The Effect of Maternal Labor Supply on Children: Evidence from Bunching

Carolina Caetano, Gregorio Caetano,
Eric Nielsen and Viviane Sanfelice

UGA/Fed Board/Temple Univ.

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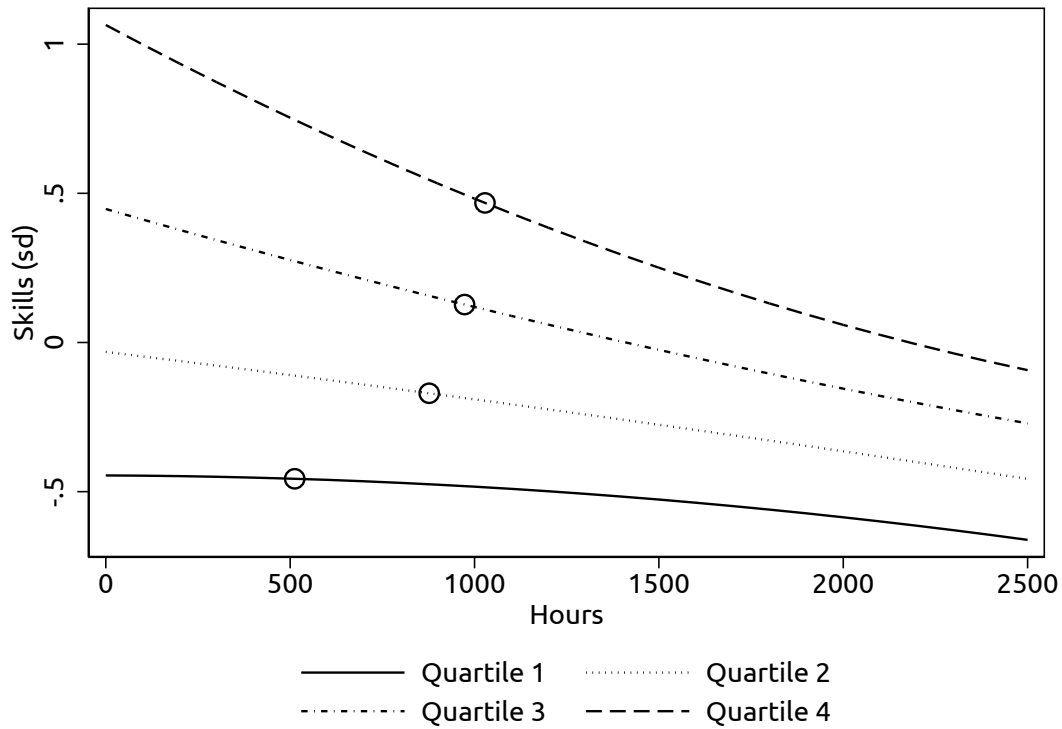
Motivation

- Maternal labor supply has increased in recent decades (Eckstein and Lifschitz 2011, Fogli and Veldkamp 2011).
- Quality parent-child interactions known to be important for child development (e.g. Todd and Wolpin 2007).
- Effect of maternal labor supply on children's skills in the short-run
  1. time channel: more time at work $\Longrightarrow$ less time at home
  2. income channel: more time at work $\Longrightarrow$ more income
- Many policies affect maternal labor supply (family leave, paid childcare, child tax credits, etc.).
- Many other reasons for work-promoting policies.

This paper

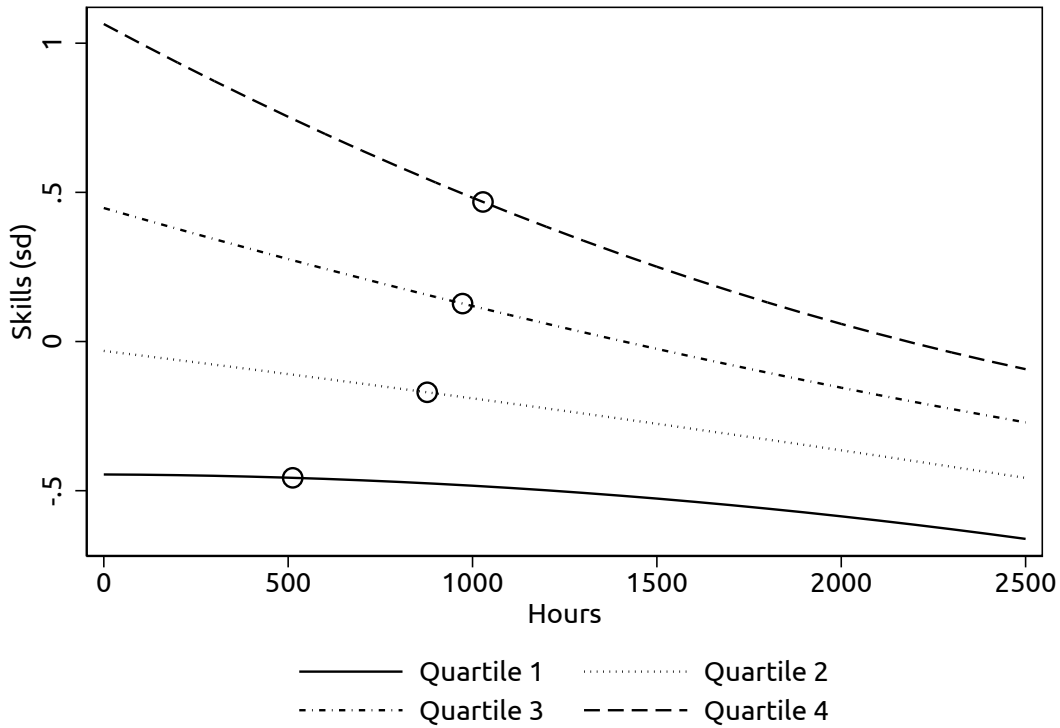
- Effect of mothers working hours during first 3 years of child's life on child's skill around age 6.
- A new approach to deal with endogeneity in this context (Caetano, Caetano and Nielsen 2021).
- We focus on heterogeneous effects:
  - By the skill of the mother.
  - By the quantity of her labor supply.

Preview of Results: By quartile of mother AFQT



- Effect tends to be negative for children's cognitive skills in the short-run.
- Less negative in the case of low-skilled mothers, except those who work long hours.

Preview of Results: By quartile of mother AFQT



- Why are higher skilled mothers' labor supply so detrimental for children's skills in the short-run?
  - ~~Because last hour is more costly for those working longer hours.~~
  - Money is not enough to compensate in the short-run for their high-skilled interaction with the child.

A third source of heterogeneity: By pre-birth wage rate

- Think of two high-skilled mothers, one with an economics major, another with a language major.
- Try to vary income holding quality of home interaction constant. The job-related skills that separate them are well valued in the job market, but not as much in the interaction with a 0-3 year old.
- Money helps, but is not enough: Even the high-skilled, high-paid mother cannot fully compensate for her absence with money.
- We interpret that giving flexibility to mothers to work from home is likely a better policy than giving financial incentives to work.

Literature

- NLSY79/CNLSY. Effect of working hours while child is 0-3 on child's early outcomes.
  - Negative effects:

    Ruhm 2004, Bernal 2008, Desai et al. 1989, Baydar and Brooks-Gunn 1991, Hill and O'Neill 1994, Baum 2003
  - Zero effects:

    James-Burdumy 2005, Parcel and Menaghan 1994, Blau et al. 1992, Waldfogel et al. 2002
  - Positive effects:

    Vandell and Ramanan 1992 (low-income families)
- More recent literature: focus on time-money trade-off
  - Negative net effects:

    Agostinelli and Sorrenti (2021): NLSY79/CNLSY. Effect of working hours while child is 4-16 on contemporaneous child outcome.
  - Zero net effects:

    Nicoletti, Salvanes and Tominey (2022): Norwegian data. Effect of working hours while child is 0-5 on outcome when child is 11-15.

Data

NLSY79 (Mothers)

- AFQT, education, marital status, age at birth, hh income
- average hours worked over three years following birth
- exclude three months immediately after birth (maternity leave)
- family structure

CNLSY (Children)

- race/ethnicity, sex
- cognitive skills – iterated principal factor analysis applied to PIAT math and reading scores, administered around age 6

Final sample consists of 6,924 mother-child pairs.

Basic set up (no controls)

