Expectation Formation and Educational Investment: Evidence from Labor Market Shocks

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Motivation and Research Question

A well established literature in economics has documented how local economic conditions affect schooling choices (Atkin (2016), Black et al. (2005), Betts and McFarland (1995), Charles et al. (2015))

- One potential mechanism are subjective expectations *rightarrow* people form subjective expectations with signals from their local environment
- Growing interest in subjective expectations about returns to schooling; limited evidence on belief formation
- The role of subjective expectations in shaping outcomes depends on how they are driven by signals and how they shape choices over time

Research questions:

- How do local unemployment shocks affect expectations about returns to education?
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Local labor market shocks → Perceived returns to secondary education → Educational investment

- Longitudinal data on **perceived returns to secondary schooling** among poor households in North Macedonia (2010, 2012 and 2013)
- Low secondary school graduation rates among people from low-income backgrounds in North Macedonia
- Match with local variation in Administrative data about **unemployment**

1. Reduced-form evidence:
   - Local labor market shocks are associated with parental expectation updating: Higher unemployment → Higher returns
2. Dynamic choice model with expectation updating:
   - Expectations updating shapes attendance and graduation in secondary school
   - Local unemployment shocks are associated with changes in graduation rates
   - Differences in belief formation by parental education account for one third of the graduation gap by parental education

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Overview

Literature

Subjective expectation and local unemployment data

Reduced-form evidence

Structural model

Concluding remarks

Literature

Local economic conditions & education choices

Atkin (2016), Black et al. (2005), Betts and McFarland (1995), Charles et al. (2015) and many others...

Subjective expectations & decision-making

Jensen (2010), Attanasio and Kaufmann (2014), Boneva and Rauh (2018), Cunha et al. (2022), Delavande et al. (2022) and many others...

Expectation updating in the lab and theory

Wiswall and Zafar (2014), Arcidiacono et al. (2025), Stinebrickner and Stinebrickner (2014) , Wiswall and Zafar (2021), Frick et al. (2022), Enke (2020), Jehiel (2018) and many others...

$\Rightarrow$ Contributions to the literature:

1. Study how parents *revise expectations* in response to local labor market in a real-world setting
2. Incorporate subjective expectations and learning into a dynamic model of parental investment

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Context

Primary education is provided from ages 6 to 15, followed by **secondary education from 15 to 18** in North Macedonia

- **Low enrollment** among poor households – only 65%
- This persists *despite* the Constitution mandating **free and compulsory primary and secondary education**
- Largely due to weak enforcement of the compulsory schooling law (World Bank, 2023)

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Data: subjective expectations

Expectations elicited in 2010, 2012, and 2013 from a random sample of parents eligible for a conditional cash transfer program

Expectations about their children conditional on completing primary or secondary:

1. **probability to be employed** at age 25, $Pr[E_i = 1|S_i]$
2. **minimum** and **maximum** income (conditional on being employed) at age 25
3. **probability to earn at least up to the mid-point**

- Expectations elicited for the youngest male and female adolescent (10-17 years old)
- Using distributional assumption we can recover (an approximation of) the probability distribution (Guiso et al. 2002)
  - **Expected income (and income variance)**
  - **Expected return to secondary school**

