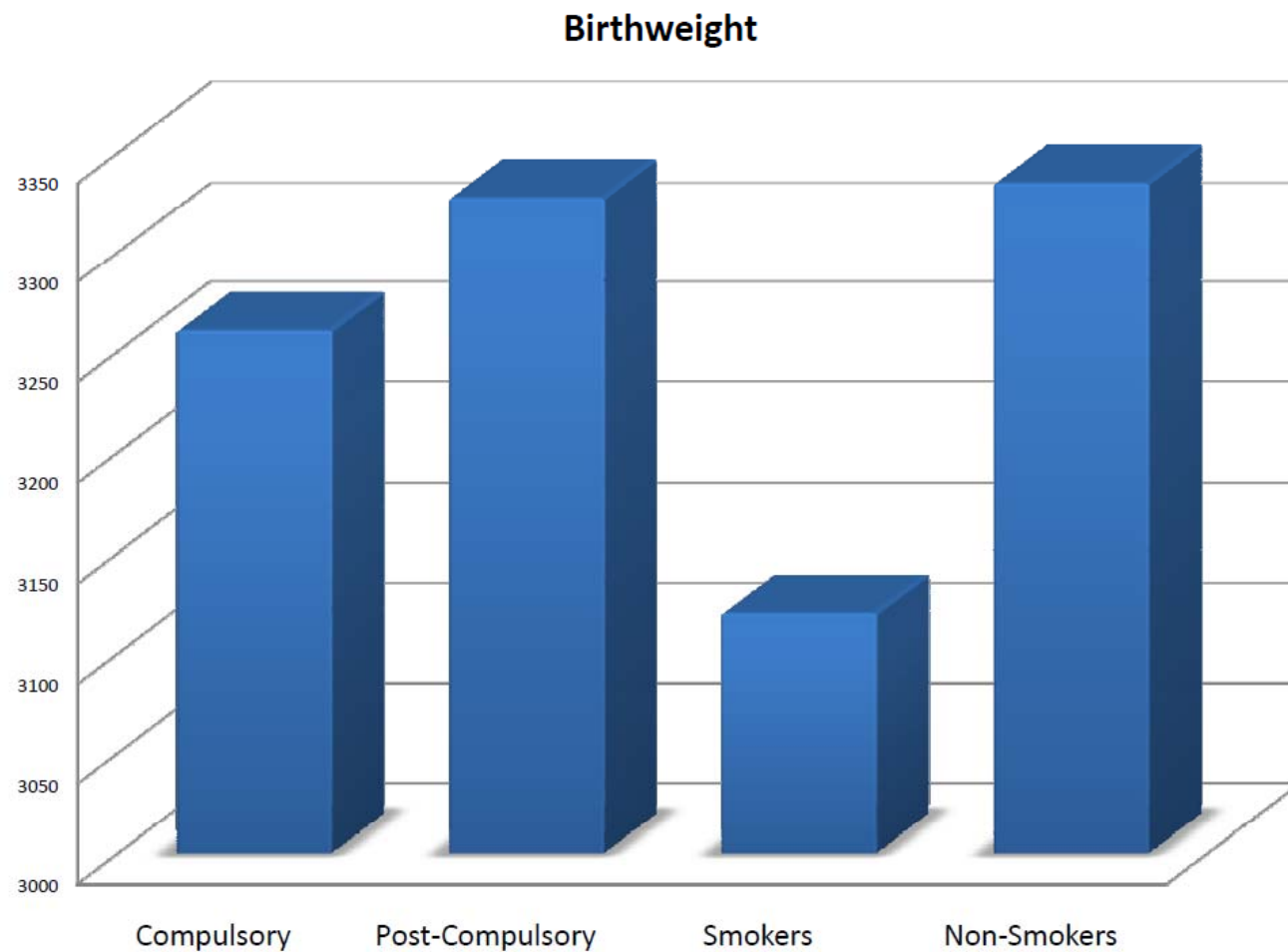
“Maternal Skills and Child Birth Weight: An Analysis of the Channels for Intergenerational Transmission of Inequality”

Gabriella Conti
Pia Pinger
Arianna Zanolini

Motivation

- What are the intergenerational determinants of early life health disparities?
- We will look at the relationship between maternal skills and birth weight of her child.
- Why birth weight? It is a determinant of future outcomes and skills.
- Focus on two channels: schooling and smoking.

Birth weight by smoking and education



Skills

- We focus on three determinants of these behaviors: cognitive, non cognitive and health skills.

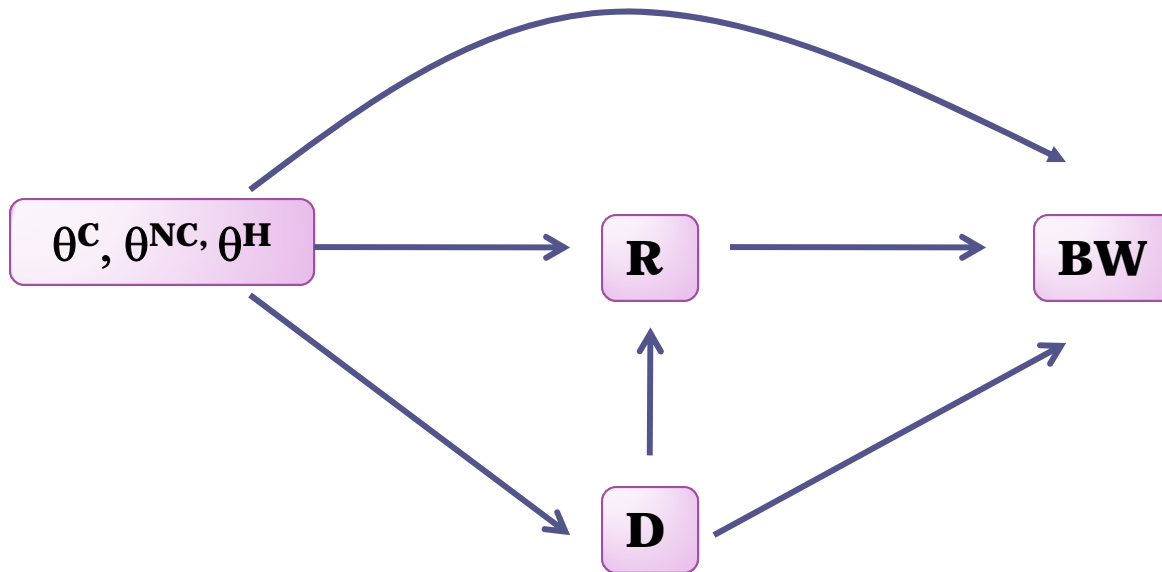
Motivation

- The literature on smoking and schooling mainly uses IV (LATE interpretation) and focuses on average effects.
- We consider the role of selection explicitly.
 - Three sources of selection: cognitive, non cognitive skills and health.
 - Decompose the total effect of skills.
- We look at heterogeneity in treatment effects.

Literature

- **Overreaching themes:**
 - Intergenerational transmission literature
 - Technology of skill formation literature
 - Birth production function and investments in pregnancy
 - Noncognitive skills and personality literature
- **Consider particular investments**
 - Education on birth weight
 - Education on smoking
 - Smoking on birth weight

The channels



D is maternal education.

R is maternal smoking.