$$S = \alpha + \beta L + \delta L^* + \epsilon$$

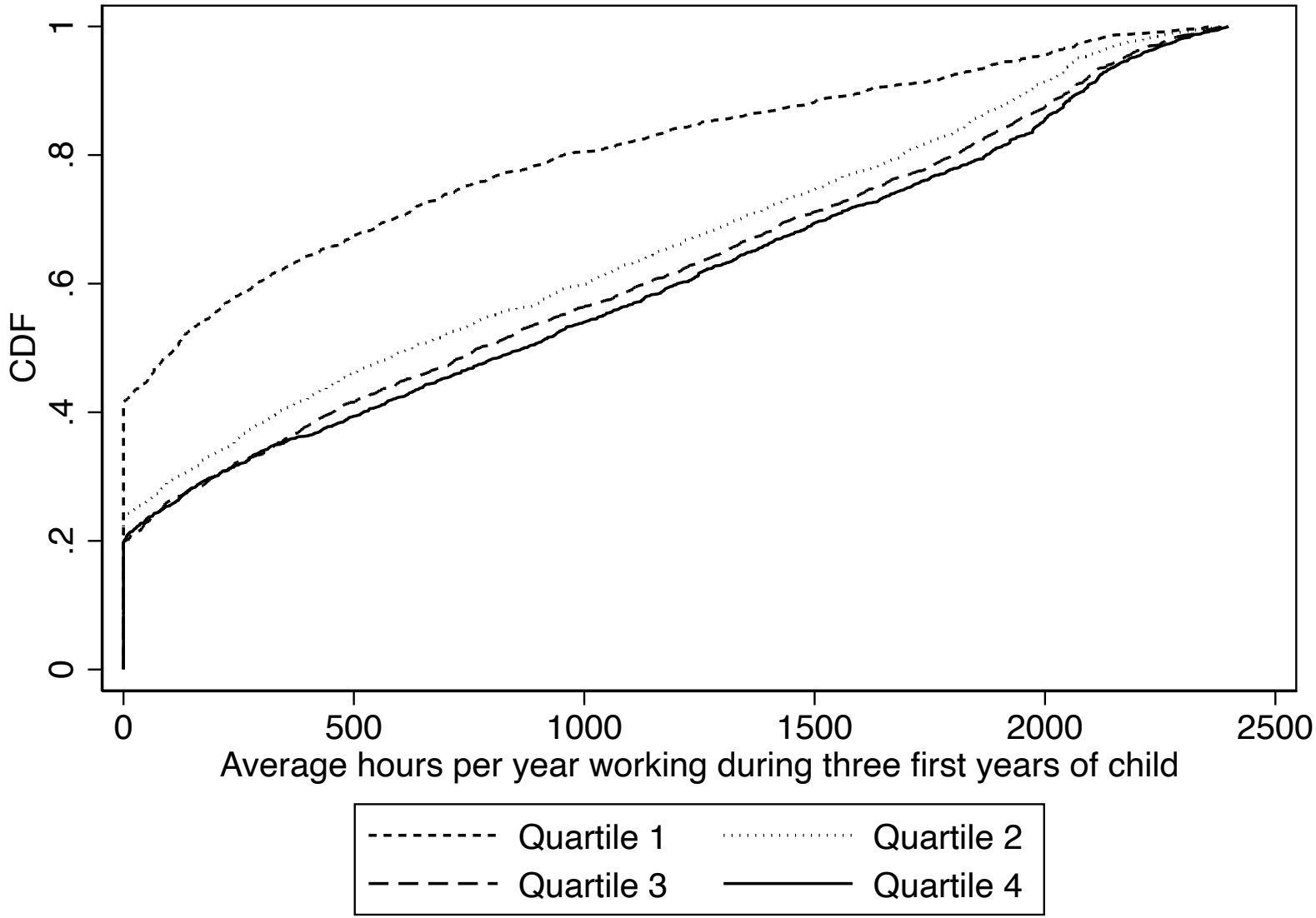
What is the effect of increasing hours from $L = l_0$ to $L = l_1$?

$$\underbrace{\mathbb{E}[S|L = l_1, L^* = l_1] - \mathbb{E}[S|L = l_0, L^* = l_0]}_{\text{what we observe}} =$$

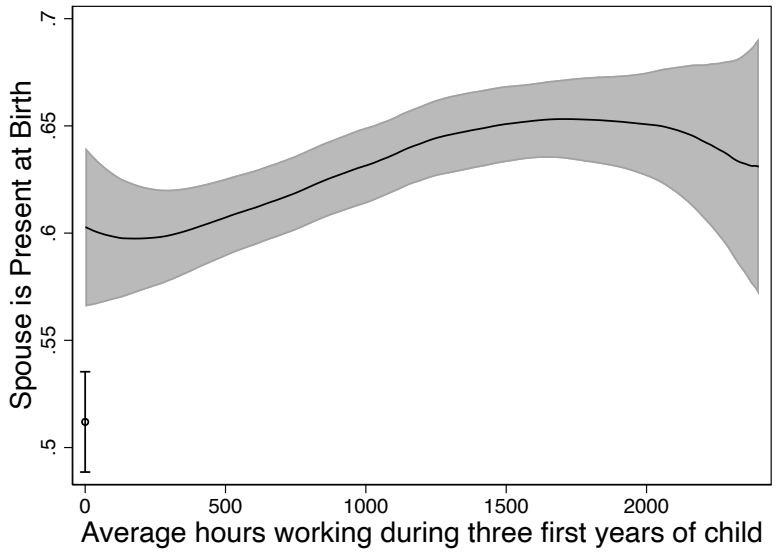
$$\underbrace{\mathbb{E}[S|L = l_1, L^* = l_1] - \mathbb{E}[S|L = l_0, L^* = l_1]}_{\text{marginal treatment effect}} +$$

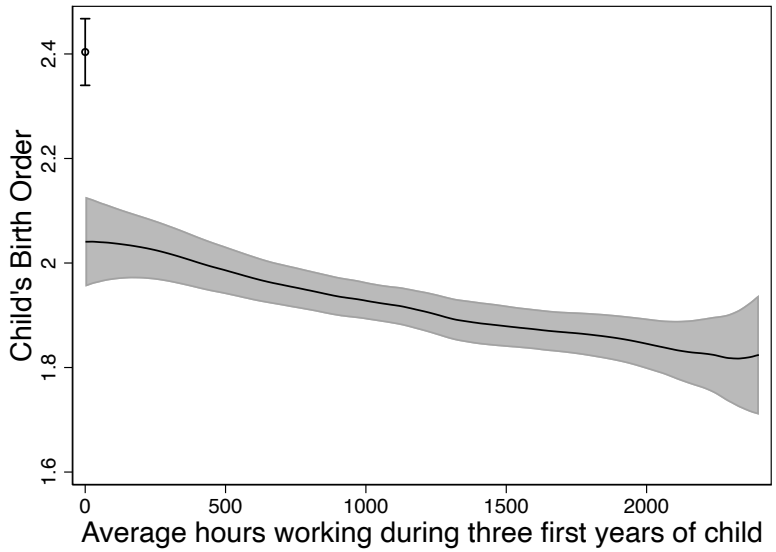
$$\underbrace{\mathbb{E}[S|L = l_0, L^* = l_1] - \mathbb{E}[S|L = l_0, L^* = l_0]}_{\text{selection bias}}$$

Bunching of Labor Supply by Quartile of AFQT score

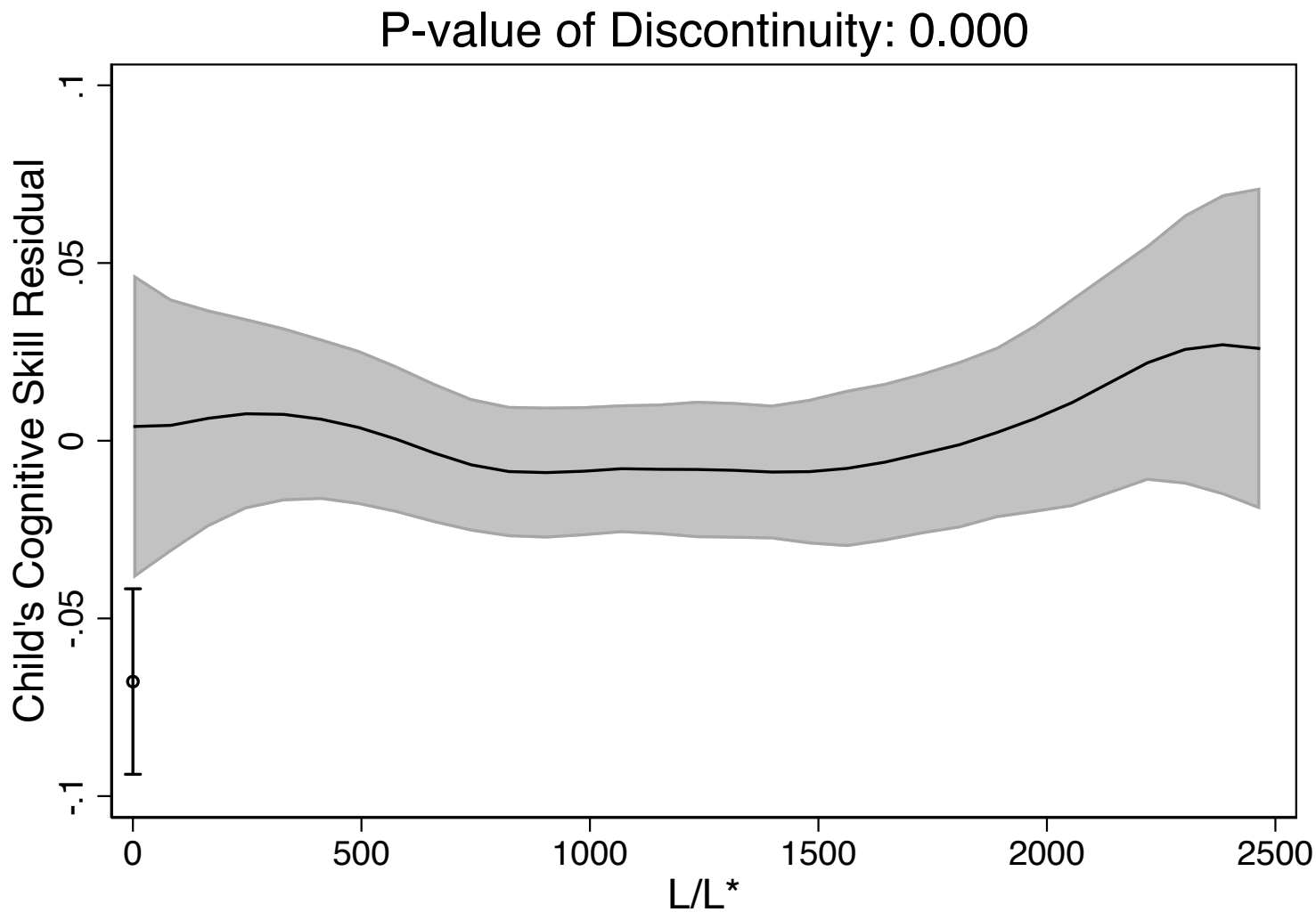


Selective Bunching





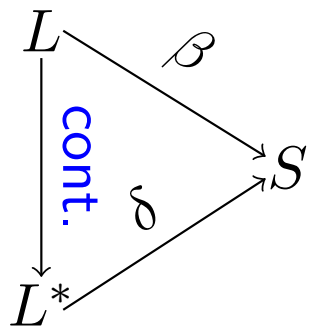
Are observed controls enough?

