UNIVERSITÄT
BERN

Estimation of Causal Education Effects in Switzerland: A Regression Discontinuity Approach

Stefan Boes (Bern)
Dominik Hangartner (Zurich, LSE)
Lukas Schmid (St.Gallen)

Seminar in Quantitative Methods, St.Gallen

Dec 13, 2011

Introduction

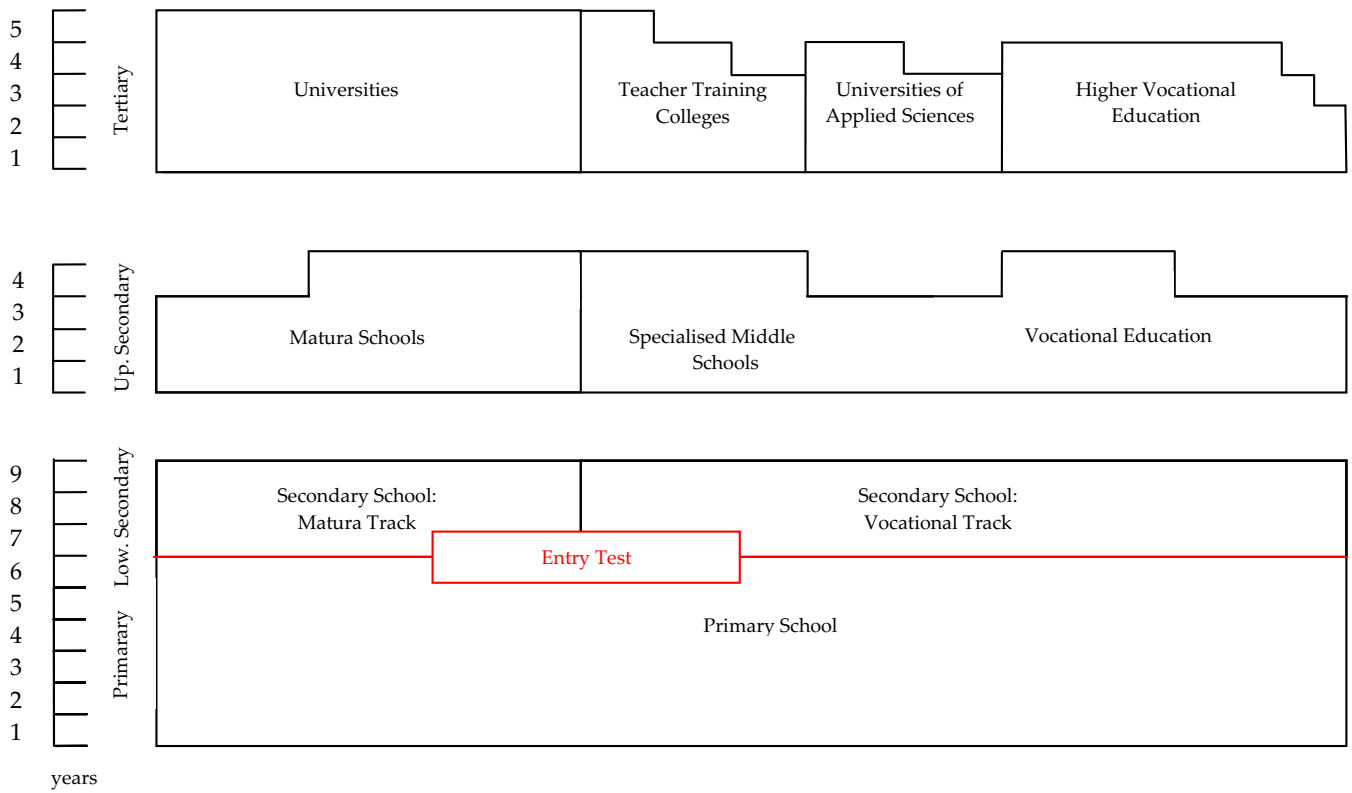
- Causal education effects on
  - employment prospects and earnings
  - health and related outcomes
  - child outcomes
  - political activity
  - social capital
  - ...
- Empirical problem: selection and heterogeneity
- Proposed solution: discontinuity in test scores

Contributions

- Unique data source
- Powerful identification strategy
- Causal education effects on common outcomes
- Causal education effects on not-yet-so-common outcomes
- School entry tests

Outline

Swiss education system



Secondary school entry tests

- Centralized exam at transition primary to secondary school
- "Sekundar-/Gymnasialprüfung" (mostly abolished in 1990s)
- Differentiation of skill levels at age 11/12
- Thresholds: rank in given school and year, or points
- Classification into two/three levels of secondary school
- Only upper level graduates can access university
- Main feature: no strategic sorting
- Main problem: heterogeneity across cantons and schools

Data collection: Part I

1st step: school entry tests

- Identify schools that conducted the test and stored the results
- Contact cantonal data protection officers
- Official agreement: get exam *and* address information
- Data collection still in progress
- KS Reussbühl, Alpenquai, Luzern (1958-77)
- Gymnasium vs. Sekundarschule (only former university track)
- Exam: Reading, writing and maths, threshold: 12/18 points

Example questions: Reading

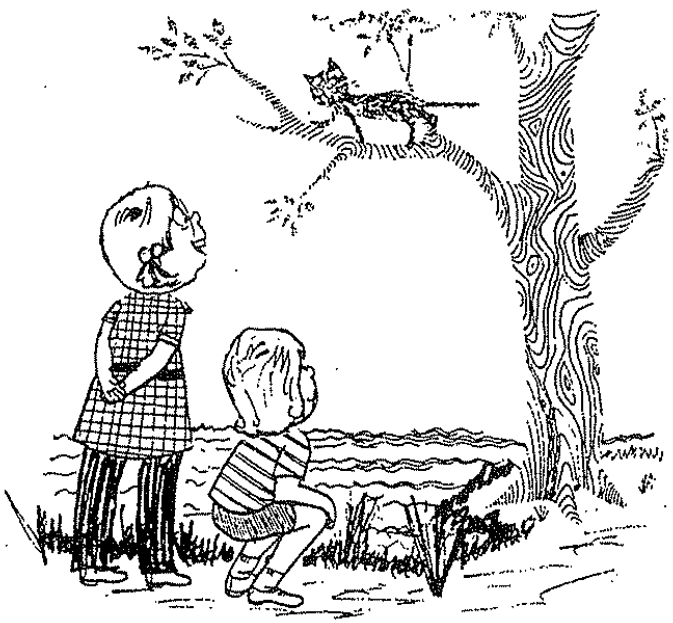
1. Lies den folgenden Text zuerst ruhig durch!

In den letzten Ferien besuchten wir unsere Verwandten in Slowenien. Unser Heimatland war glücklicherweise vom Krieg verschont geblieben. Während einer kurzen Rast in einem ländlichen Gasthof rief meine Schwester überrascht: „Schaut, dort ist Urska Hrovat !" „Wer ist das denn ?" fragte meine Mutter. „Die hat doch im Slalom Vreni Schneider geschlagen !" antwortete meine Schwester.

Im Text kommen vier verschiedene Zeiten vor. Gib diese vier Zeitformen an und schreibe zu jeder einen Satz aus dem Text auf!

Example questions: Writing

Beschreibe die vorgegebenen Bilder nur kurz !
Erfinde den weiteren Ablauf nach freier Fantasie - dabei schlüpfst Du in die Rolle des Knaben oder des Mädchens oder der Katze !
(Schreibe also in der ICH-Form !)