$\theta^C, \theta^{NC}, \theta^H$ are maternal cognitive, non cognitive and health skills

BW is the child birth weight

Education on birth weight

- Literature divided: some finds effects of schooling (*Currie and Moretti 2003, Chou et al 2003*) and some does not (*Lindeboom et al (2009), Doyle (2005)*).
- Some evidence of heterogeneity by cognitive and by race (*Carneiro et al. (2007), McCrary and Royer (2009)*).
- Note: these are LATEs.

Smoking on birth weight

- Negative impact of smoking agreed in the literature.
- The effect ranges widely, from 50 grams (*Walker 2007*) to 400 grams (*Permutt and Hebel*).
- Most likely between 100 and 200 grams (*Liens and Evans, Abrevaya (2006), Rosenzweig and Wolpin (1991)*).
- Diversity could be effect of heterogeneity in health endowments.

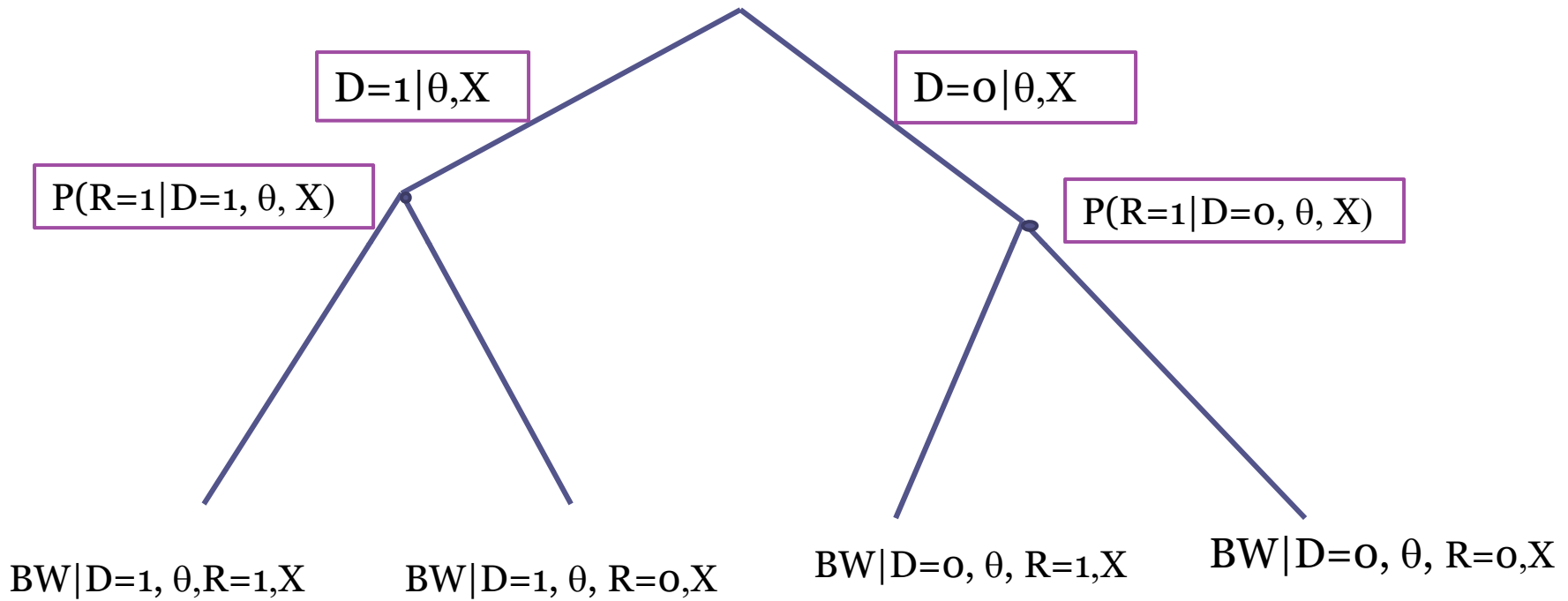
Schooling on smoking

- One additional year of schooling reduces the probability of smoking during pregnancy of 3 to 6% (*Currie and Moretti (2003), Carneiro et al. (2007)*)
- (*McCrary and Royer (2009)*) find no effect

Data

- NCDS.
- Mothers born in 1958.
- We use data until 1991 follow-up.
- Education choice: continuing school after 16.
- Selection into sample equation: first live birth by 33.
- Smoking after 3 months of pregnancy.
- Outcome: child birth weight in grams.
- Measurements taken at age 11.
 - **Cognitive scores:** Verbal/nonverbal IQ, reading comprehension, mathematics test, copying designs test.
 - **Non Cognitive:** Dychotomized BSAG.
 - **Health:** Maternal birth weight, grandmother height at birth, maternal height at age 11.

Maternal: θ, X



D: Education

R: Smoking

Model

Simultaneous equation framework (following Carneiro, Hansen and Heckman):

- Education choice

$$\begin{aligned} I^* &= Z\beta + V \\ D &= 1(I^* > 0) \end{aligned}$$

- Smoking Choice

$$\begin{aligned} I_R^*(d) &= Z_R\beta_R(d) + V_R(d) \quad \text{with } d \in \{l, h\} \\ R(d) &= 1(I_R^*(d) > 0) \end{aligned}$$

- Birth Weight

$$BW(d, r) = X_{BW}\beta_{BW}(d, r) + U_{BW}(d, r) \quad \text{with } d \in \{l, h\} \quad \text{and } r \in \{s, ns\}$$

Model

Measurement System:

$$M_{kj} = \theta_k \lambda_{kj} + X_{kj} \beta_{kj} + \epsilon_{kj} \quad \text{with } k \in \{c, nc, h\}, \quad \lambda_{k1} = 1$$

Model

Unobserved Heterogeneity

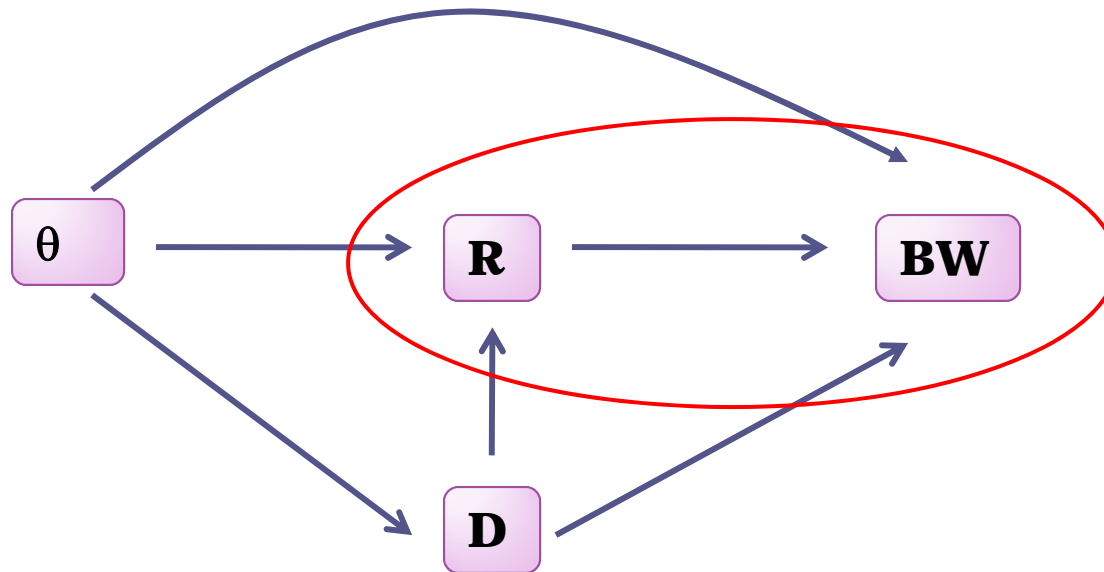
■ Linear Separability

$$\begin{aligned} V_d &= \Theta \lambda_d + \epsilon_d & \Theta &= (\theta_C, \theta_N, \theta_H) \\ V_r(d) &= \Theta \lambda_r(d) + \epsilon_r(d) & & \text{with } d \in \{l, h\} \\ U_{BW}(d, r) &= \Theta \lambda_{BW}(d, r) + \epsilon_{BW}(d, r) & & \text{with } d \in \{l, h\} \quad \text{and } r \in \{s, ns\} \end{aligned}$$

- All of the correlation conditional on X across equations is captured by the factors.
- The factor distribution is modeled as a mixture of two normals.
- The parameters of the likelihood of the simultaneous equation system are estimated by MCMC methods.