Survey questions

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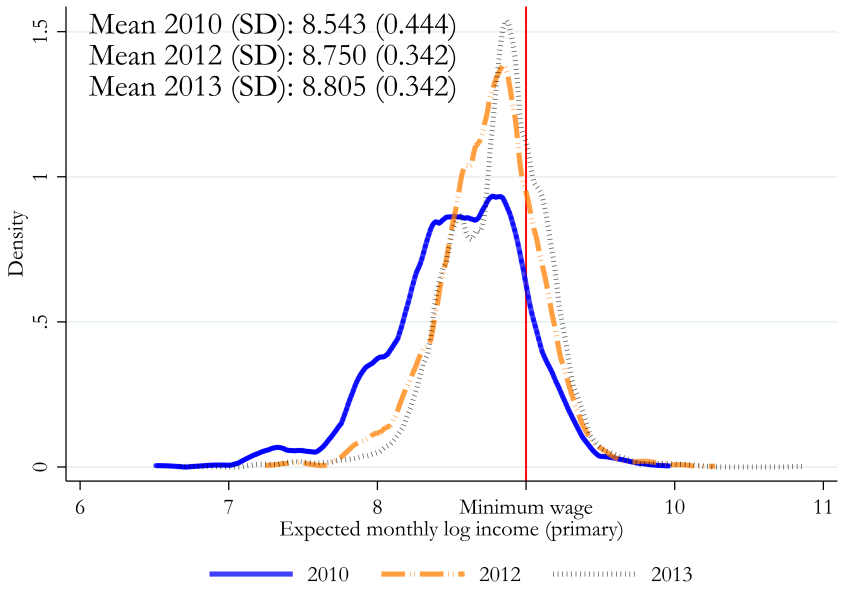
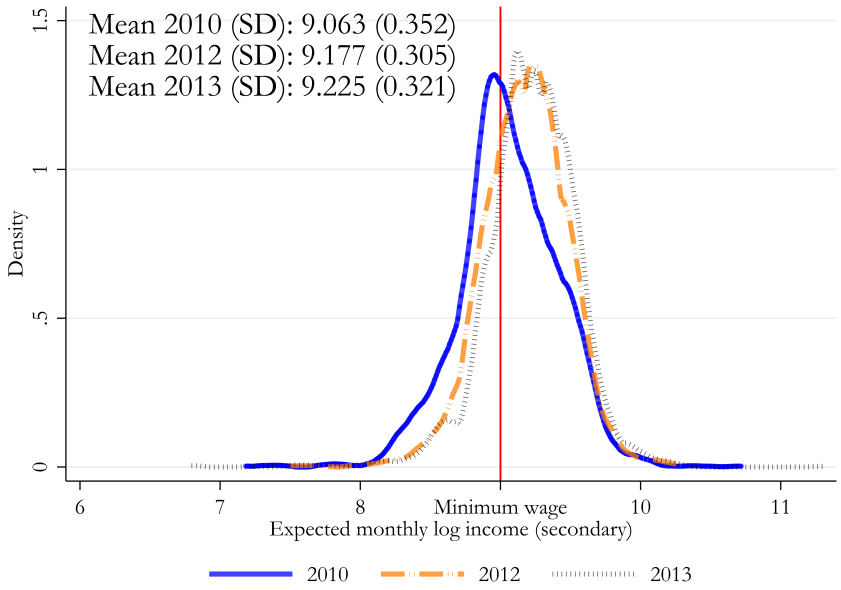
Expected log income from primary and secondary school

Primary



Secondary



Raw data Upper and lower bounds Unemployment risk

Measuring local unemployment rate

Estimate local unemployment for each household as a weighted average of nearby centers:

$$\text{LocalUnemp}_{it} = \sum_{i=h}^{N} w_{ih} \cdot U_{ht} \quad \text{where} \quad w_{ih} = \frac{1/d_{ih}}{\sum_{j=1}^{N} 1/d_{ij}}$$