Example questions: Math

1. Andrea hat in der Bibliothek ein spannendes Buch geholt und liest pro Stunde 12 Seiten.
   Wie viele Seiten hat das Buch, wenn sie jeden Tag drei Stunden mit Lesen verbringt und es nach 2 Wochen und 3 Tagen beendet hat ?

2. Drei Erwachsene und fünf Kinder zahlen für eine gemeinsame Bahnfahrt 204.60 Fr. .
   Wie teuer ist ein Billett für einen Erwachsenen, wenn die Kinder zum halben Preis der Erwachsenen fahren ?

3. Ein grosser Benzinkanister wiegt halbvoll 11,5 kg.
   Wie schwer sind zwölf volle Kanister, wenn ein leerer 4,5 kg wiegt ?

4. Ein Sturm nähert sich mit einer Geschwindigkeit von 102 km/h von Westen her der Schweiz. Er erreicht um 15:34 Uhr die Wetterstation in Neuchâtel.
   Wann muss in Arbon die gelbe Warnleuchte eingeschaltet werden, wenn sie eine Stunde vor Sturmbeginn blinken soll ?
   Die Luftlinie Neuchâtel - Arbon misst 187 km .

Data collection: Part II

2nd step: survey of pupils

- Trace former pupils and update address information
- Telephone survey on key outcomes, background, education
- First wave:
  - Educational achievements
  - Political outcomes
  - Health outcomes
  - Labor market outcomes
  - Willingness to take risks (basic)
  - Background: age, gender, civil status, children and situation at age 12
- Larger survey this summer/fall (given successful funding)

Basic destats

	Passed	Not passed	Total
Matura	66.1%	37.9%	59.7%
Age	53.5	53.3	53.4
	(5.7)	(5.1)	(5.6)
Female	21.8%	26.4%	22.8%
# obs	298	87	385

Identification strategy

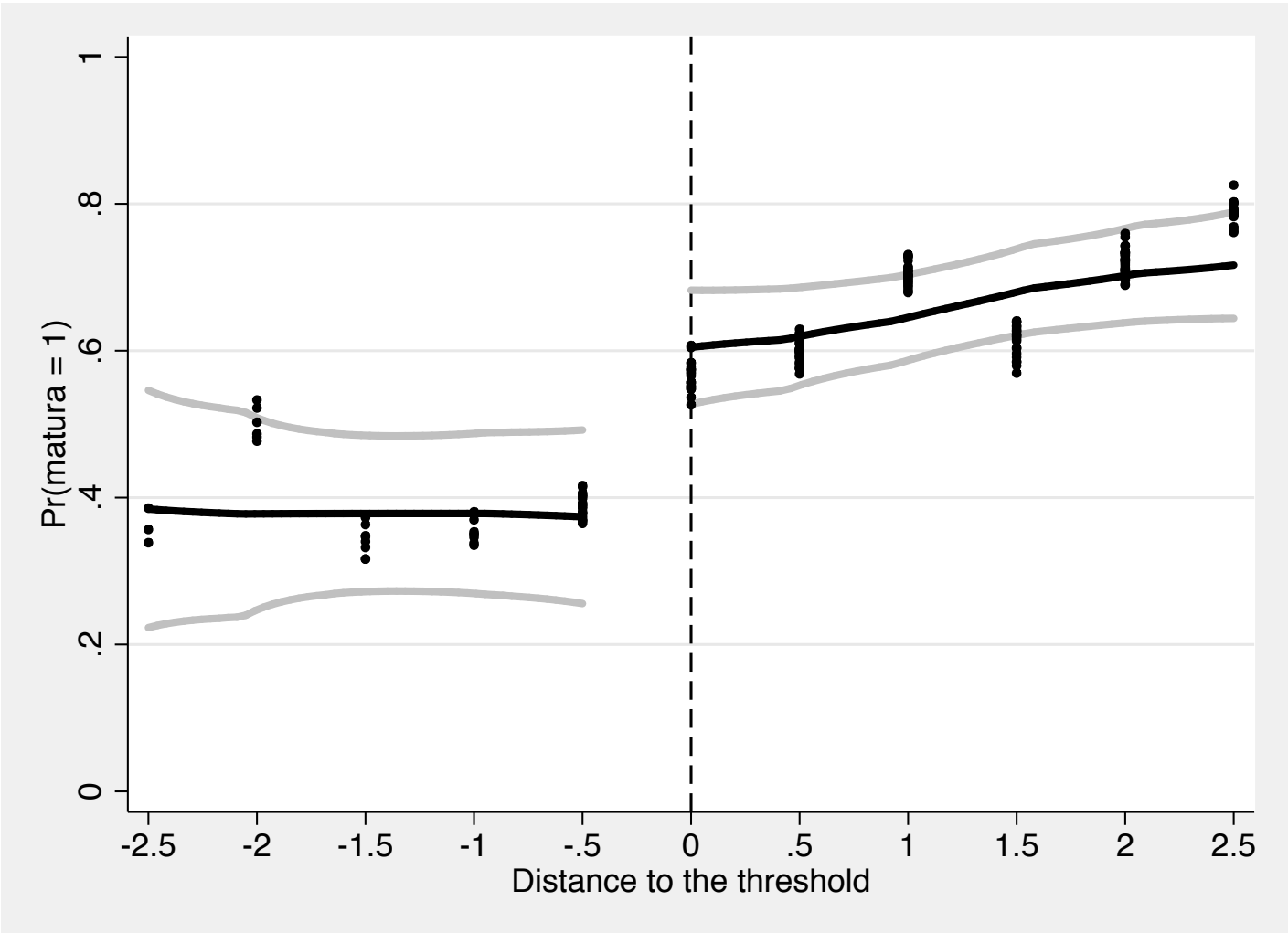
Regression discontinuity design: fuzzy

- Treatment S is educational achievement
- Running variable X are test scores, treshold τ
- Identifying assumption