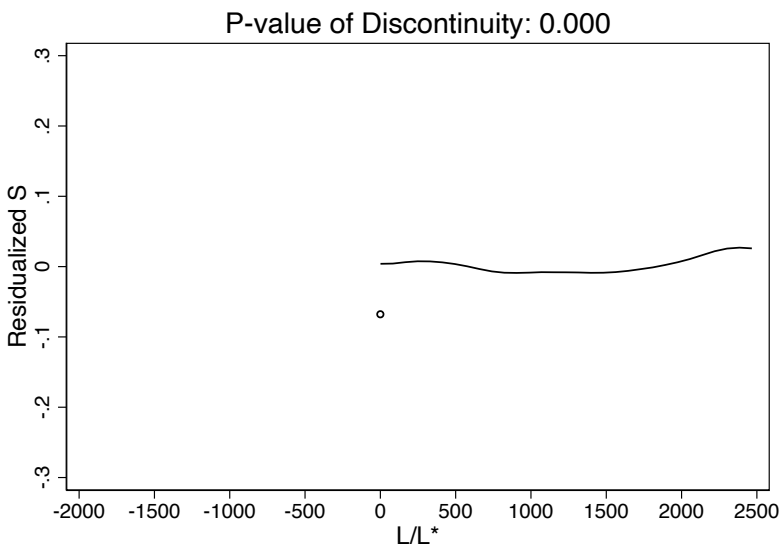


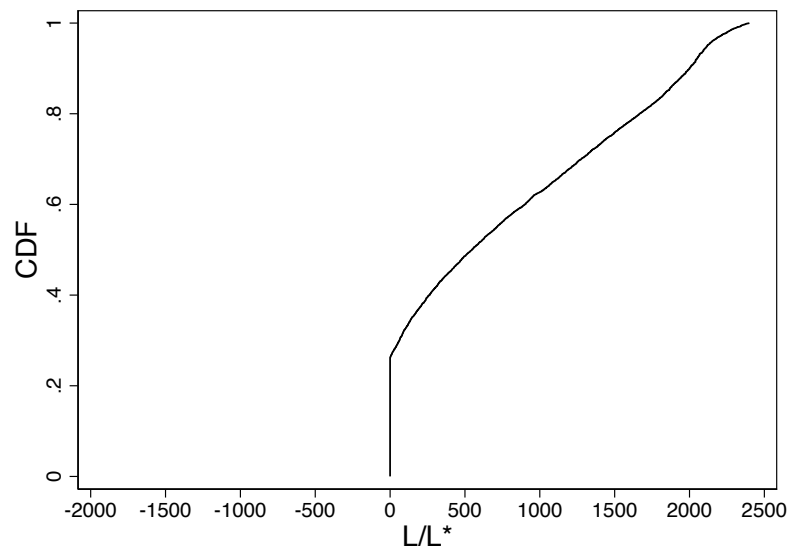
Intuition

▸ RDD ▸ Linearity ▸ Formal Model w/ Covariates

$$S = \alpha + \beta L + \delta L^* + \epsilon, \qquad L = \max\{0, L^*\}$$







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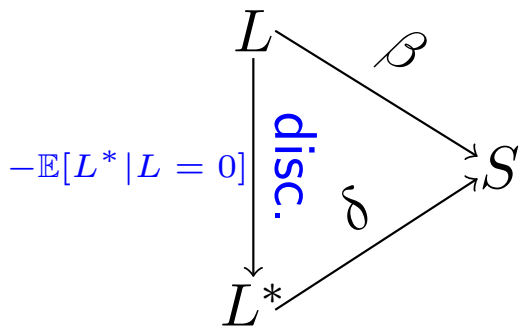

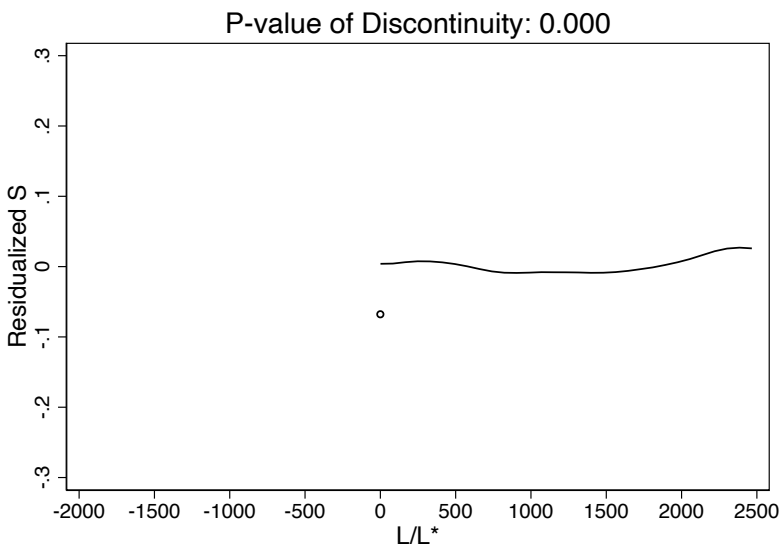

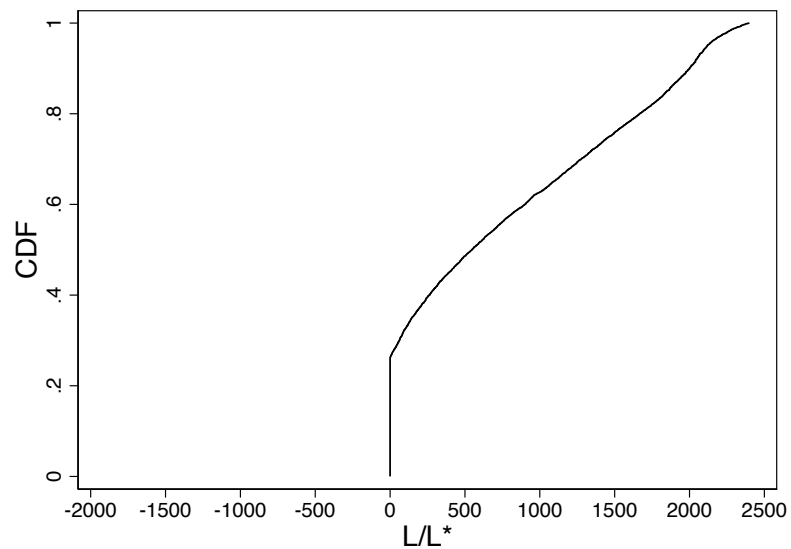

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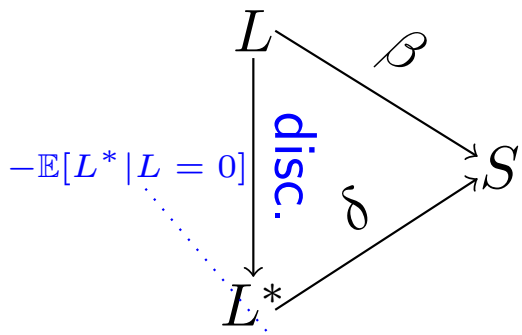

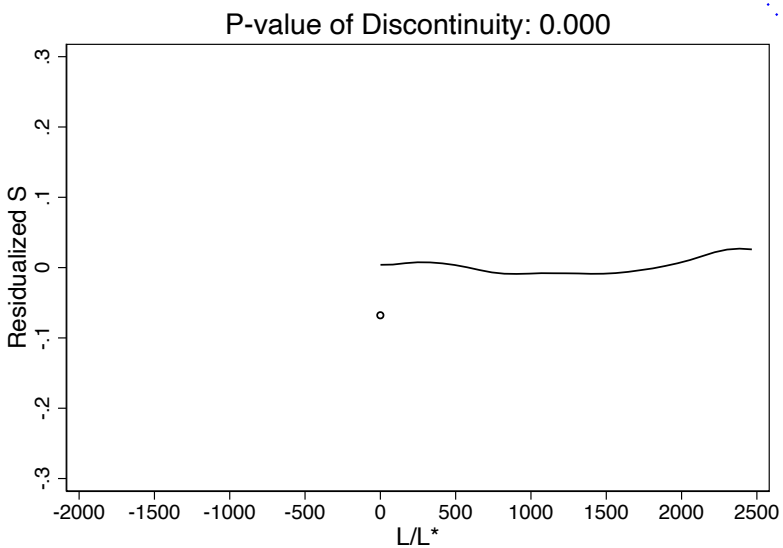

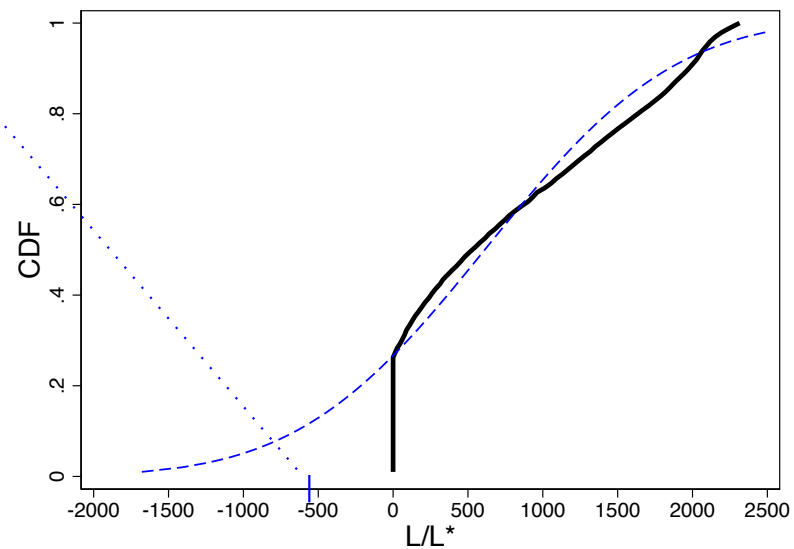

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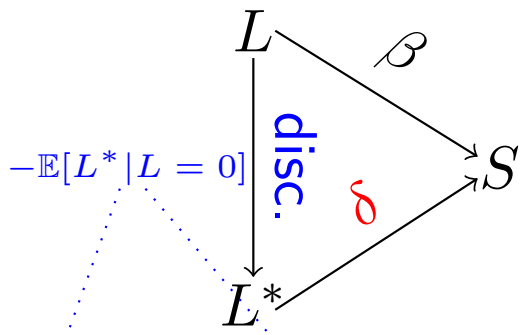