1. Smoking on birthweight

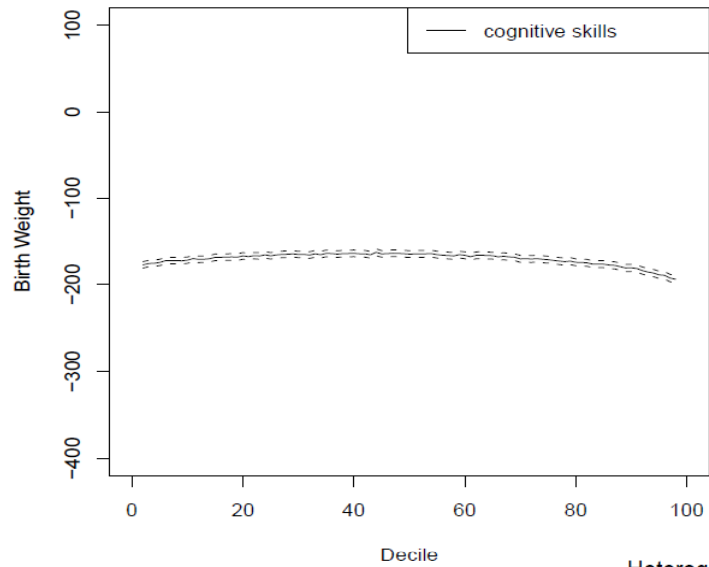
The channels



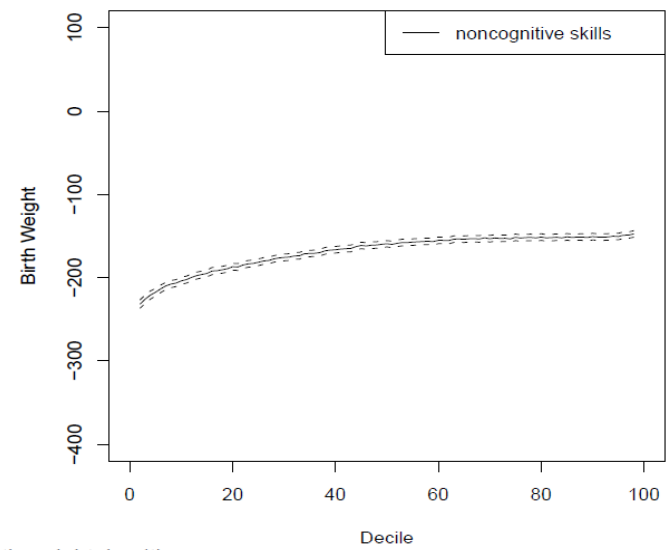
ATE of smoking on birth weight

- We compute the overall $ATE = E(Y_1 - Y_0) = -167$ grams
- We also compute ATE: $E(Y_1 - Y_0 | \theta)$

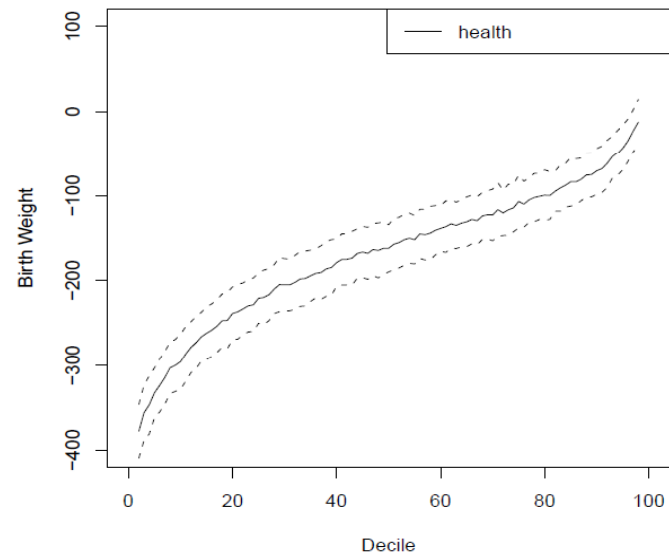
Heterogenous ATE of smoking on birth weight, cognitive skills