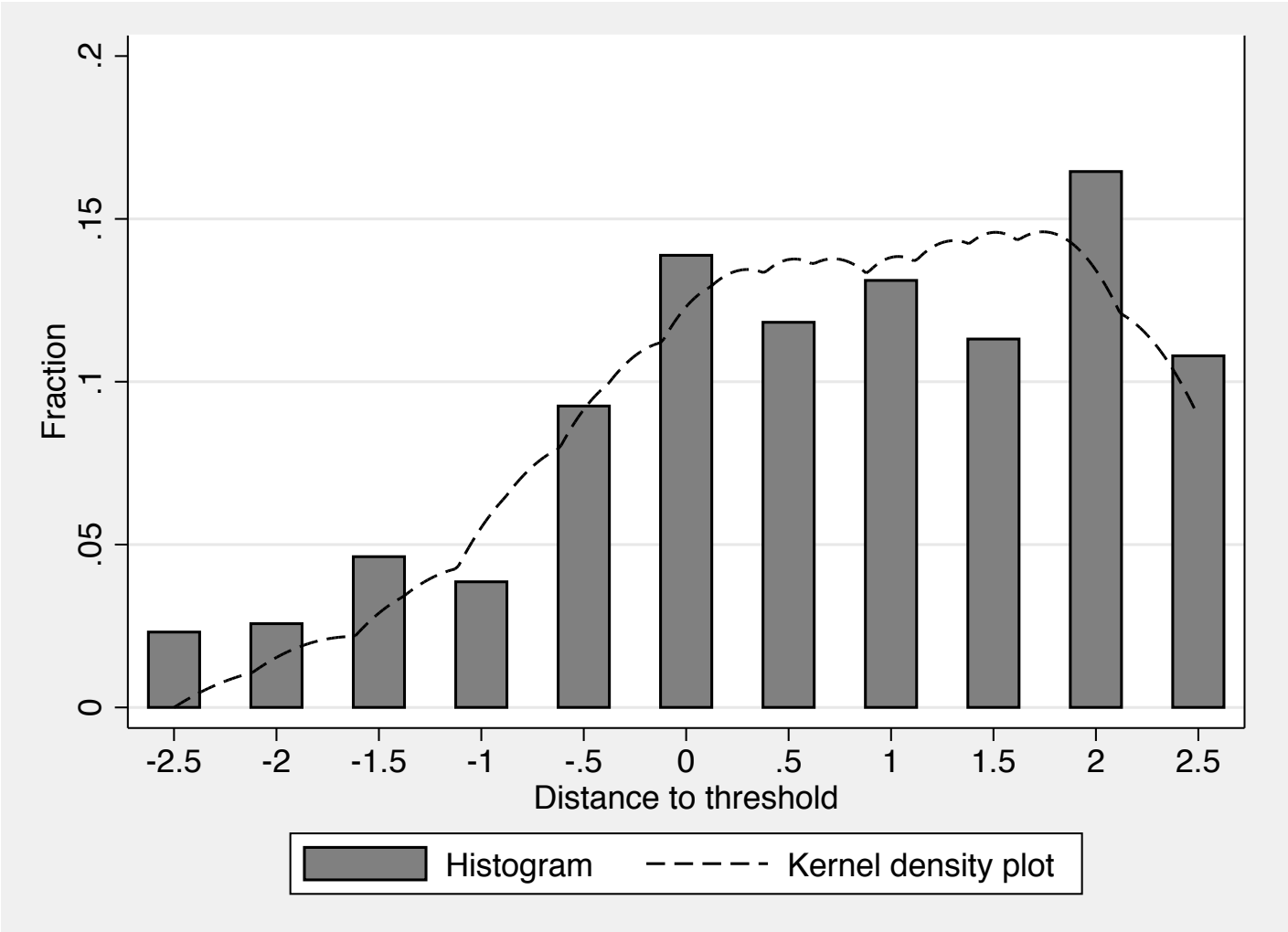
$$\lim_{x \uparrow \tau} E(S|X = x) < \lim_{x \downarrow \tau} E(S|X = x)$$