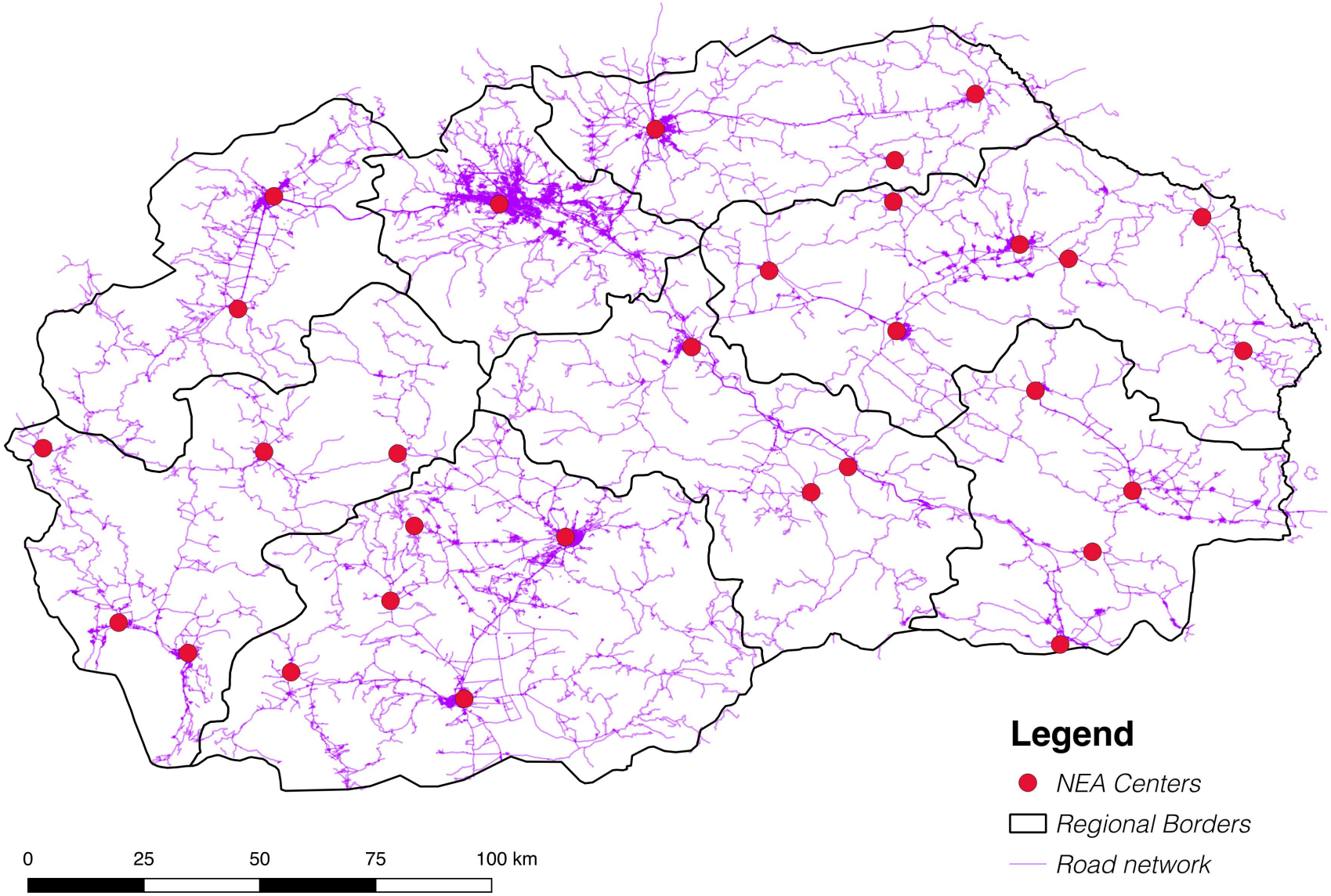
- U_{ht}: Unemployment rate at employment center h in month t
- d_{ih}: Distance from household i to center h
- w_{ih}: Inverse-distance weight

Steps:

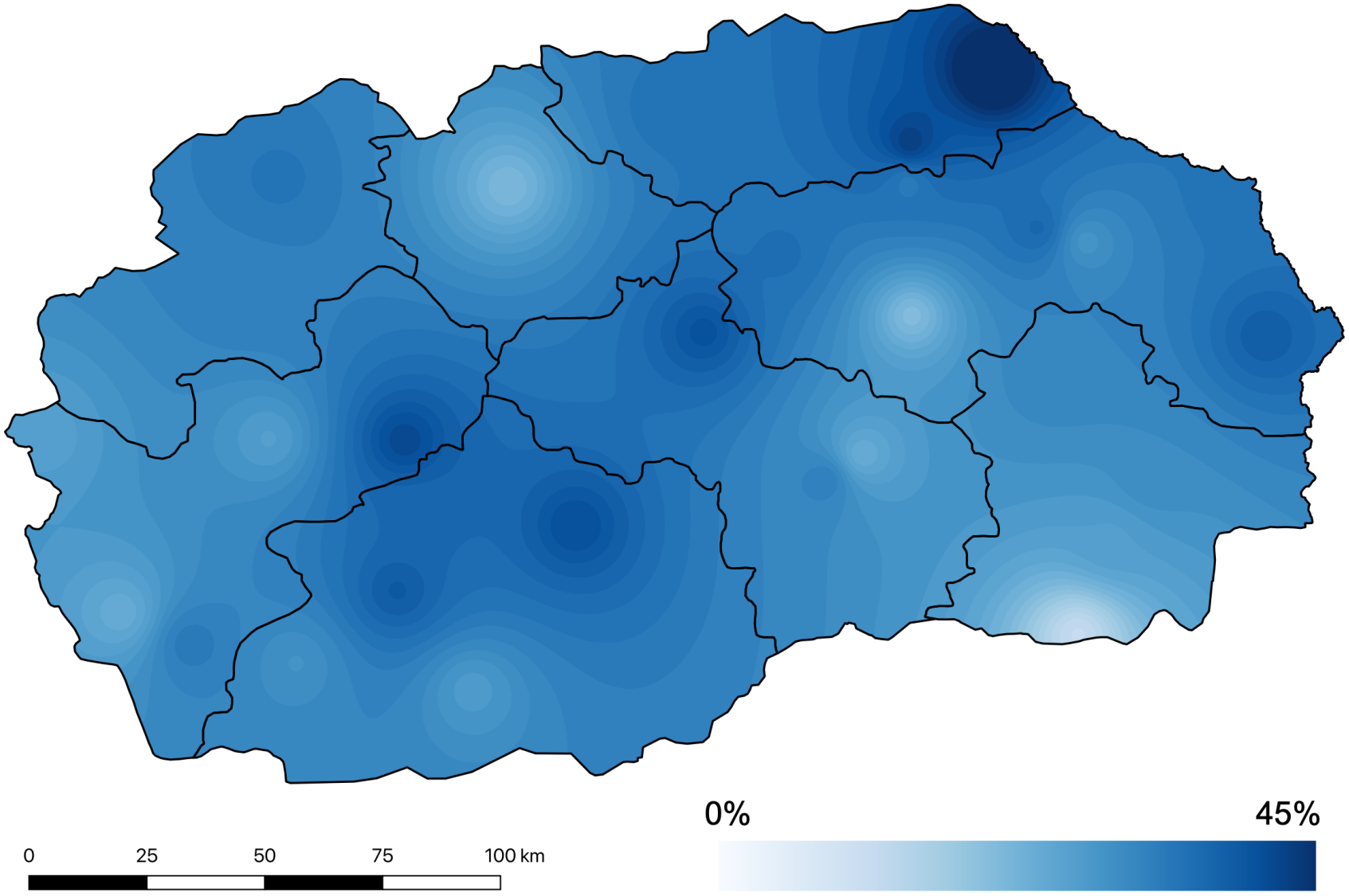
1. Use **administrative data** from 29 local offices example data
2. Proxy active population with working-age data
3. Geo-link households to employment centers
4. Compute **distance-weighted average** unemployment rate per household

Decomposition unemployment Unemployment in the region

Building spatial distribution of unemployment



Local unemployment rate in 2010



Local unemployment rate over time

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School absences (secondary)

Dependent variable:	Number of missed school days (secondary)			
	(1)	(2)	(3)	(4)
ln(expected income prim.)$_t$	0.615	13.835***	14.466***	14.597***
	(3.868)	(4.475)	(4.501)	(4.674)
ln(expected income sec.)$_t$	-5.751	-3.965	-8.065	-9.085
	(4.669)	(5.617)	(5.536)	(5.748)
Var. ln(expected income prim.)$_t$			59.876	58.456
			(60.935)	(60.943)
Var. ln(expected income sec.)$_t$			60.655	55.707
			(93.639)	(93.452)
Prob. of employment (prim.)				1.854
				(6.178)
Prob. of employment (sec.)				3.038
				(6.448)
Observations	3063	3063	3063	3060
Mean	59.045	59.045	59.045	59.058
Individual FE	No	Yes	Yes	Yes
Year FE	No	No	Yes	Yes
Other controls	No	No	Yes	Yes
Year x Macro-region FE	No	No	Yes	Yes

Note. Standard errors clustered at the individual level in parentheses (*** p<0.01, ** p<0.05, * p<0.1). Controls: age, population living in the municipality, average net wage in the municipality, precipitations on the day and in the year of the interview, macro-region-specific time fixed effects by introducing interaction terms between the year fixed effects, and macro-region indicators.