Heterogenous ATE of smoking on birth weight, noncognitive sk

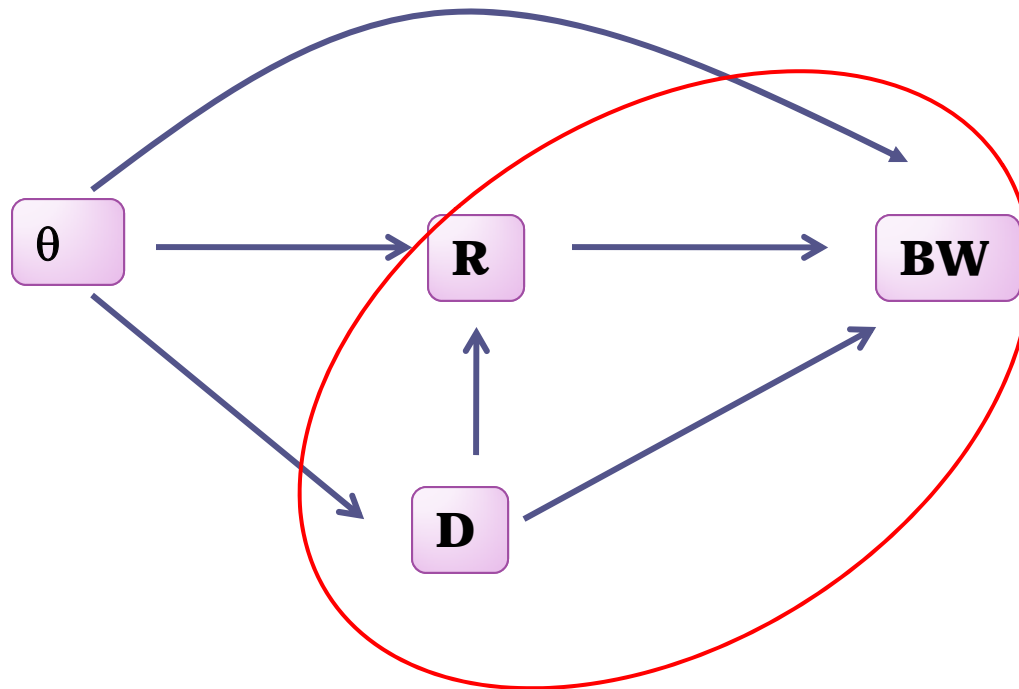


Heterogenous ATE of smoking on birth weight, health

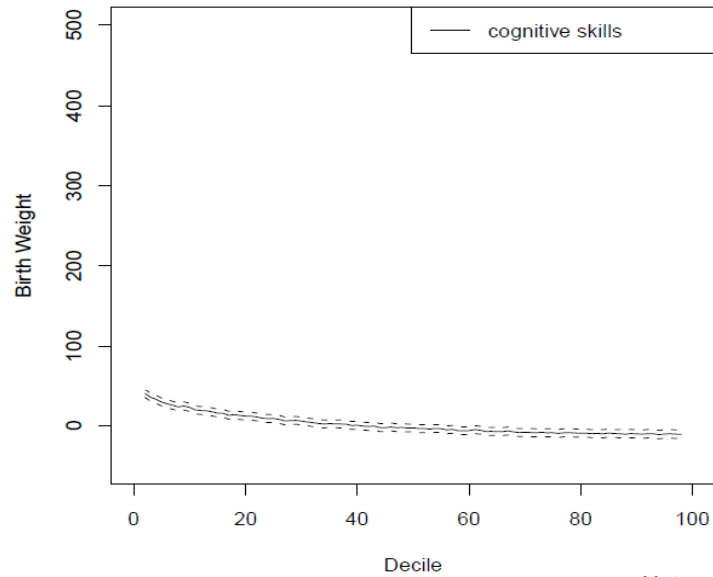


2. Education on birth weight

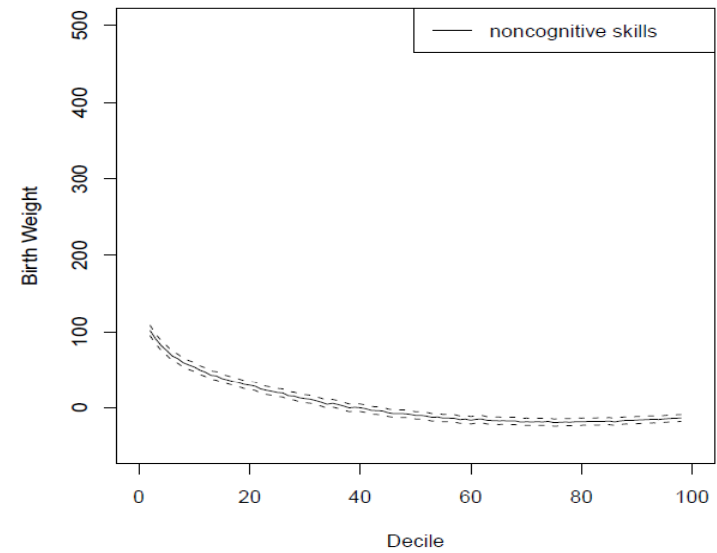
The channels



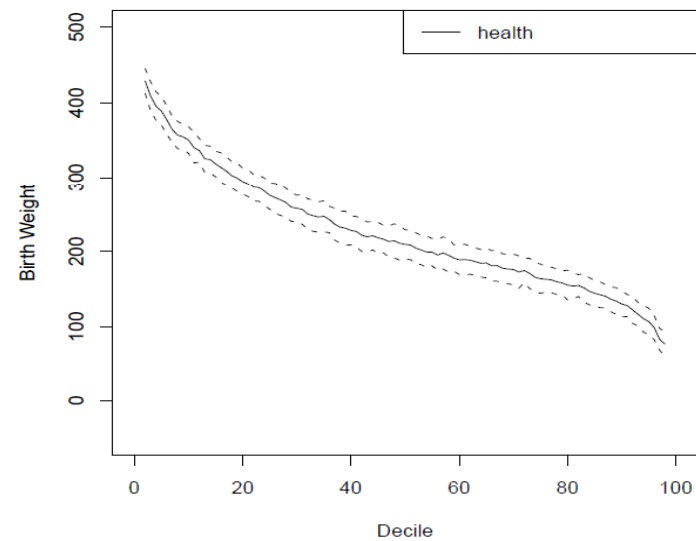
Heterogenous ATE of education on birth weight, cognitive skills



Heterogenous ATE of education on birth weight, noncognitive skill



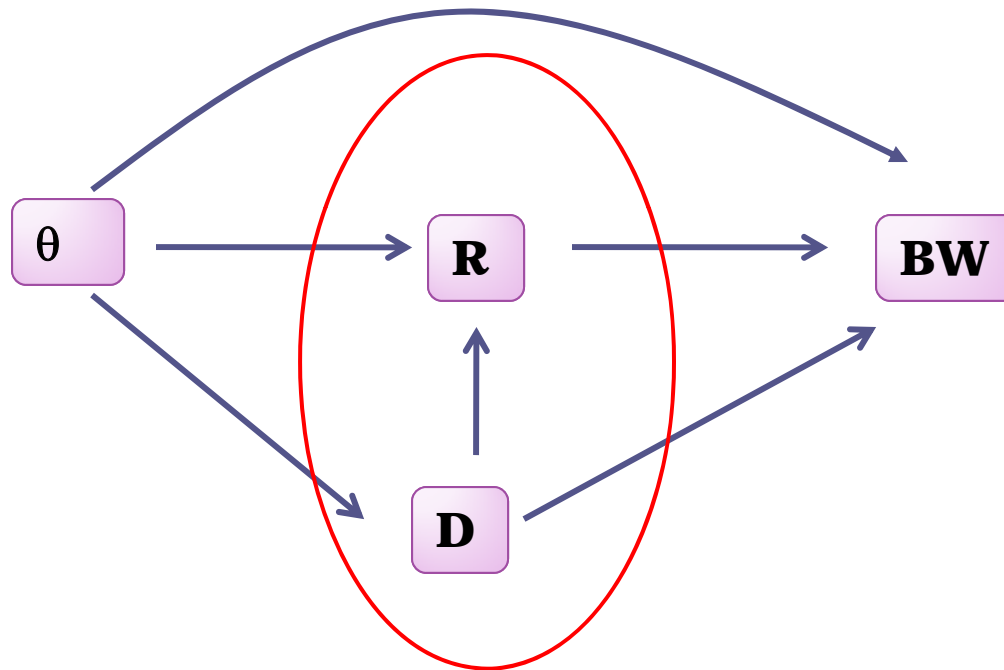
Heterogenous ATE of education on birth weight, health