- No jump in pre-treatment variables

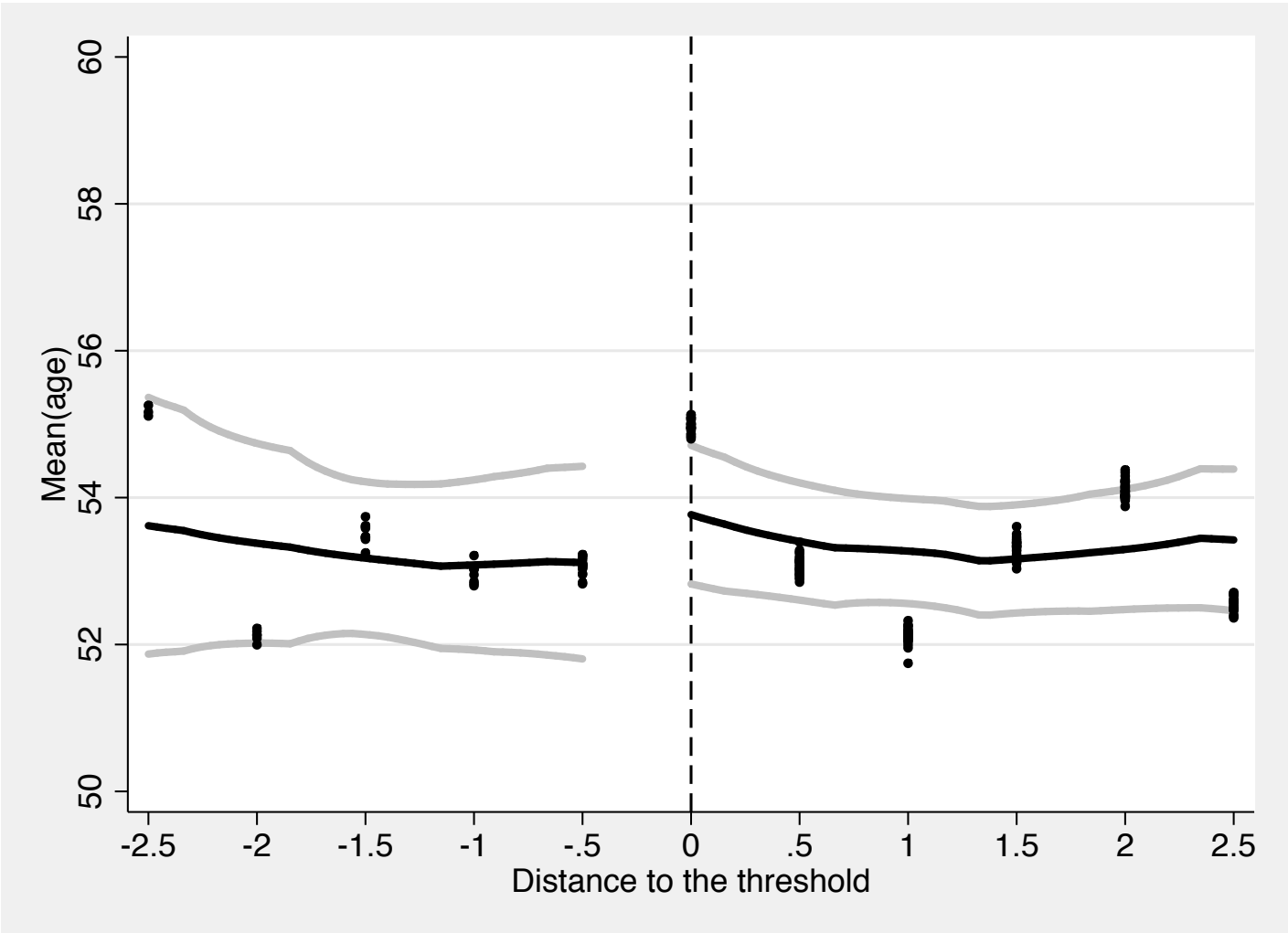
Jump in matura degrees



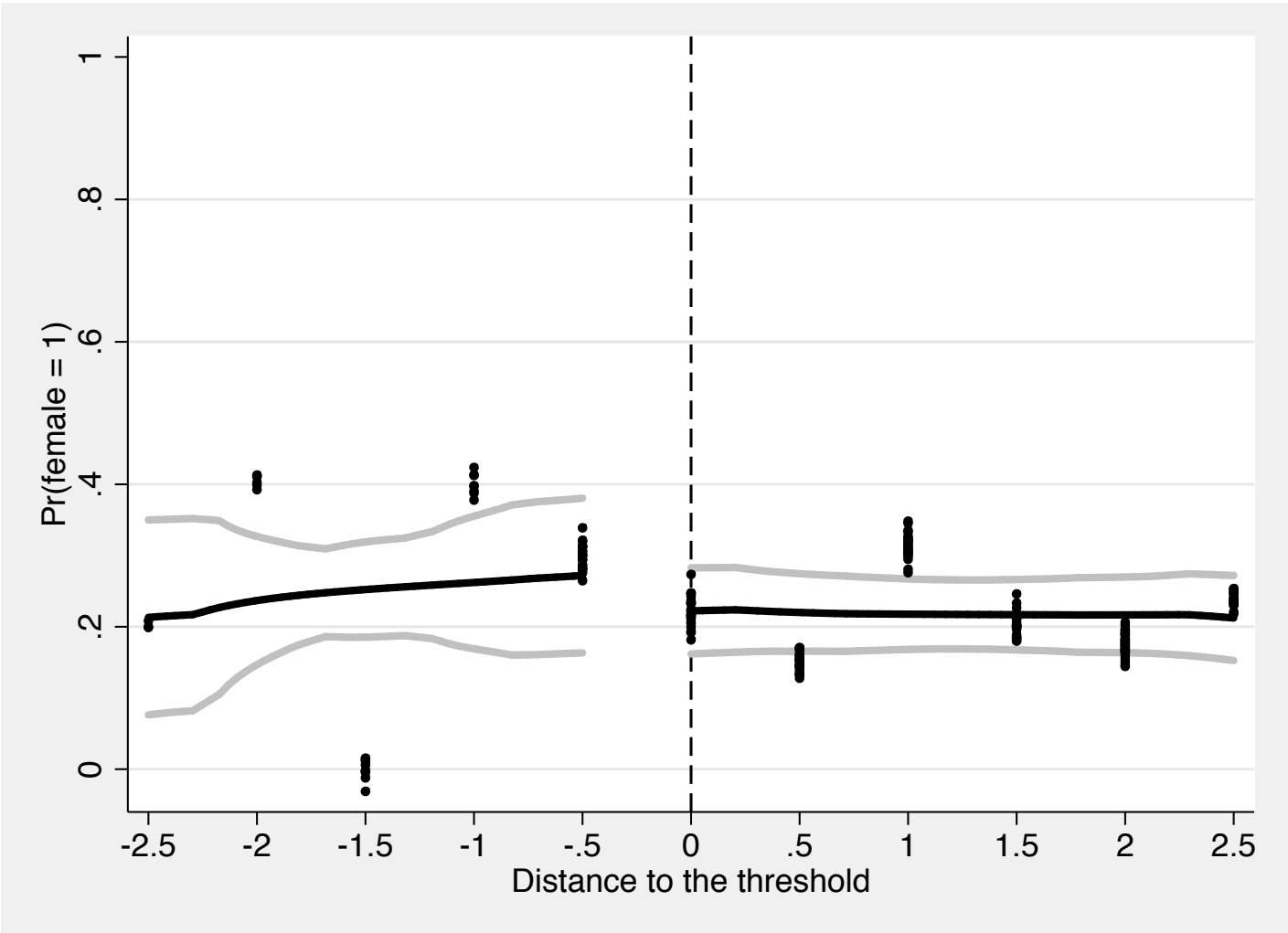
Histogram of test scores



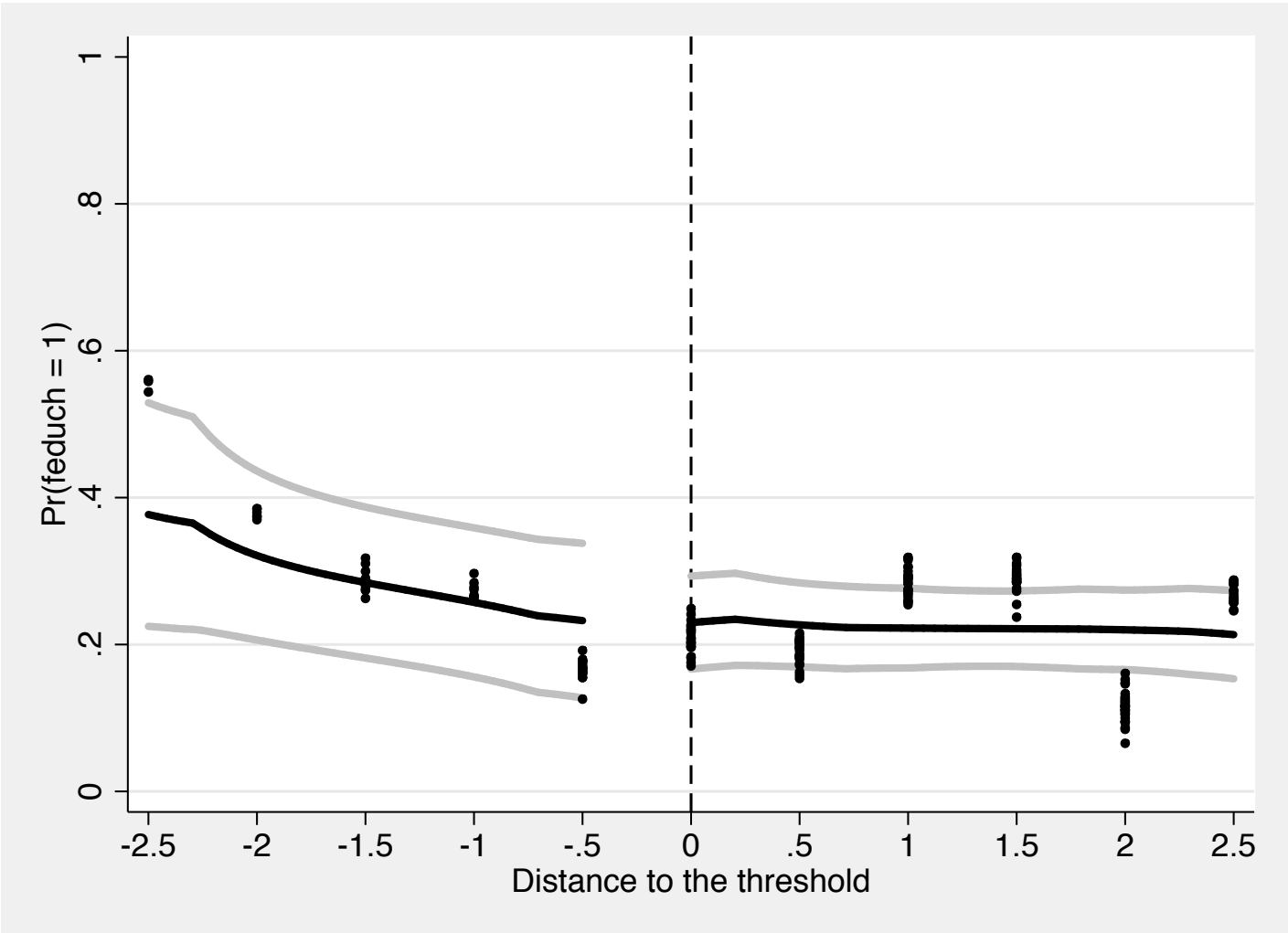
Age


Mean(age)
50
52
54
56
58
60
-2.5
-2
-1.5
-1
-.5
0
.5
1
1.5
2
2.5
Distance to the threshold