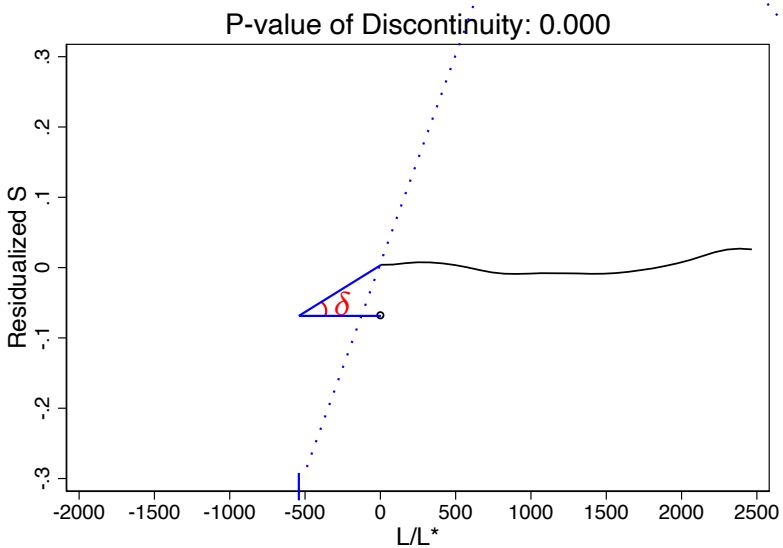

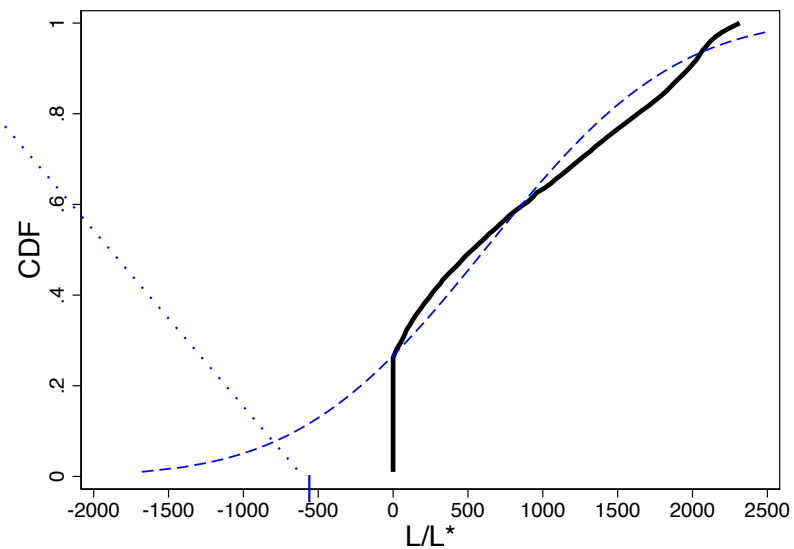

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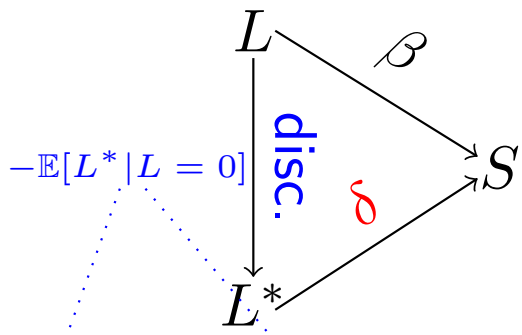

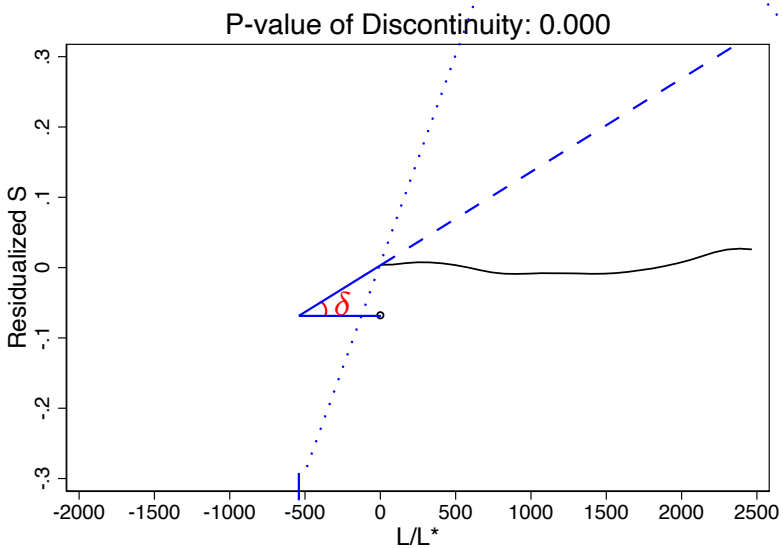

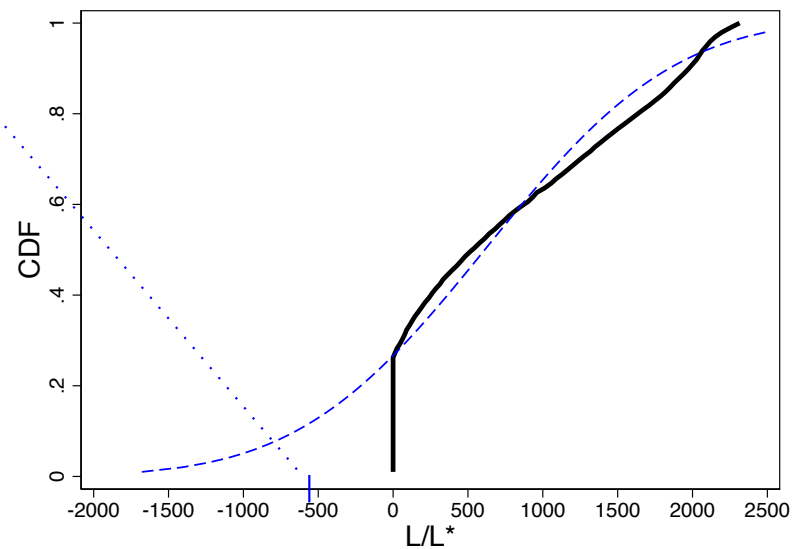

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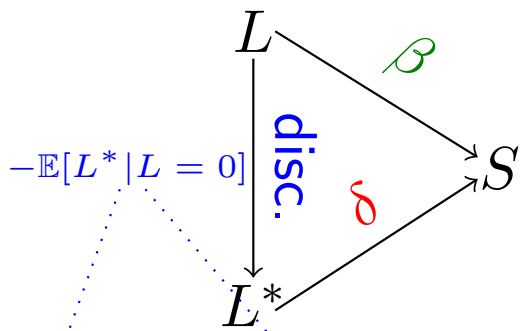

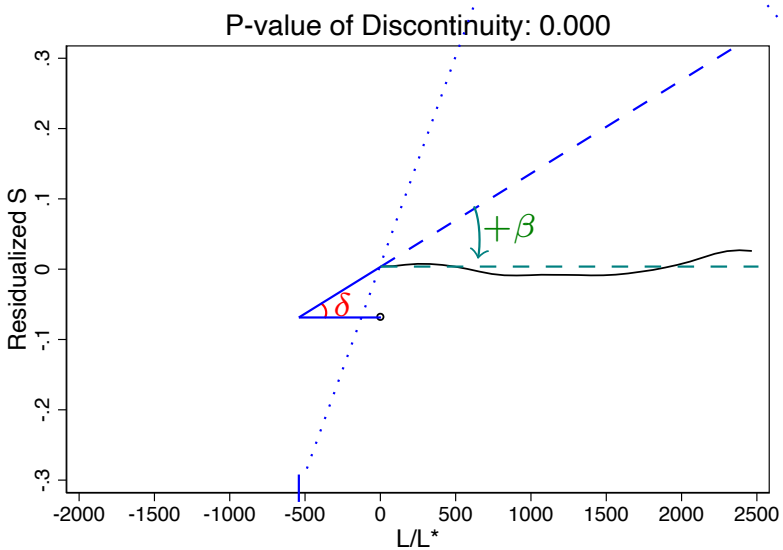

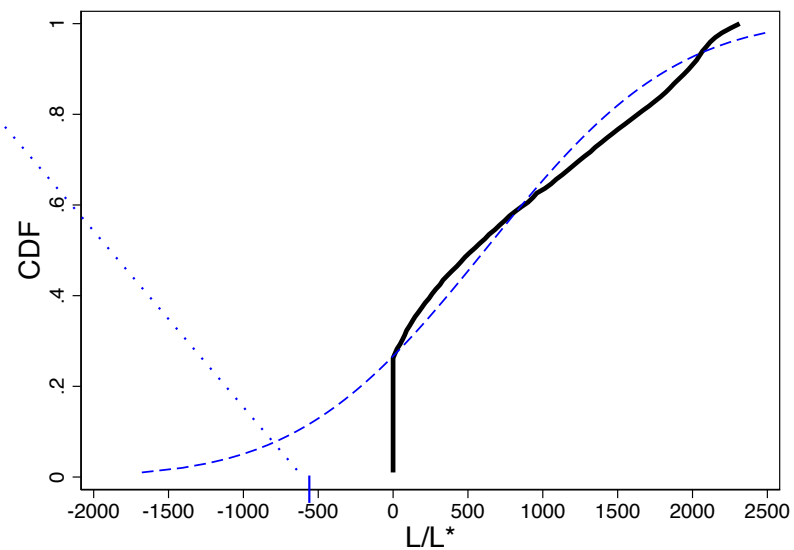

$$S = \beta L + g(X) + \delta\eta + \varepsilon, \quad \eta = L^* - h(X)$$

	(i) No Controls	(ii) Controls	(iii) Het. Tobit	(iv) Het. Uniform	(v) Het. Symmetric
β	0.014**	0.000	-0.016**	-0.019**	**-0.019****
	(0.001)	(0.001)	(0.005)	(0.006)	**(0.005)**
δ			0.014**	0.017**	**0.017****
			(0.004)	(0.005)	**(0.005)**

Note: This table shows estimates of the effect of an additional 100 hours per year working in the three years following the child's birth on the child's early cognitive skills. N=6,924. Bootstrapped standard errors in parentheses (1,000 bootstrap samples). ** $p<0.05$, * $p<0.1$.