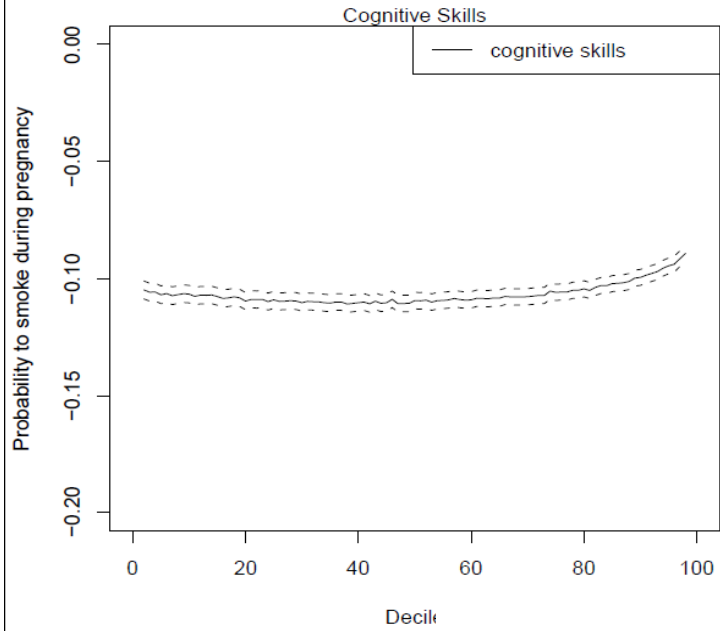
- The overall ATE is 0

3. Education on smoking.

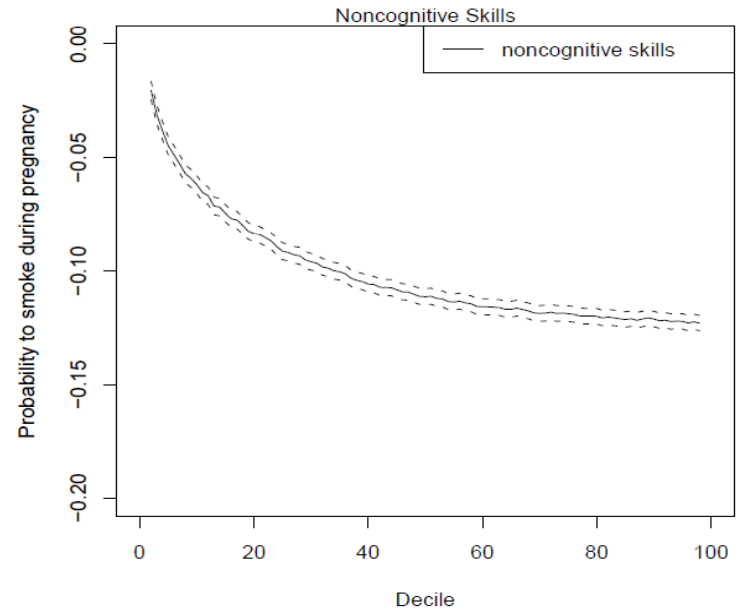
The channels



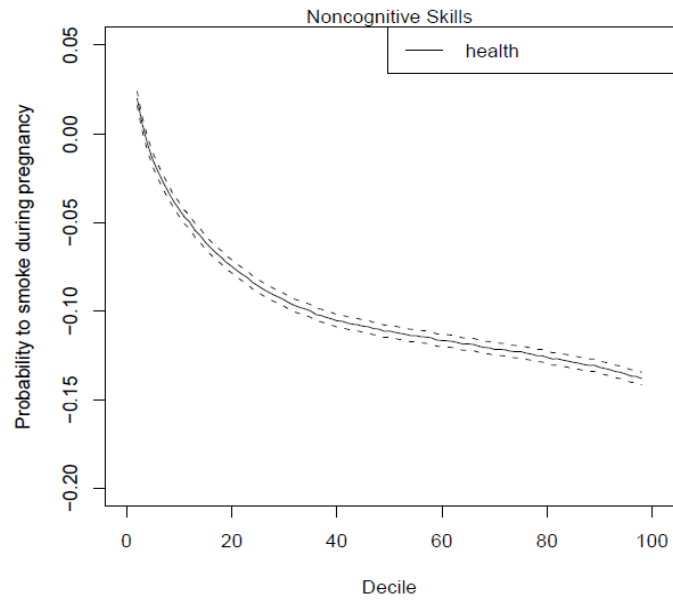
Heterogenous ATE of education on the probability to smoke



Heterogenous ATE of education on the probability to smoke

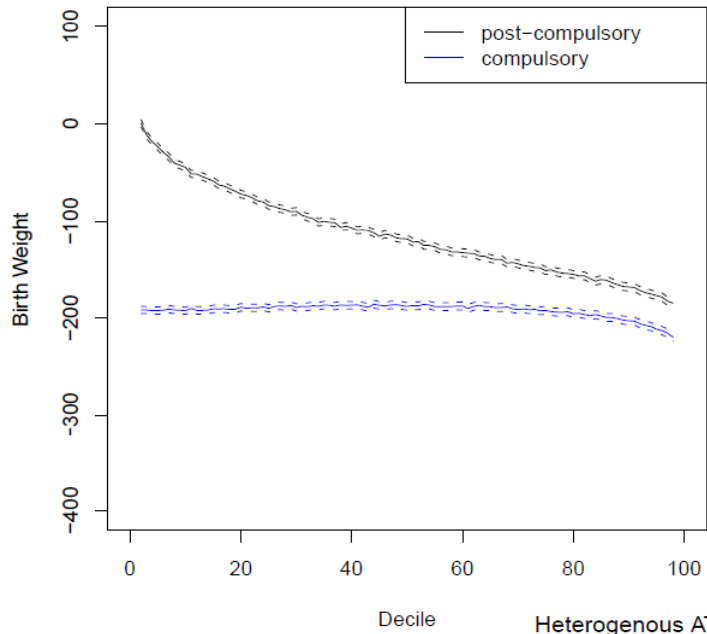


Heterogenous ATE of education on the probability to smoke

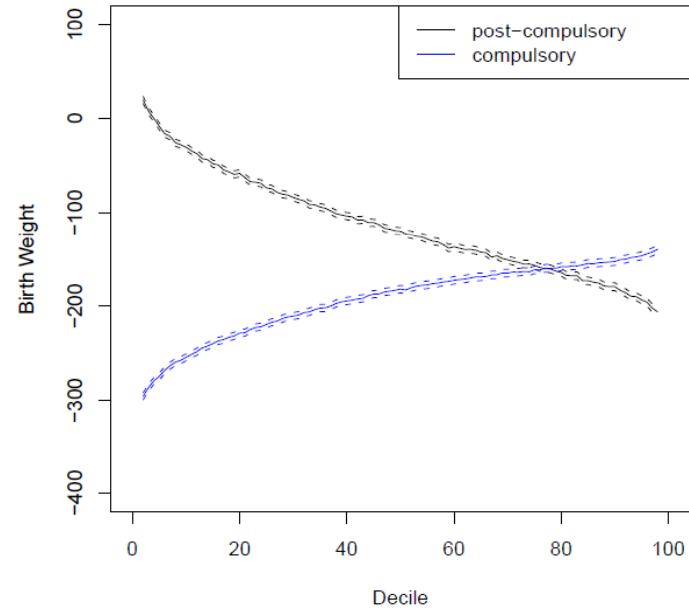


Human Capital Complementarity

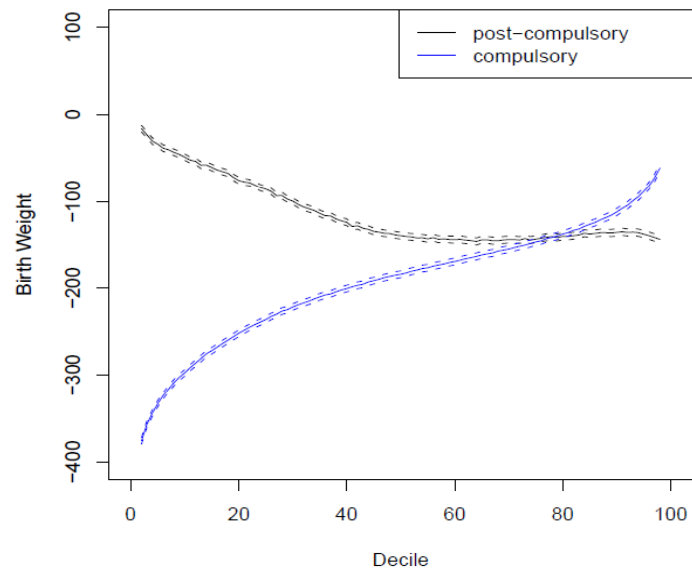
Heterogenous ATE of smoking on birth weight by education, cognitive