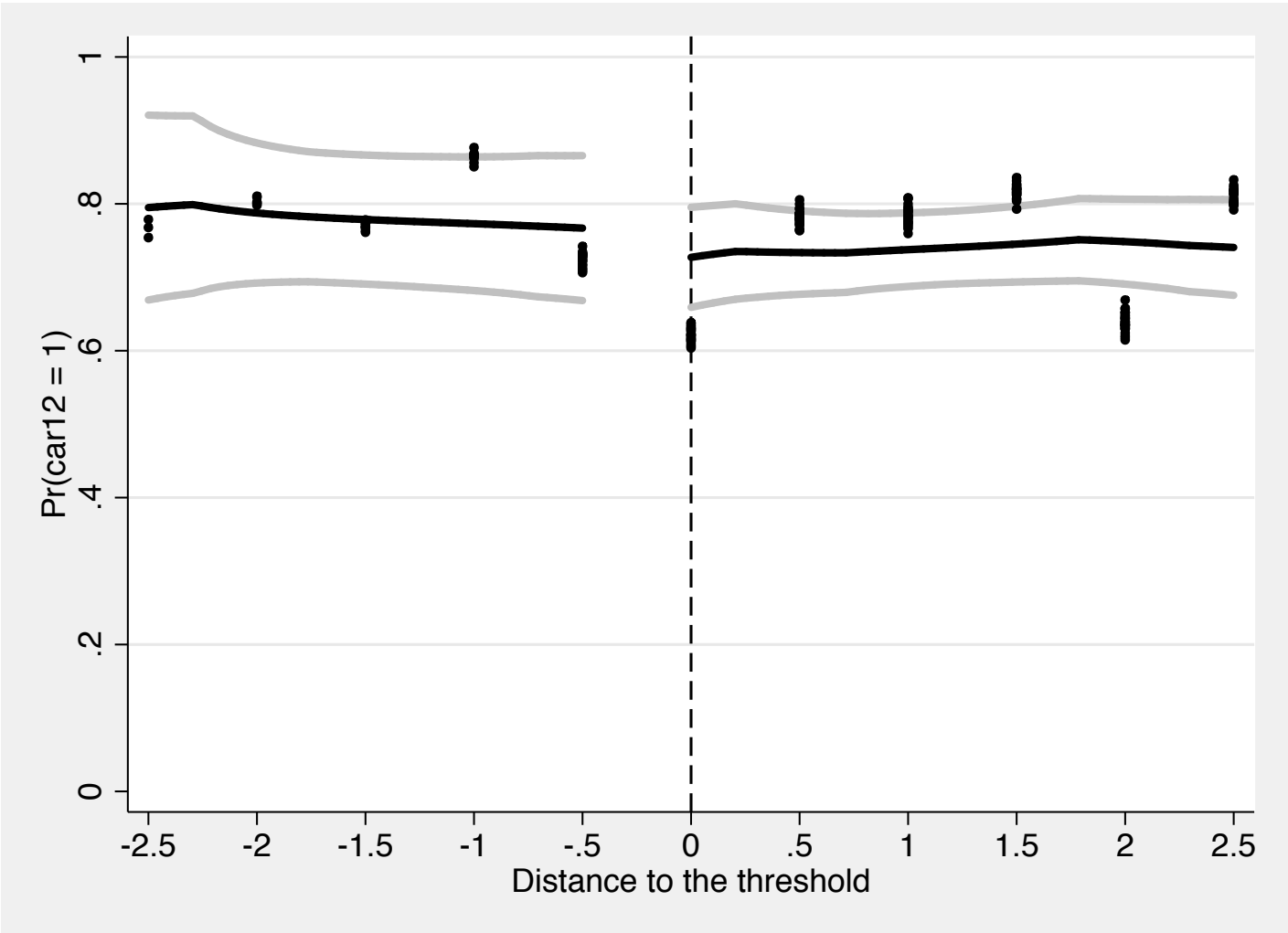
Gender


Pr(female = 1)
0
.2
.4
.6
.8
1
-2.5
-2
-1.5
-1
-.5
0
.5
1
1.5
2
2.5
Distance to the threshold