Heterogeneity by Maternal Skill and Hours

$$S = \beta(L, X) + g(X) + \delta(X)\eta + \varepsilon$$

$A =$ AFQT score of the mother

$$\beta(L, X) = \beta L + \beta_A AL + \beta_L L^2 + \beta_{AL} AL^2$$

$$\delta(X) = \delta + \delta_A A$$

Heterogeneity by Maternal Skill and Hours

	(i) No Controls	(ii) Controls	(iii) Het. Tobit	(iv) Het. Uniform	(v) Het. Symmetric
β	0.018**	0.003	-0.023**	-0.026**	**-0.030****
	(0.004)	(0.003)	(0.008)	(0.010)	**(0.009)**
β_A	0.047**	-0.010**	-0.017**	-0.021**	**-0.026****
	(0.003)	(0.004)	(0.008)	(0.009)	**(0.009)**
β_L ($\times$1000)	-0.004**	-0.001	0.002	0.001	**0.002**
	(0.002)	(0.001)	(0.002)	(0.002)	**(0.002)**
β_{AL} ($\times$1000)	-0.015**	0.003**	0.004**	0.004**	**0.004****
	(0.001)	(0.002)	(0.002)	(0.002)	**(0.002)**
δ			0.016**	0.022**	**0.023****
			(0.005)	(0.007)	**(0.006)**
δ_A			0.005	0.009	**0.013****
			(0.005)	(0.006)	**(0.006)**

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β_L ($\times$1000)	-0.004**	-0.001	0.002	0.001	**0.002**
	(0.002)	(0.001)	(0.002)	(0.002)	**(0.002)**
β_{AL} ($\times$1000)	-0.015**	0.003**	0.004**	0.004**	**0.004****
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δ			0.016**	0.022**	**0.023****
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β_A	0.047**	-0.010**	-0.017**	-0.021**	**-0.026****
	(0.003)	(0.004)	(0.008)	(0.009)	**(0.009)**
β_L ($\times$1000)	-0.004**	-0.001	0.002	0.001	**0.002**
	(0.002)	(0.001)	(0.002)	(0.002)	**(0.002)**
β_{AL} ($\times$1000)	-0.015**	0.003**	0.004**	0.004**	**0.004****
	(0.001)	(0.002)	(0.002)	(0.002)	**(0.002)**
δ			0.016**	0.022**	**0.023****
			(0.005)	(0.007)	**(0.006)**
δ_A			0.005	0.009	**0.013****
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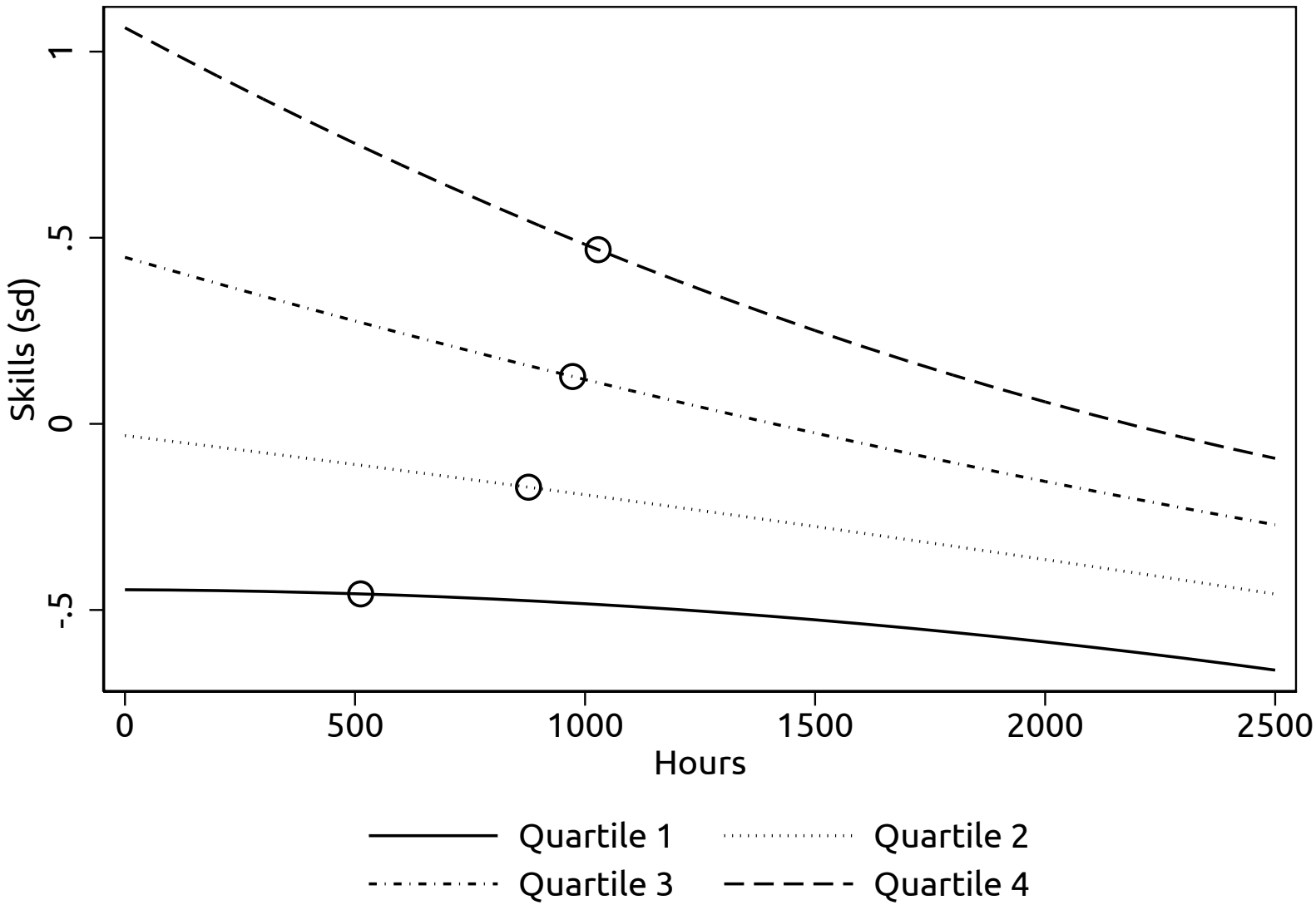
Visualizing the Heterogeneous Effects



Further Heterogeneity: by Wage

$$S = \beta(L, X) + g(X) + \delta(X)\eta + \varepsilon$$

$A =$ AFQT score, $W =$ Pre-birth wage

$$\beta(L, X) = \beta L + \beta_A A L + \beta_W W L + \beta_L L^2 + \beta_{AL} A L^2 + \beta_{WL} W L^2$$

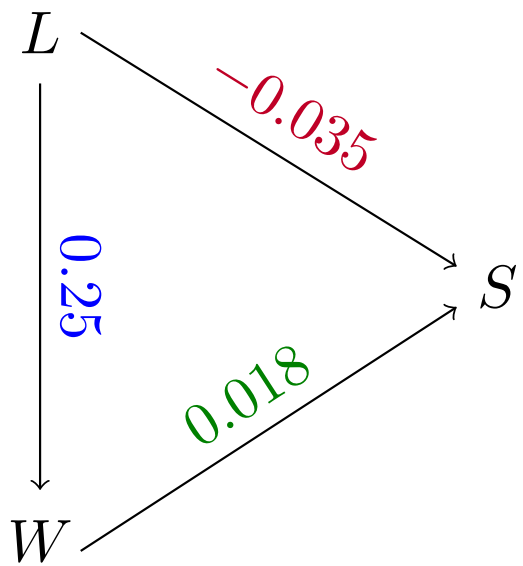
$$\delta(X) = \delta + \delta_A A + \delta_W W$$

Heterogeneity by Maternal Skill, Wages, and Hours

	(i) No Controls	(ii) Controls	(iii) Het. Tobit	(iv) Het. Uniform	(v) Het. Symmetric
β	-0.004	-0.002	-0.009	-0.013	**-0.017**
	(0.005)	(0.004)	(0.014)	(0.026)	**(0.017)**
β_A	0.039**	-0.016**	-0.027**	-0.047**	**-0.035****
	(0.004)	(0.004)	(0.014)	(0.023)	**(0.017)**
β_W	0.007*	0.001	0.014	0.029	**0.018**
	(0.004)	(0.005)	(0.016)	(0.026)	**(0.019)**
β_L ($\times$1000)	0.002	0.001	0.001	0.001	**0.001**
	(0.002)	(0.002)	(0.002)	(0.002)	**(0.002)**
β_{AL} ($\times$1000)	-0.012**	0.005**	0.006**	0.007**	**0.007****
	(0.002)	(0.002)	(0.002)	(0.002)	**(0.002)**
β_{WL} ($\times$1000)	-0.002	0.001	-0.000	-0.001	**-0.000**
	(0.002)	(0.002)	(0.002)	(0.002)	**(0.002)**
δ			0.006	0.010	**0.013**
			(0.010)	(0.022)	**(0.013)**
δ_A			0.008	0.027	**0.015**
			(0.009)	(0.020)	**(0.013)**
δ_W			-0.009	-0.024	**-0.014**
			(0.010)	(0.021)	**(0.014)**

Back-of-the-envelope calculation

Compare the marginal effect of L for two mothers: $A = 1$ and $A = 0$:



$$\beta(A=1) - \beta(A=0) = \underbrace{-0.035}_{\text{OC of time}} + \Big(\underbrace{0.25}_{\text{Return to } A} \times \underbrace{0.018}_{\text{Money}} \Big) = -0.031$$

Conclusion

- Effect of mother working in the first 3 years of the child on child's cognitive skills around age 6: negative on average, very negative for high-skilled mothers.
  - Last hour of work is more costly the longer the mother works?
    No – effects are close to linear and maybe convex for high-skilled mothers.
  - Incremental earnings insufficient to offset direct time effect?
    Yes, even for high-skilled high-wage mothers. Estimates are too noisy though.
- What work-promoting policies would avoid negative effects on children's skills?
  - For low-skilled mothers: no negative effects unless mother works close to full time.
  - Increasing financial rewards to working would likely be ineffective.
  - Flexible work arrangements seem the best bet for higher-skilled mothers.
  - Flexible work for partners may be complementary.