Heterogenous ATE of smoking on BW by education, noncognitive

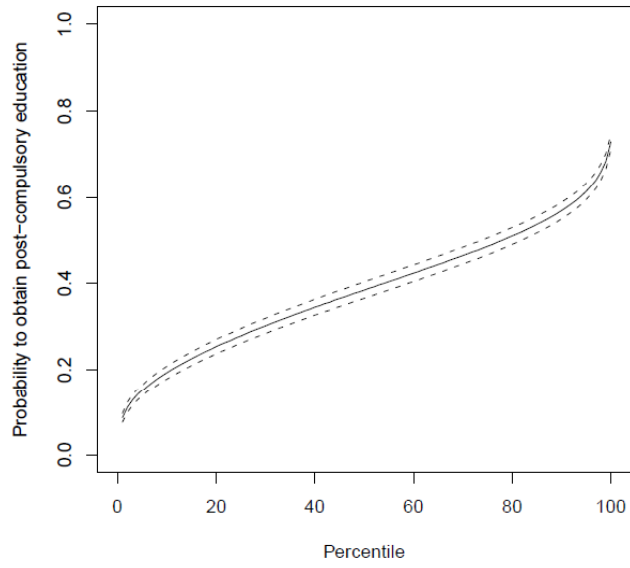


Heterogenous ATE of smoking on BW by education, health

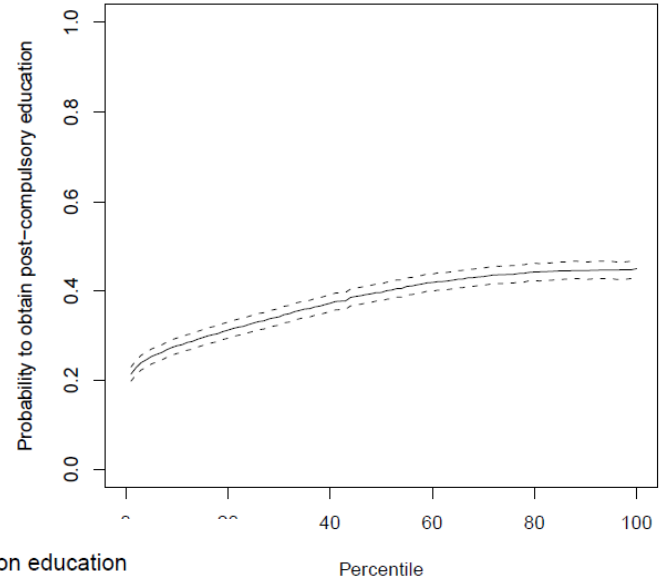


Effect of skills on choices

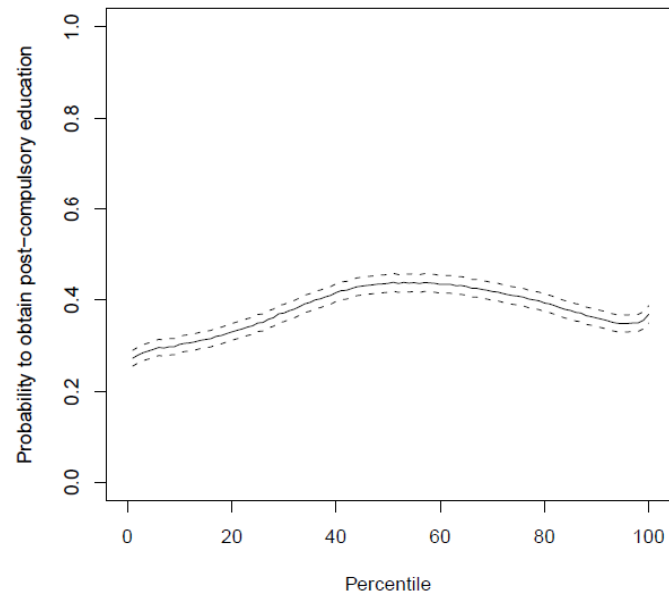
The effect of cognitive skills on education



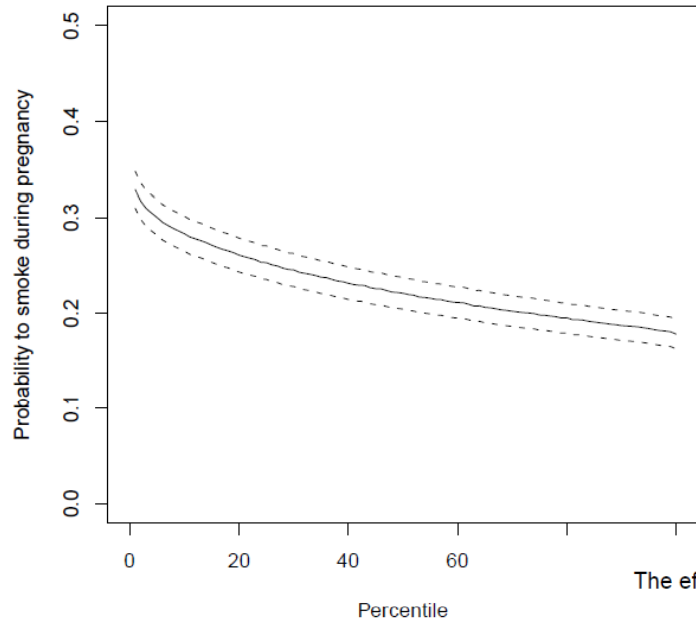
The effect of noncognitive skills on education



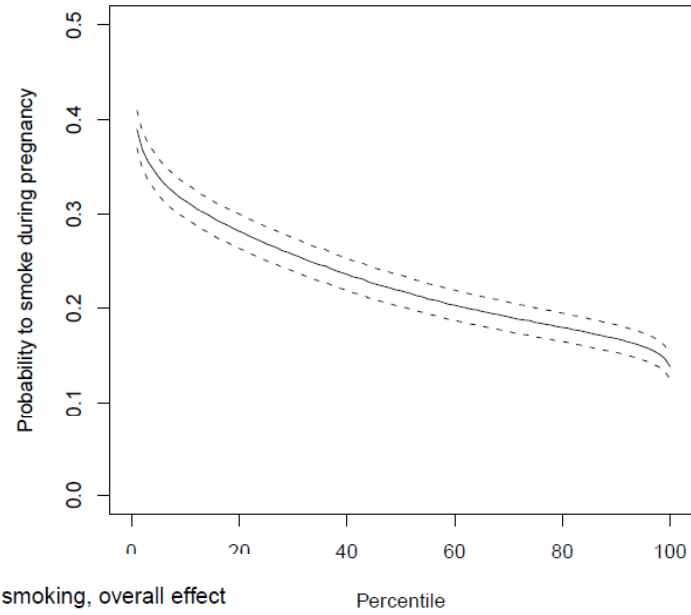
The effect of health on education



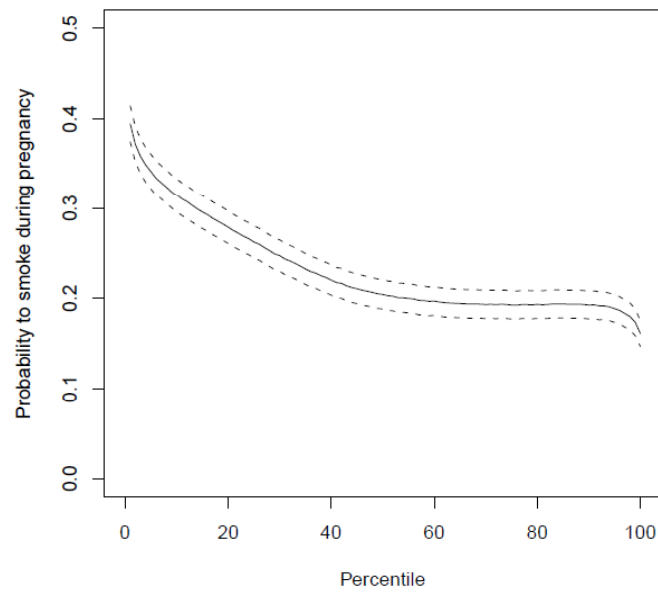
The effect of cognitive skills on smoking, overall effect