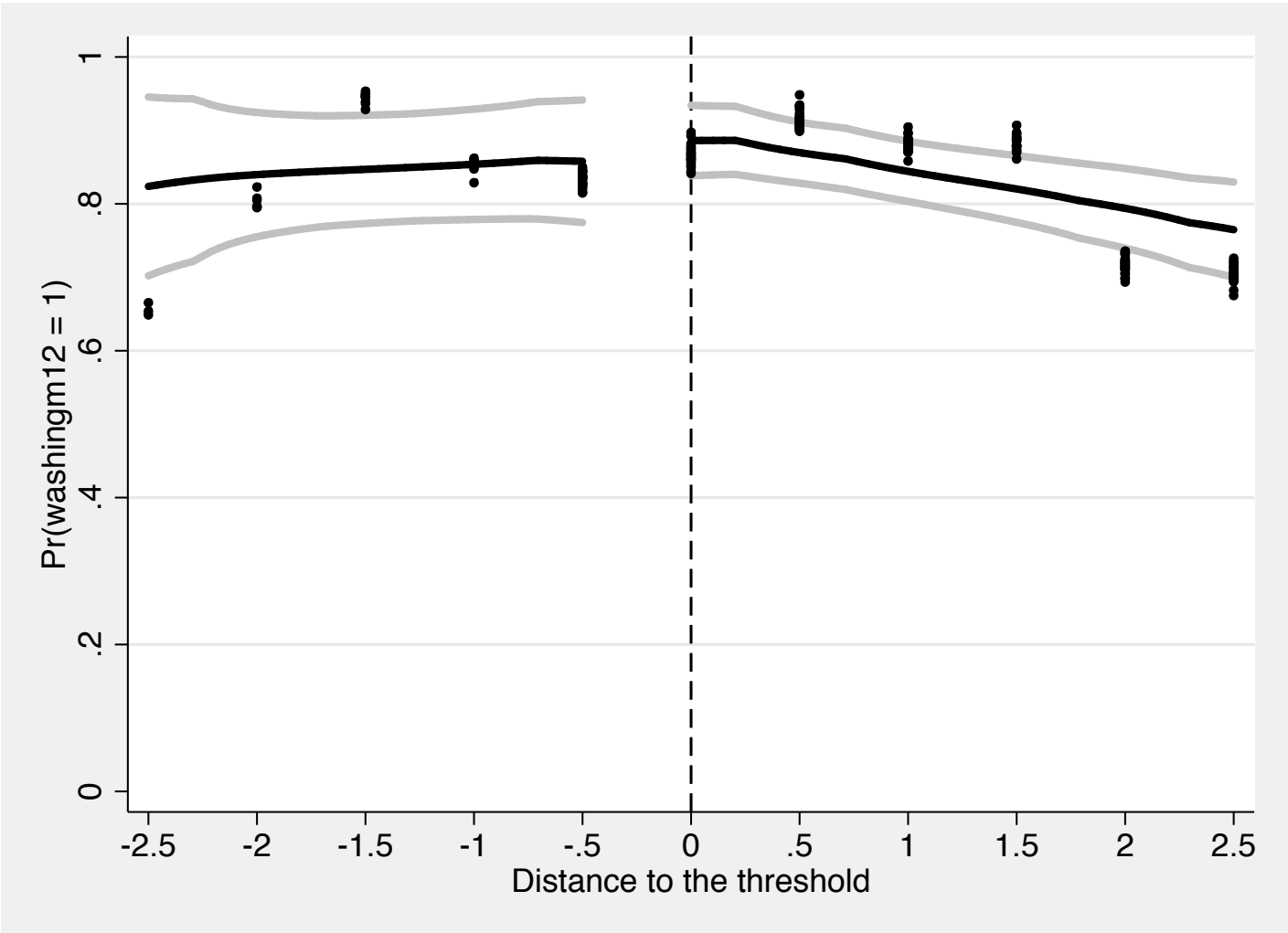
Father education



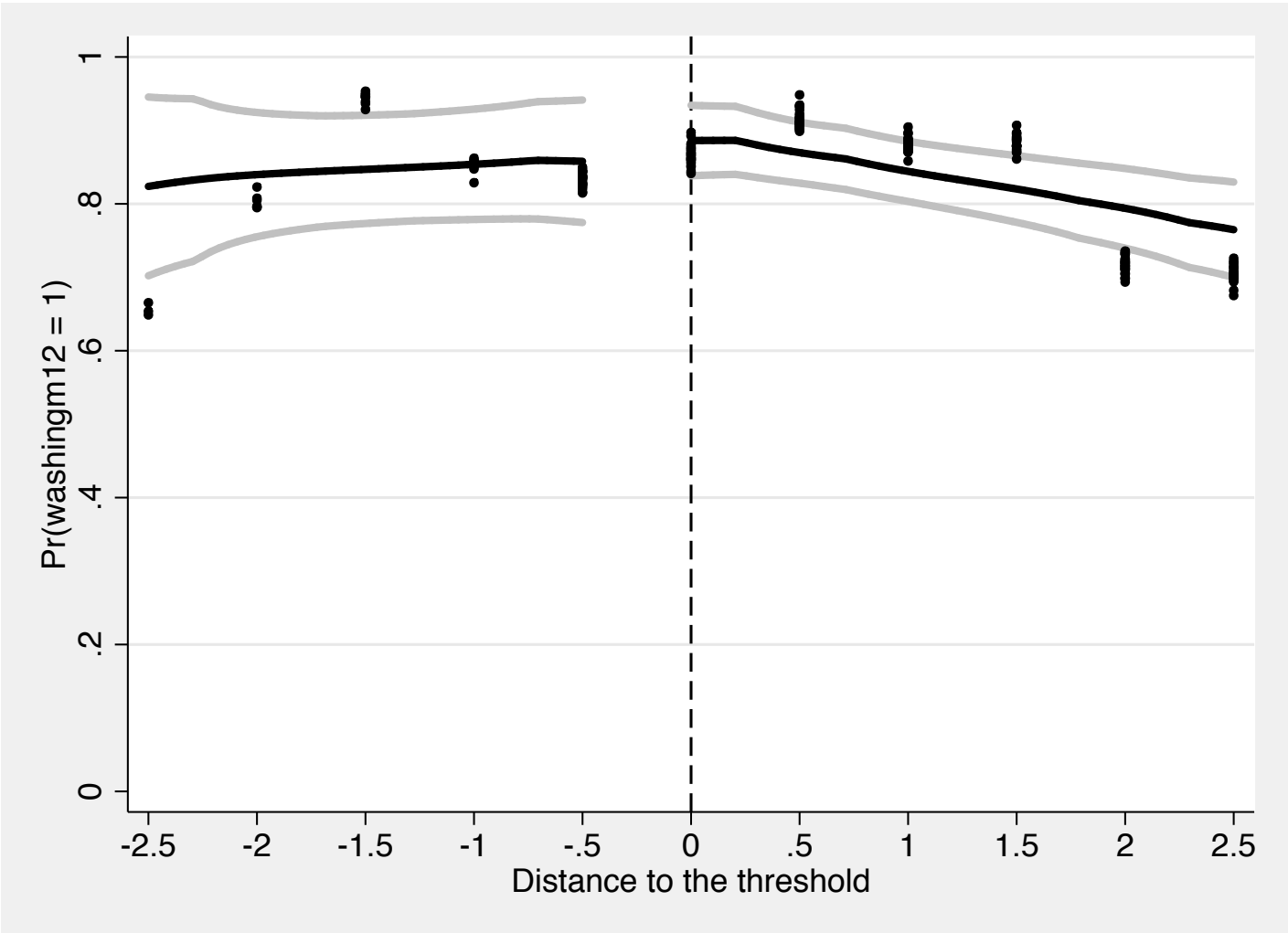
Having a car in family at age 12



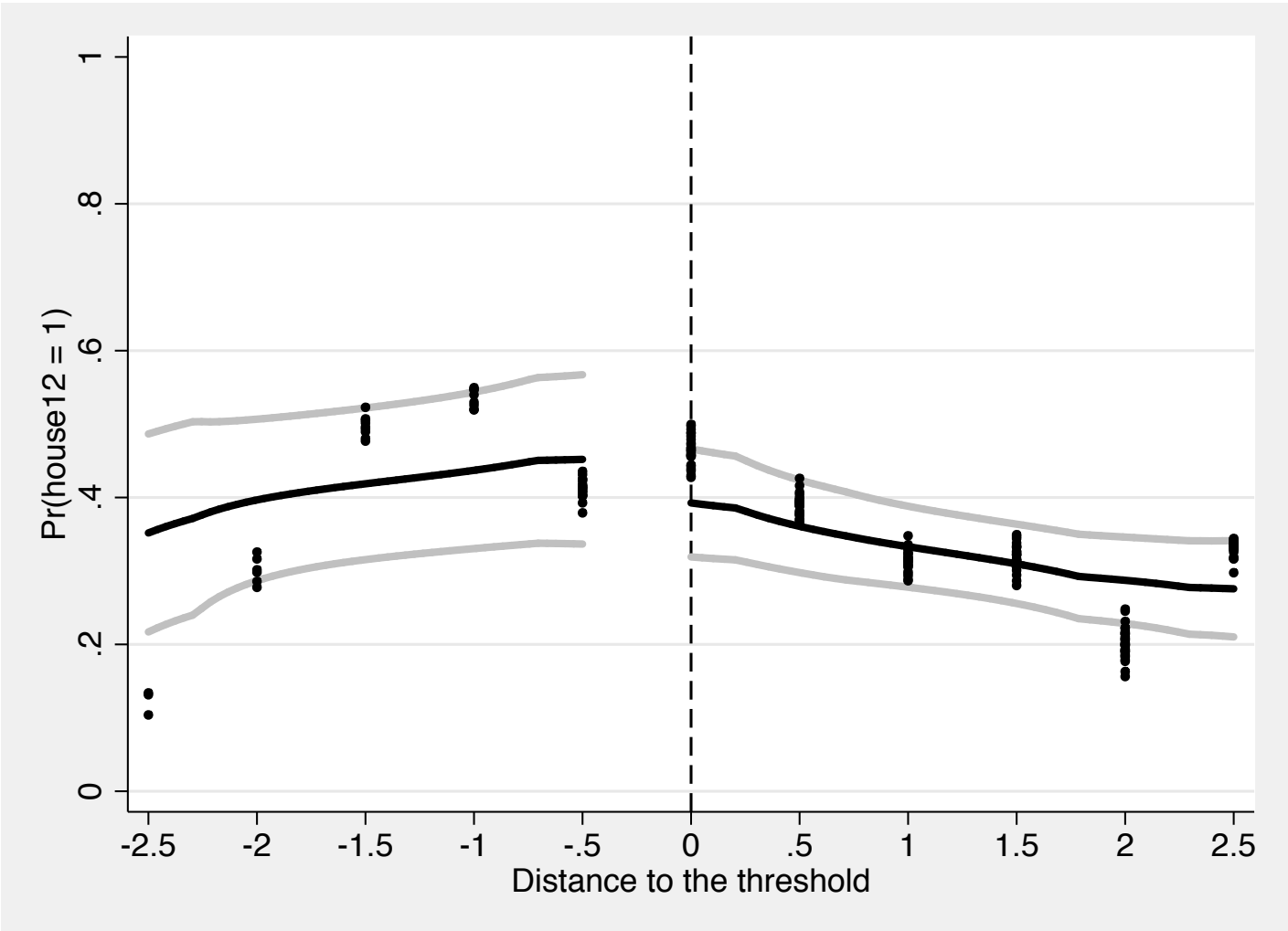
Having a washing machine in family at age 12