Expectation formation

Dependent variable:	ln(expected income prim.)$_t$			ln(expected income sec.)$_t$		
	(1)	(2)	(3)	(4)	(5)	(6)
ln(expected income prim.)$_{t-1}$	0.052**	0.057**	0.025	-0.016	-0.020	-0.076*
	(0.024)	(0.023)	(0.046)	(0.021)	(0.022)	(0.041)
ln(expected income sec.)$_{t-1}$	0.021	0.036	0.191***	0.125***	0.130***	0.266***
	(0.028)	(0.027)	(0.066)	(0.027)	(0.027)	(0.057)
Local unemployment rate$_t$	-0.024***	-0.027***	-0.023***	-0.014***	-0.008*	-0.005
	(0.004)	(0.005)	(0.006)	(0.003)	(0.004)	(0.005)
Observations	2630	2630	2630	2770	2770	2770
Individual FE	No	No	Yes	No	No	Yes
Year FE	No	Yes	Yes	No	Yes	Yes
Other controls	No	Yes	Yes	No	Yes	Yes
Year x Macro-region FE	No	Yes	Yes	No	Yes	Yes
Blundell-Bond	No	No	Yes	No	No	Yes

Note. Standard errors clustered at the individual level in parentheses (*** p<0.01, ** p<0.05, * p<0.1). Controls: age, population living in the municipality, average net wage in the municipality, precipitation on the day and in the year of the interview, macro-region-specific time fixed effects by introducing interaction terms between the year fixed effects and macro-region indicators.

Multiple signals | Heterogeneity by gender | Heterogeneity by parental education | Unemployment rate definition | Non-linearities | Learning on bounds

Flexibly estimating expectation formation

Models used so far assume that expectation formation is homogeneous across the population

- Estimate a flexible model of expectation formation taking into account past expectations, unemployment shocks and parental education

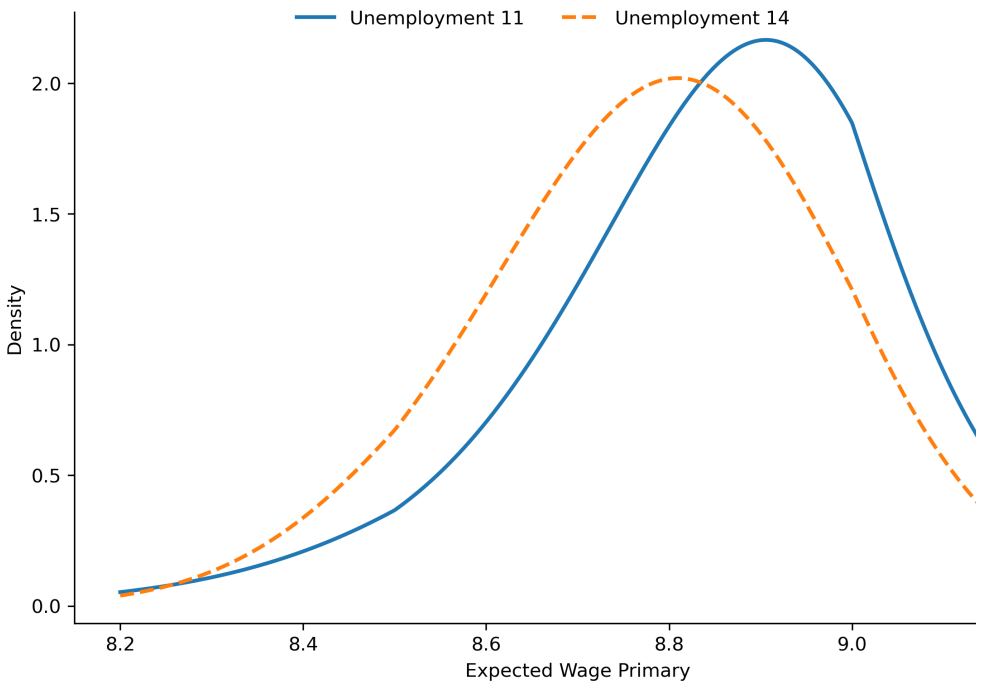
Distributional Regression to estimate distribution of expectations conditional on control variables