In the paper but not in the presentation

- Formal Discussion of Identification Strategy ▸ Details
- Relation to RDD ▸ Details
- Detailed Sensitivity Analysis ▸ Details

Thanks!

Adding Covariates

Back

$$S = \beta(L, X) + g(X) + \epsilon, \quad \mathbb{E}[\epsilon|L, X] \neq 0$$

Adding Covariates

Back

$$S = \beta(L, X) + g(X) + \overbrace{\delta(X)\eta + \varepsilon}^{\epsilon}, \quad \mathbb{E}[\varepsilon | L, X, \eta] = 0$$

Adding Covariates

Back

$$S = \beta(L, X) + g(X) + \overbrace{\delta(X)\eta + \varepsilon}^{\epsilon}, \quad \mathbb{E}[\varepsilon | L, X, \eta] = 0$$

$$L^* = h(X) + \eta$$

$$L = \max\{0, L^*\}$$

Adding Covariates

Back

$$S = \beta(L, X) + g(X) + \overbrace{\delta(X)\eta + \varepsilon}^{\epsilon}, \quad \mathbb{E}[\varepsilon | L, X, \eta] = 0$$

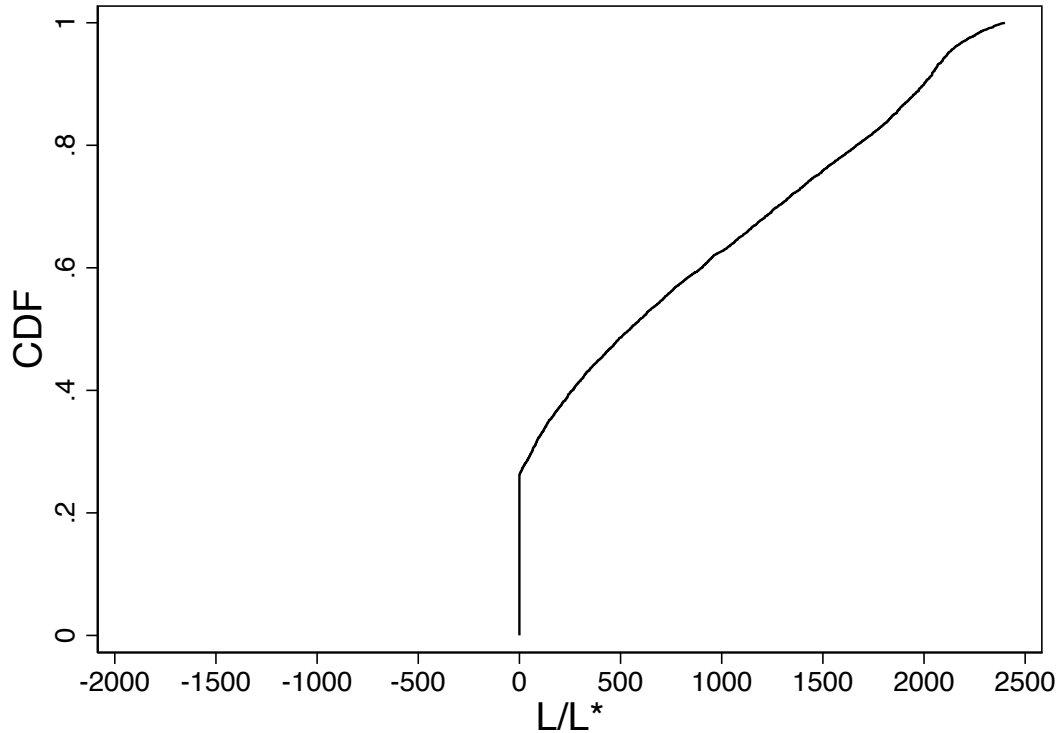
$$L^* = h(X) + \eta$$

$$L = \max\{0, L^*\}$$

$$\mathbb{E}[S|L, X] = \beta(L, X) + \underbrace{g(X) - \delta h(X)}_{m(X)} + \\ + \delta(X) \underbrace{[L + \mathbb{E}[L^*|L = 0, X]1(L = 0)]}_{\text{new regressor}}$$

$\mathbb{E}[L^*|L=0,X]$

▸ Test 1 ▸ Test 2 ▸ Test 3



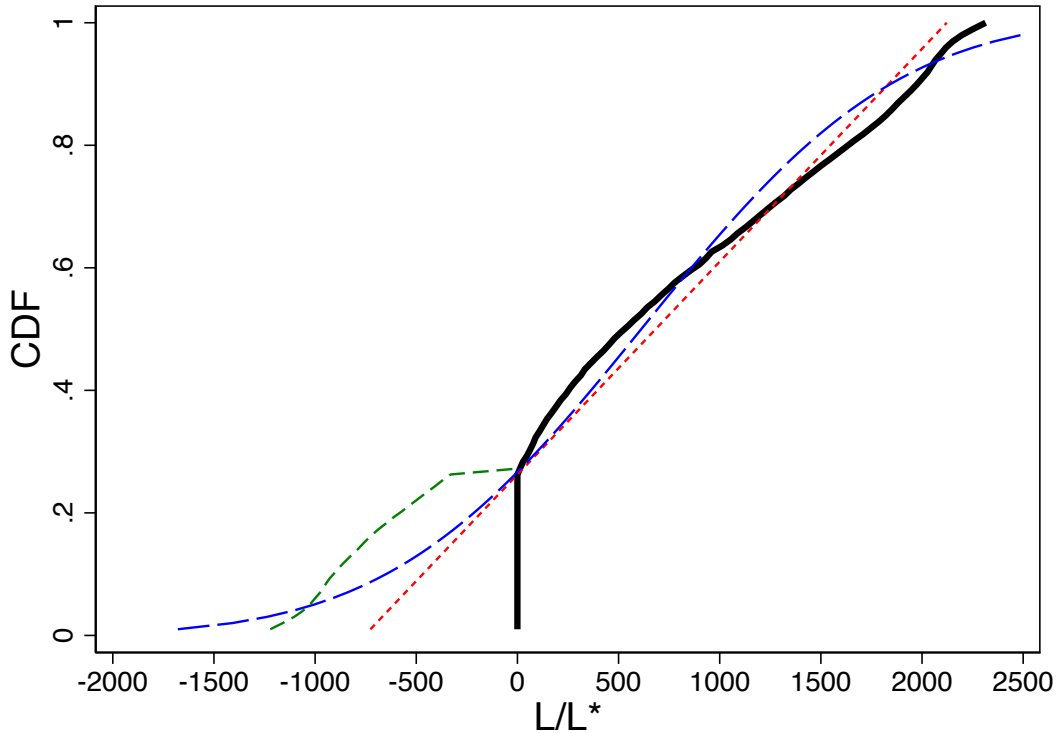
$$S = \beta(L,X) + g(X) + \delta(X)\eta + \varepsilon, \quad \mathbb{E}[\varepsilon|L,X,\eta] = 0$$

$$L^* = h(X) + \eta$$

$$\mathbb{E}[S|L,X] = \beta(L,X) + m(X) + \delta(X)\underbrace{[L + \mathbb{E}[L^*|L=0,X]1(L=0)]}_{\text{new regressor}}$$

$\mathbb{E}[L^*|L=0,X]$

▸ Test 1 ▸ Test 2 ▸ Test 3



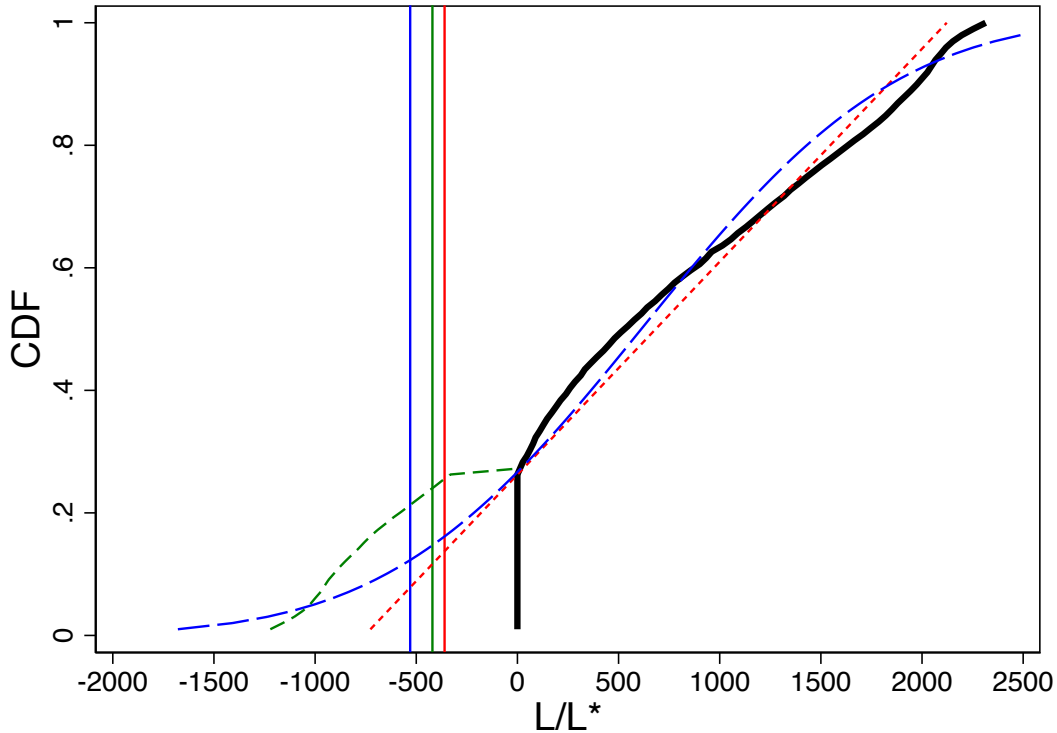
$$S = \beta(L,X) + g(X) + \delta(X)\eta + \varepsilon, \quad \mathbb{E}[\varepsilon|L,X,\eta] = 0$$

$$L^* = h(X) + \eta, \qquad \eta \sim \text{Normal}, \text{Uniform}, \text{ or Symmetric}$$

$$\mathbb{E}[S|L,X] = \beta(L,X) + m(X) + \delta(X)\underbrace{[L + \mathbb{E}[L^*|L=0,X]1(L=0)]}_{\text{new regressor}}$$