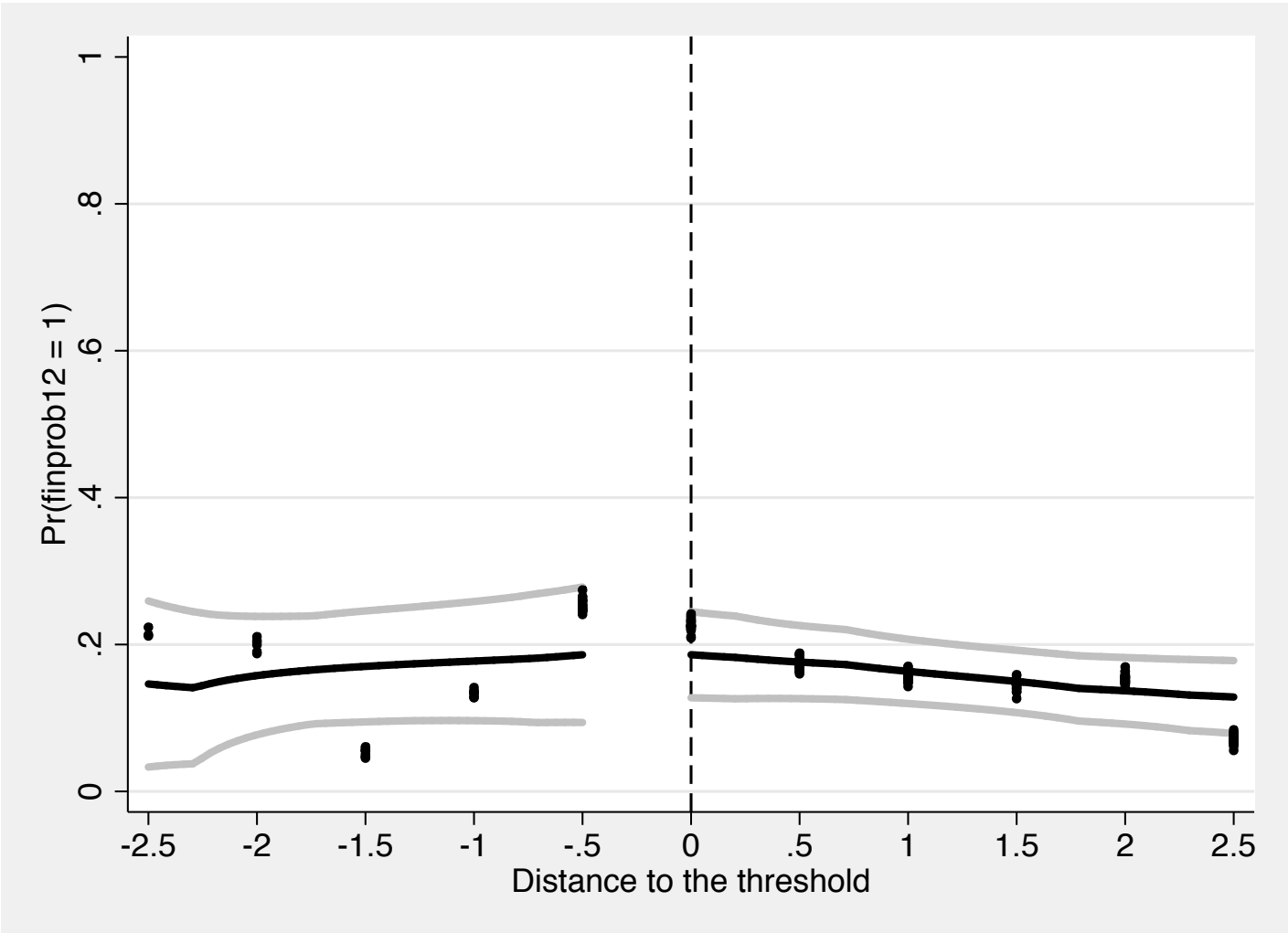
Having a freezer in family at age 12



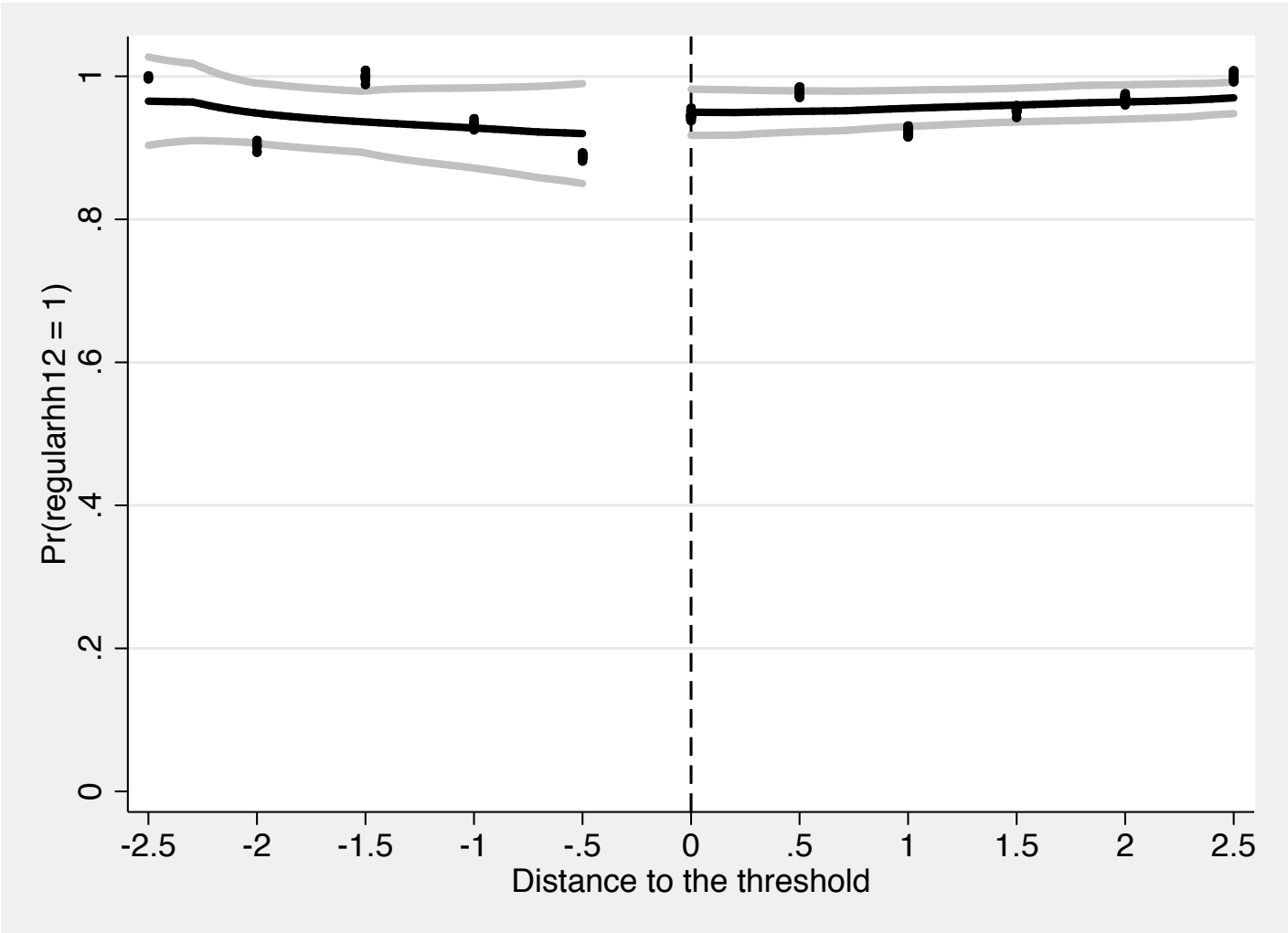
Having a house at age 12



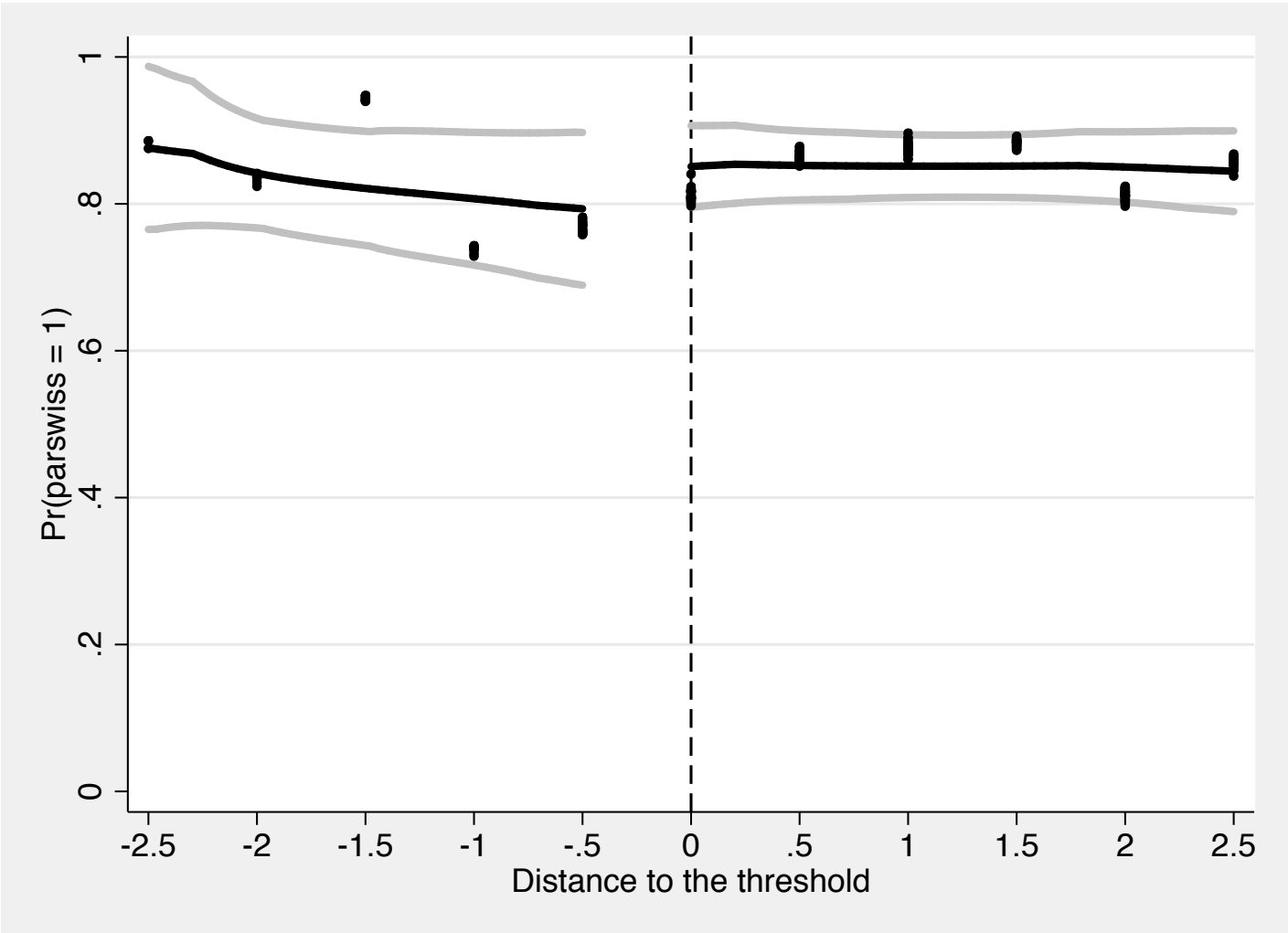
Having financial problems at age 12



Having regular household structure at age 12



Swiss nationality of parents



Identification strategy

Fuzzy RD estimand:

$$\Delta_{FRD} = \frac{\lim_{x \downarrow \tau} E(Y|X=x) - \lim_{s \uparrow \tau} E(Y|X=x)}{\lim_{x \downarrow \tau} E(S|X=x) - \lim_{x \uparrow \tau} E(S|X=x)}$$

Implementation: 2SLS/Nonlinear IV

$$\begin{aligned} S &= \alpha_0 + \alpha_1 Pass + f^-(X-\tau) + f^+(X-\tau) + \nu \\ Y &= \beta_0 + \beta_1 S + g^-(X-\tau) + g^+(X-\tau) + \epsilon \end{aligned}$$

First stage regression

Dependent variable: matura degree (yes/no)

	Coeff	SE	t-stat
Passed	0.184	0.072	2.54
Distance to threshold	0.000	0.074	0.00
Distance $\times$ Passed	0.079	0.032	2.50
Constant	0.379	0.052	7.26

Some causal effects of matura degree (1)

	Probit		RD/BiProb	
Effects on	MargEff	SE	MargEff	SE
Fulltime	0.037	0.051	0.228	0.349
High wages (>120k)	0.196	0.053	0.373	0.365
Risk	0.002	0.032	0.343	0.218
Doctor visit	0.021	0.053	-0.096	0.535
Smoking	-0.048	0.040	-0.245	0.241
Health status	0.014	0.053	0.453	0.178

Some causal effects of matura degree (2)

	Probit		RD/BiProb	
Effects on	MargEff	SE	MargEff	SE
Headaches	0.030	0.028	-0.039	0.144
Sleeping problems	-0.067	0.041	-0.078	0.327
Pains	0.027	0.024	-0.203	0.123
Healthy diet	-0.030	0.036	0.145	0.240
Women anorexic	0.111	0.114	-0.404	0.277
Men obese	-0.020	0.037	-0.431	0.211

Outlook

- Powerful identification strategy
- Huge potential to provide range of causal education effects
- Additional outcomes
  - Preference parameters (time discount, risk aversion)
  - Child education and income
  - Political variables (turnout, party identification, attitudes toward immigration, globalization, support for welfare state, redistribution, environmental protection)
  - Sociological aspects (altruism, trust, networks)
- Possibility to follow-up