The effect of noncognitive skills on smoking, overall effect

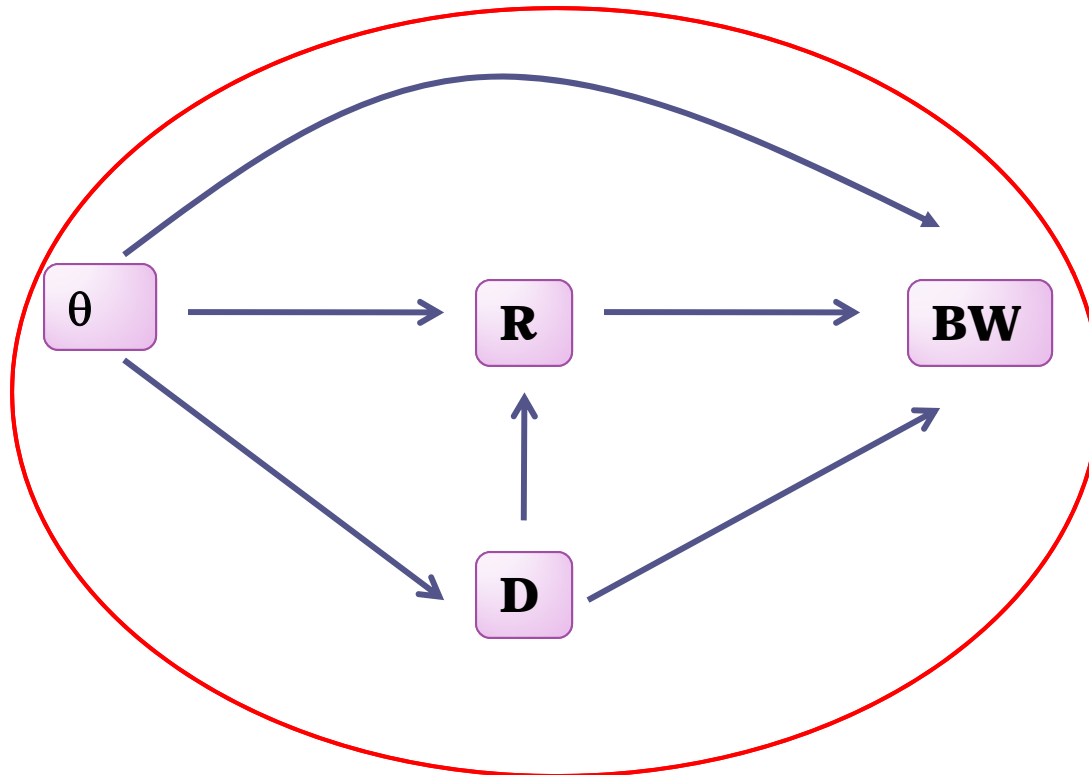


The effect of health on smoking, overall effect

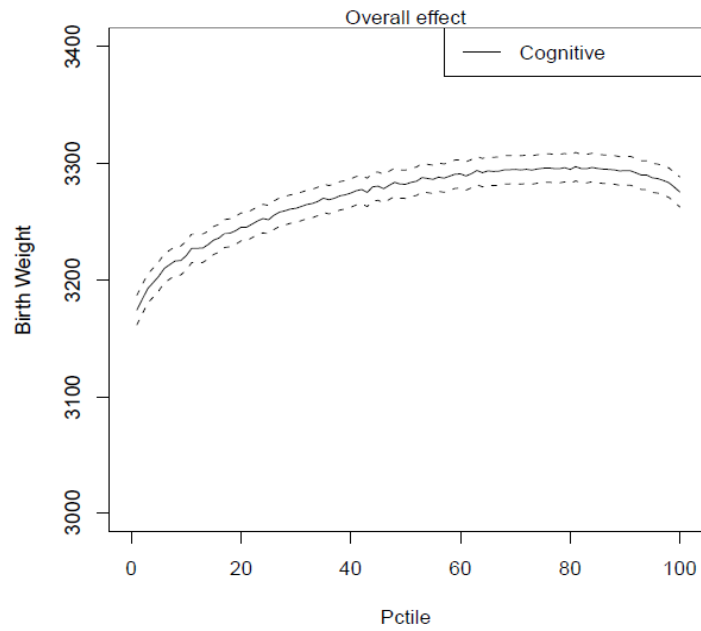


Overall effect of skills on birth weight

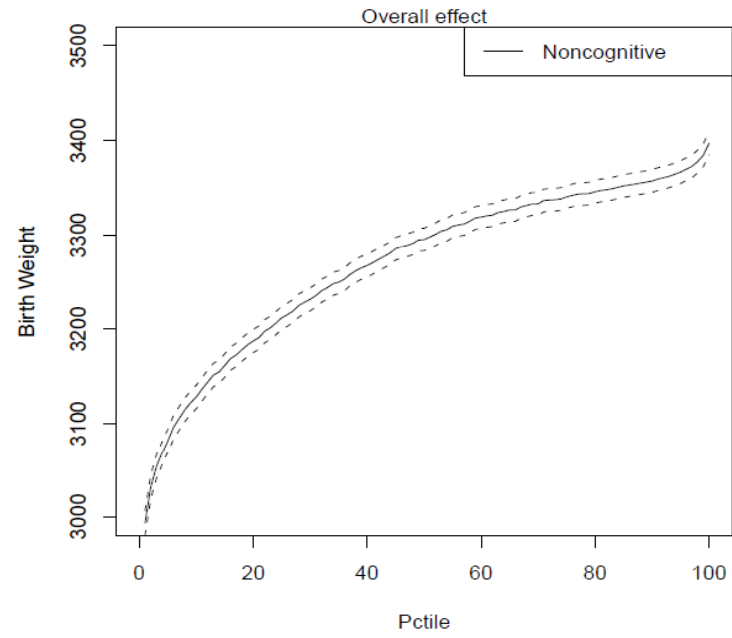
The channels



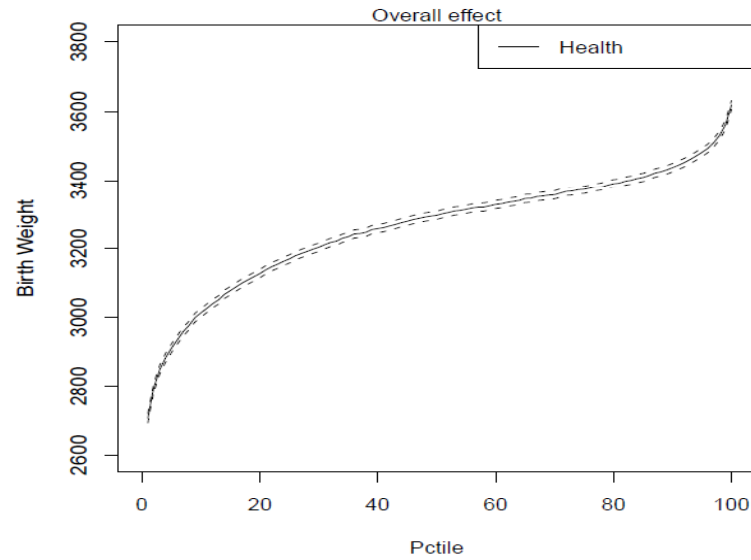
The effect of cognitive skills on birth weight