$\mathbb{E}[L^*|L=0,X]$

▸ Test 1 ▸ Test 2 ▸ Test 3



$$S = \beta(L,X) + g(X) + \delta(X)\eta + \varepsilon, \quad \mathbb{E}[\varepsilon|L,X,\eta] = 0$$

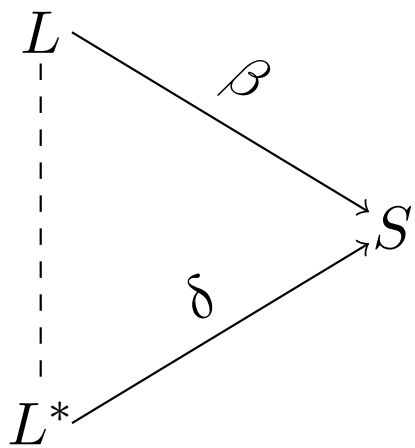
$$L^* = h(X) + \eta, \qquad \eta \sim \text{Normal, Uniform, or Symmetric}$$

$$\mathbb{E}[S|L,X] = \beta(L,X) + m(X) + \delta(X)\underbrace{[L + \mathbb{E}[L^*|L=0,X]1(L=0)]}_{\text{new regressor}}$$

Relation to RDD

Back

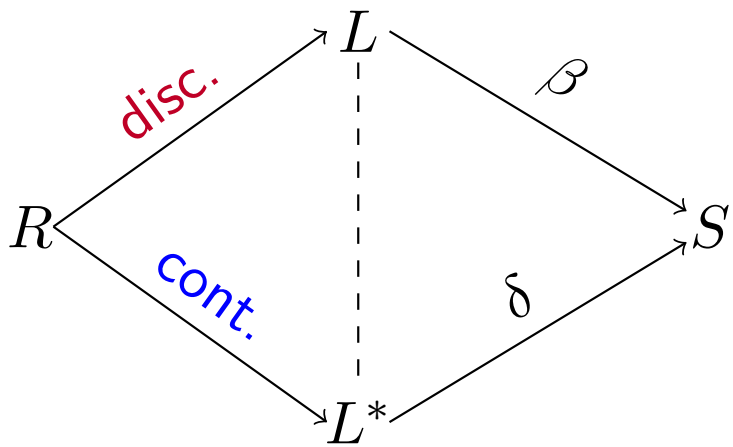
$$S = \alpha + \beta L + \delta L^* + \epsilon$$



Relation to RDD

Back

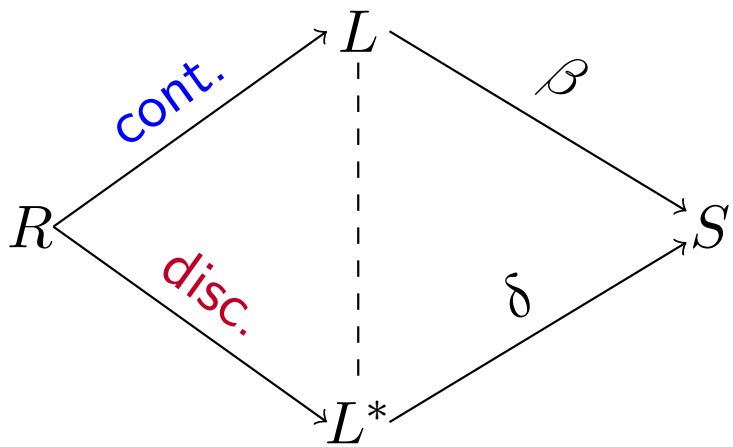
$$S = \alpha + \beta L + \delta L^* + \epsilon$$



Relation to RDD

Back

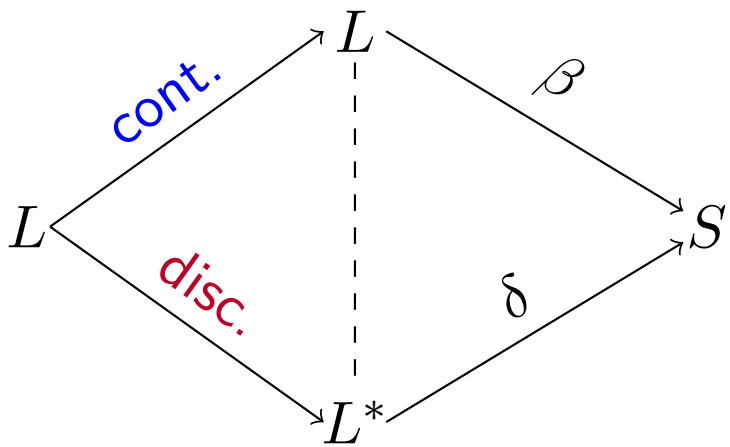
$$S = \alpha + \beta L + \delta L^* + \epsilon$$



Relation to RDD

Back

$$S = \alpha + \beta L + \delta L^* + \epsilon$$
$$L = \max\{0, L^*\}$$

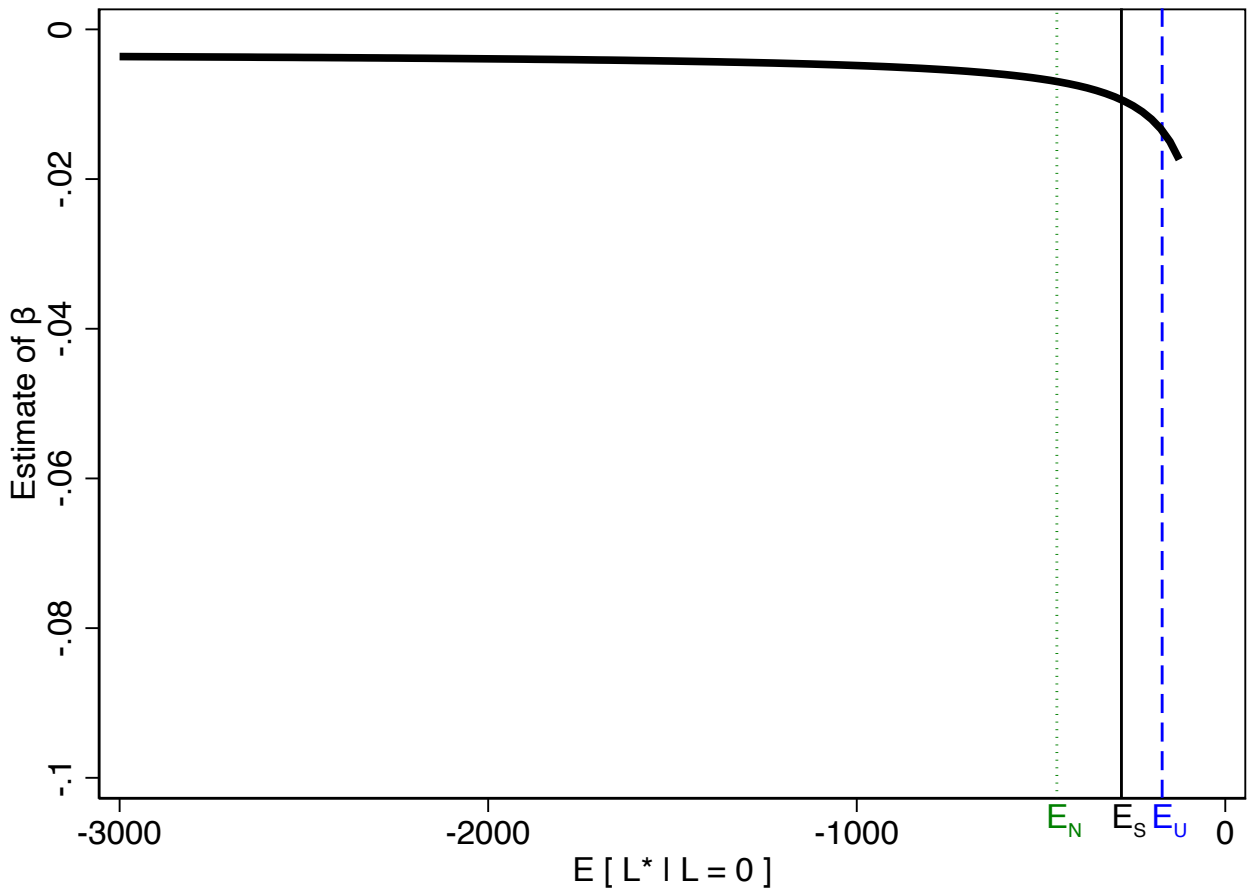


Treatment: $\lim_{l \to 0^+} \mathbb{E}[\beta L | L = l] - \mathbb{E}[\beta L | L = 0] = 0$

Endogeneity: $\lim_{l \to 0^+} \mathbb{E}[\delta L^* | L = l] - \mathbb{E}[\delta L^* | L = 0] = -\delta \mathbb{E}[L^* | L = 0]$

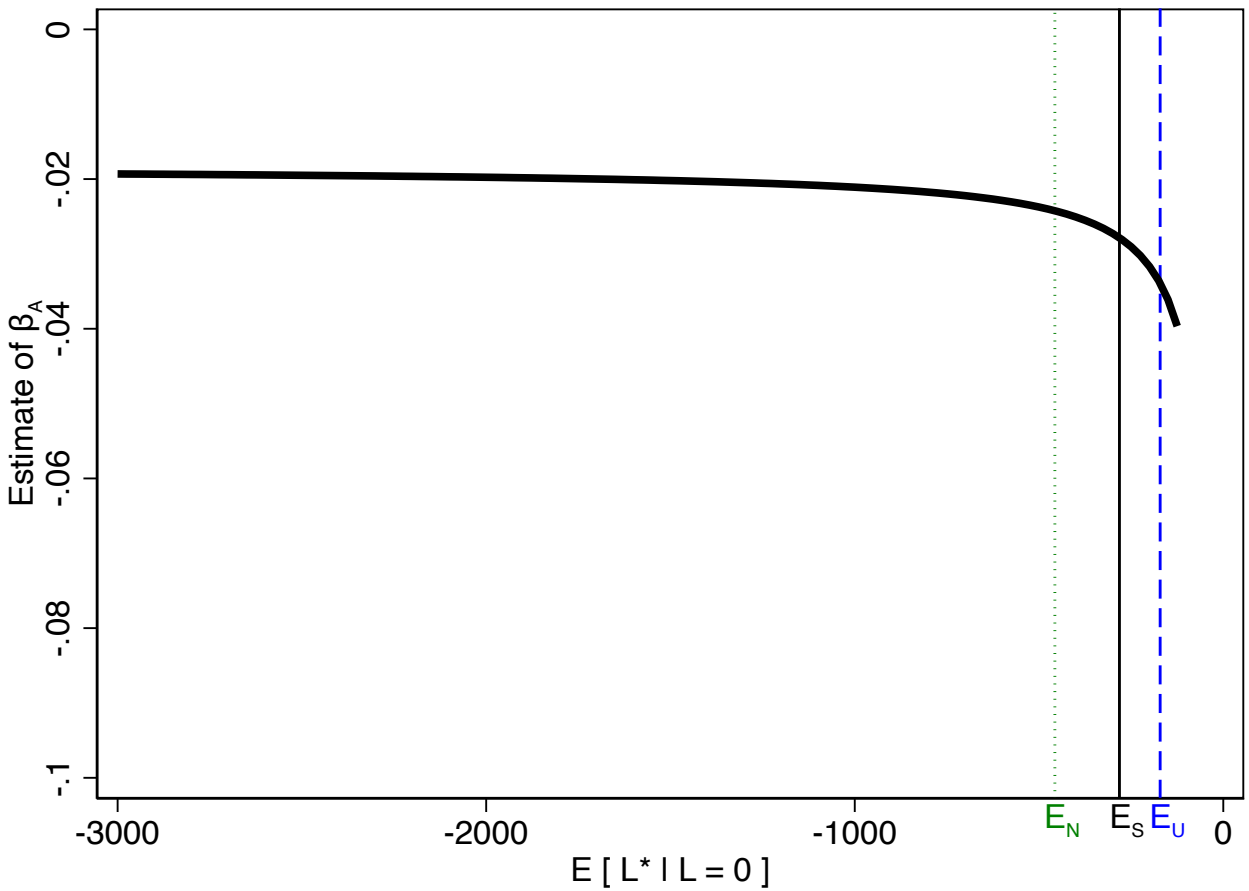
Robustness to Distributional Assumption

Back



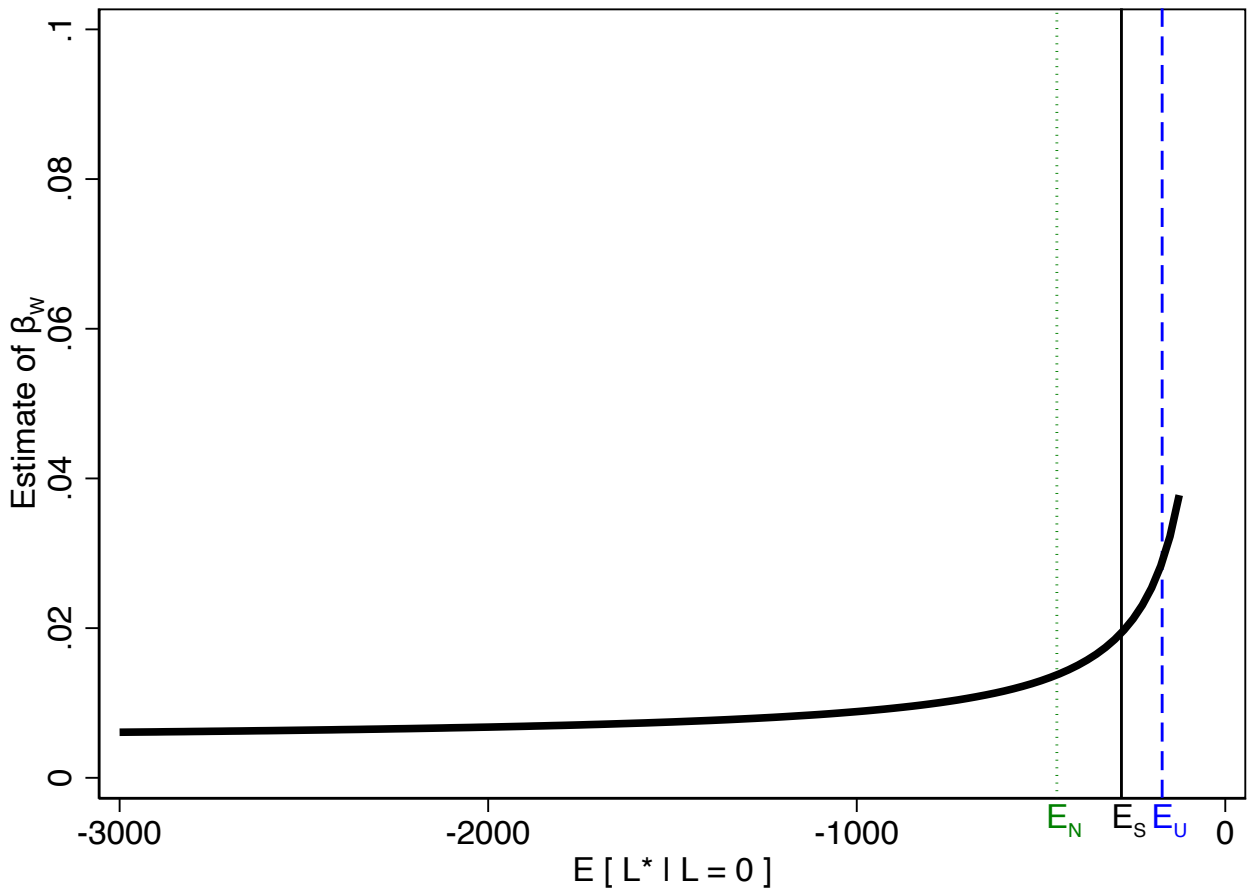
Robustness to Distributional Assumption

Back



Robustness to Distributional Assumption

Back



Testing Assumption $\mathbb{E}[\varepsilon|L, X, \eta] = 0$

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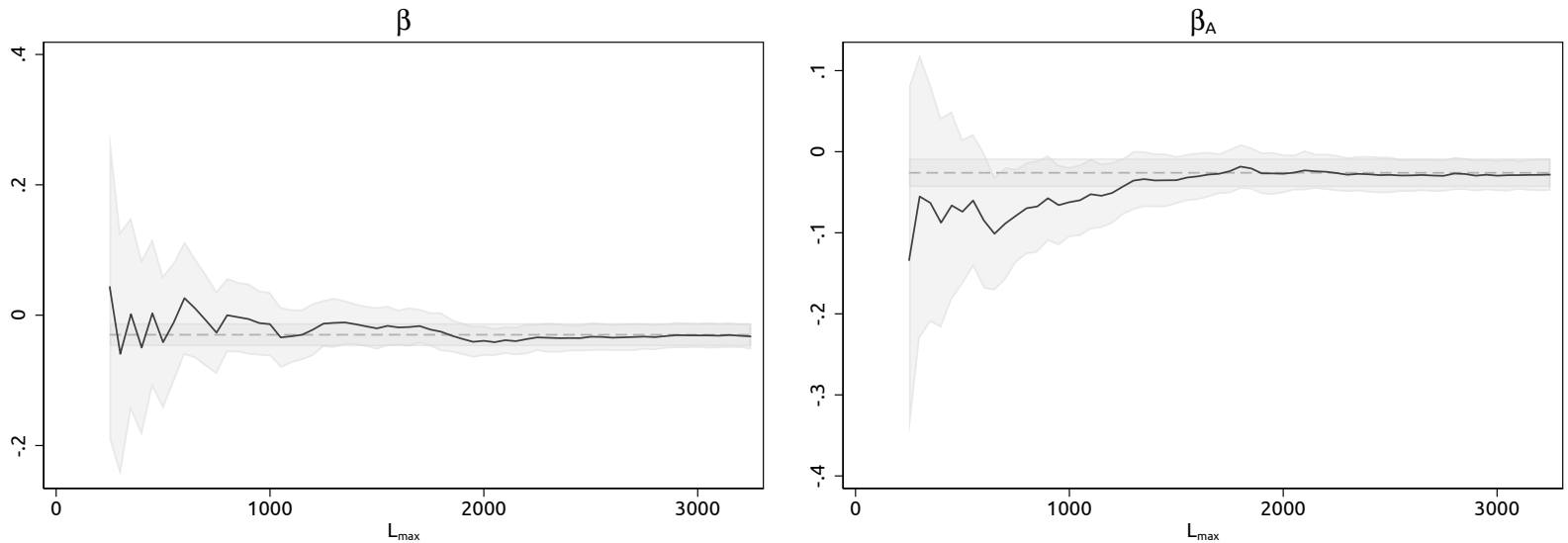

Estimation Details

- It is a good idea to discretize X first, then use cluster indicators to approximate $m(X)$, $\delta(X)$ and $\mathbb{E}[L^*|L^* \leq 0, X]$.
- We use hierarchical cluster with 50 clusters in all reported results.
- Intuition: as the number of clusters increase, these approximations improve.
- See Caetano, Caetano and Nielsen (2021) for details.

Changing the number of clusters

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