The effect of non-cognitive skills on birth weight

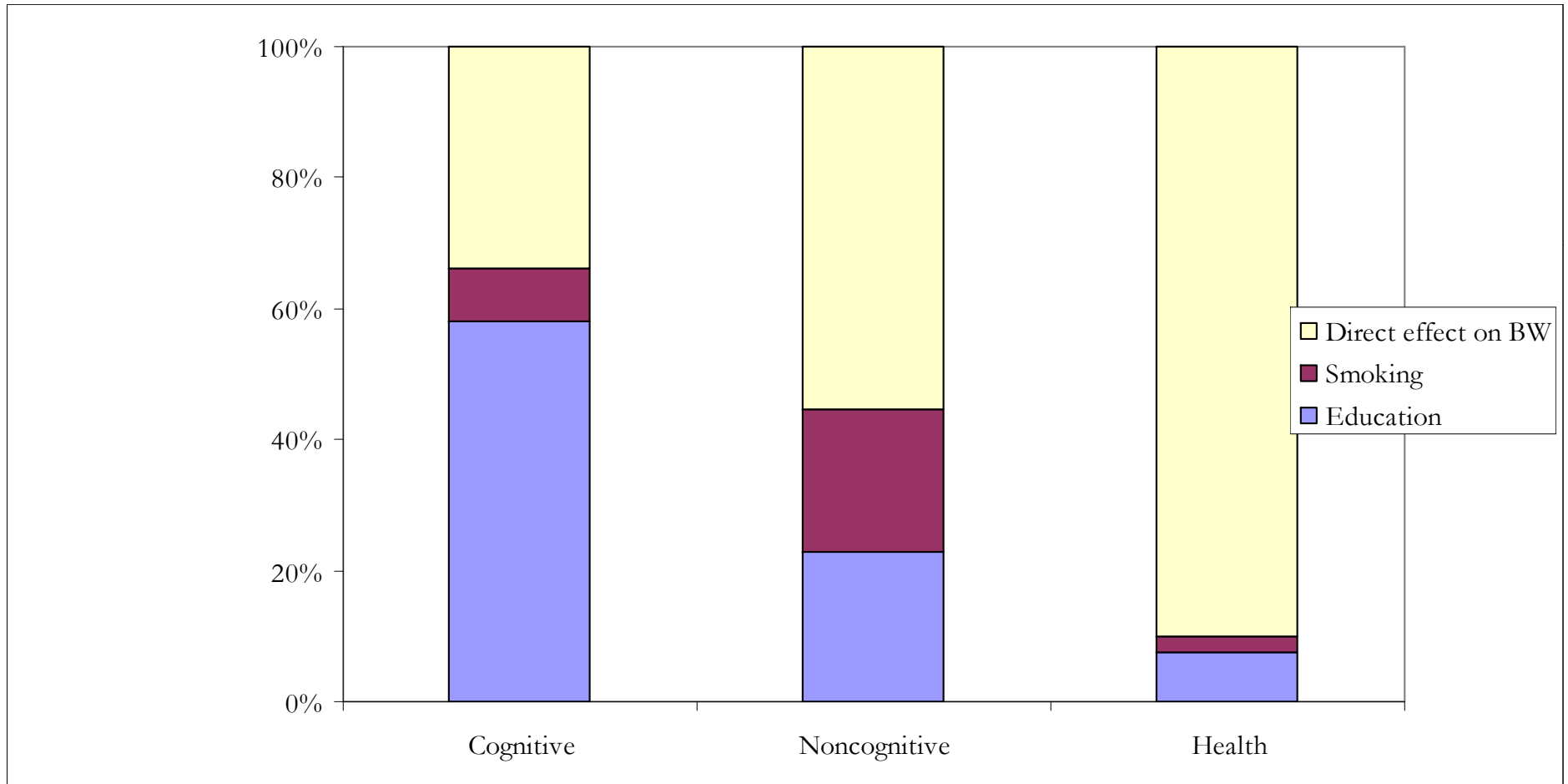


The effect of non-cognitive skills on birth weight



Decomposition

How much of the skill effect on birth weight passes through smoking/education?



Conclusions

- Analysis of the channels of the intergenerational transmission of inequality.
- Evidence of a causal effect of smoking on birthweight – and of treatment effect heterogeneity.
- No evidence of a causal effect of education on birthweight – some evidence of treatment effect heterogeneity.
- Maternal skills have a significant effect on birthweight, but the channels differ by skills.

Thank you!

Covariates

	Meas	Education	Pregnancy	Smoking	Outcomes
Sample size	3818	3818	3818	2852	2852
Constant	✓	✓	✓	✓	✓
Broken family (Maternal Age 7)	✓	✓	✓		
Household size (Maternal Age 7)	✓	✓	✓		
Mother first born	✓	✓	✓		
Grandmother (S=1)	✓	✓	✓		✓
Grandmother's age ^a	✓	✓	✓		
Grandmother reads to mother	✓	✓	✓		
Class/SES	✓	✓	✓	✓	✓
Mother catholic			✓		
Mother has no religion			✓		
Region: London	✓	✓	✓	✓	✓
Region: Wales	✓	✓	✓	✓	✓
Region: Scotland	✓	✓	✓	✓	✓
Claimant Counts		✓			
% of smoking in region				✓	
Child sex					✓

Decomposition

How much of the skill effect on birth weight passes through smoking/education?

- Define

$$E[BW|\theta^{99}] - E[BW|\theta^1] = \Delta E[BW]$$

$$\begin{aligned} \Delta E[BW|\theta] = & \Delta p(d=1) * [E[BW|d=1, \theta^h]] + \\ & \Delta p(d=0) * [E[BW|d=0, \theta^h]] + \\ & p(d=0|\theta) * [\Delta p(r=1|d=0) * E[BW|r=1, d=0] + \\ & \Delta p(r=0|d=0) * E[BW|r=0, d=0]] + \\ & p(d=1|\theta) * [\Delta p(r=1|d=1) * E[BW|r=1, d=1] + \\ & \Delta p(r=0|d=1) * E[BW|r=0, d=1]] + \\ & p(d=0|\theta) * [p(r=1|d=0, \theta^l) * \Delta E[BW|r=1, d=0] + \\ & p(r=0|d=0, \theta^l) * \Delta E[BW|r=0, d=0]] + \\ & p(d=1|\theta) * [p(r=1|d=1, \theta^l) * \Delta E[BW|r=1, d=1] + \\ & p(r=0|d=1, \theta^l) * \Delta E[BW|r=0, d=1]] \end{aligned}$$