- Gaussian Representation to estimate distribution of expectations (Spady and Stouli, forthcoming)
- Objective function:

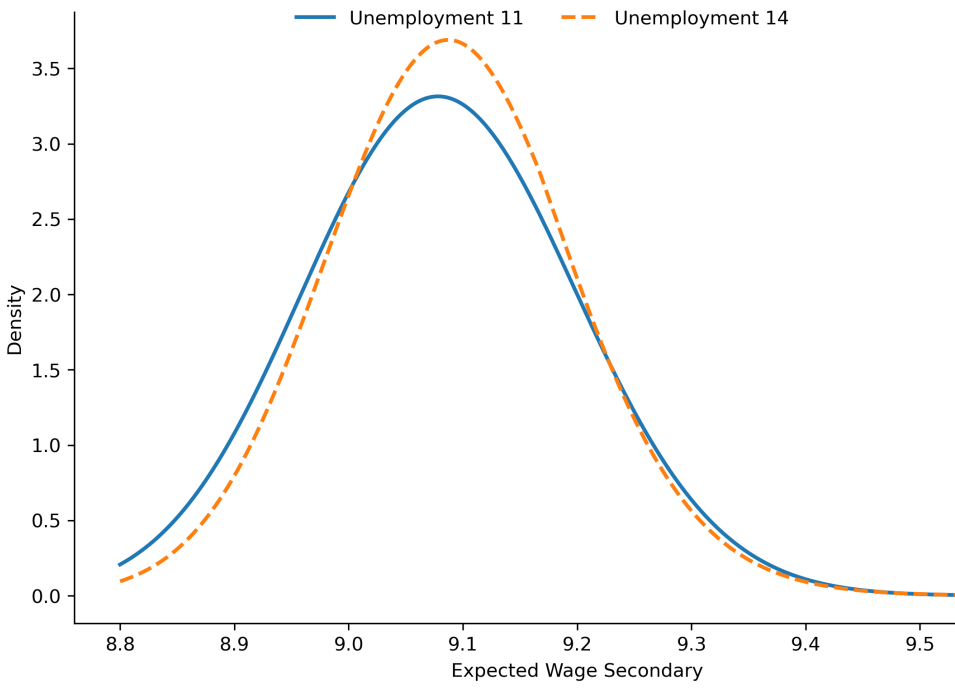
$$g(Y, X) = \beta\, S(Y) \otimes W(X)$$

- g is the gaussian representation of the target distribution
- S, W are flexible functions of outcomes and control variables

Marginal Distributions



(a) Primary Estimation



(b) Secondary Estimation

Figure: Effect of an Unemployment Shock on Expected Wages

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Dynamic discrete choice with expectation revision

Parents, together with their children, choose the level of attendance and enrollment in each period in secondary school

We model the **trade-off** between:

1. Completing secondary school to enjoy higher wage in the future
2. Dropping out of school and receiving a lower wage today

Two key features of the model:

1. Choices based on **expected wages** from primary and secondary school
2. Expected wages are **revised via local unemployment shocks**

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Key ingredients of the model

- **Time:** 3 periods $T = \{1, 2, 3\}$
- **Choices:** School attendance decision $d_t \in \{1, 2, 3, 4, W\}$
  - $1 =$ very low attendance; $4 =$ high attendance
  - $W =$ dropout (no attendance)
- **Graduation Probability:** After period 3, a lottery determines high school graduation
  - Probability depends on final-period attendance: $P_{\text{sec}}(d_{i3})$
- **Beliefs about age-25 wages:**
  - Primary education: $\hat{Y}_{it}^{\text{prim}}$
  - Secondary education: $\hat{Y}_{it}^{\text{sec}}$
- **State space:** s_{it}
  - Human capital (years of schooling): H_{it}
  - Previous period's decision: d_{it-1}
  - Expected wage with primary education: $\hat{Y}_{it-1}^{\text{prim}}$
  - Expected wage with secondary education: $\hat{Y}_{i}^{\text{sec}}$
  - Local unemployment rate: U_{it}
  - Parental Education: H^P
  - Type: θ_i (affected by parental assets and municipality type)
- **Estimation:** The model is estimated using *indirect inference* More

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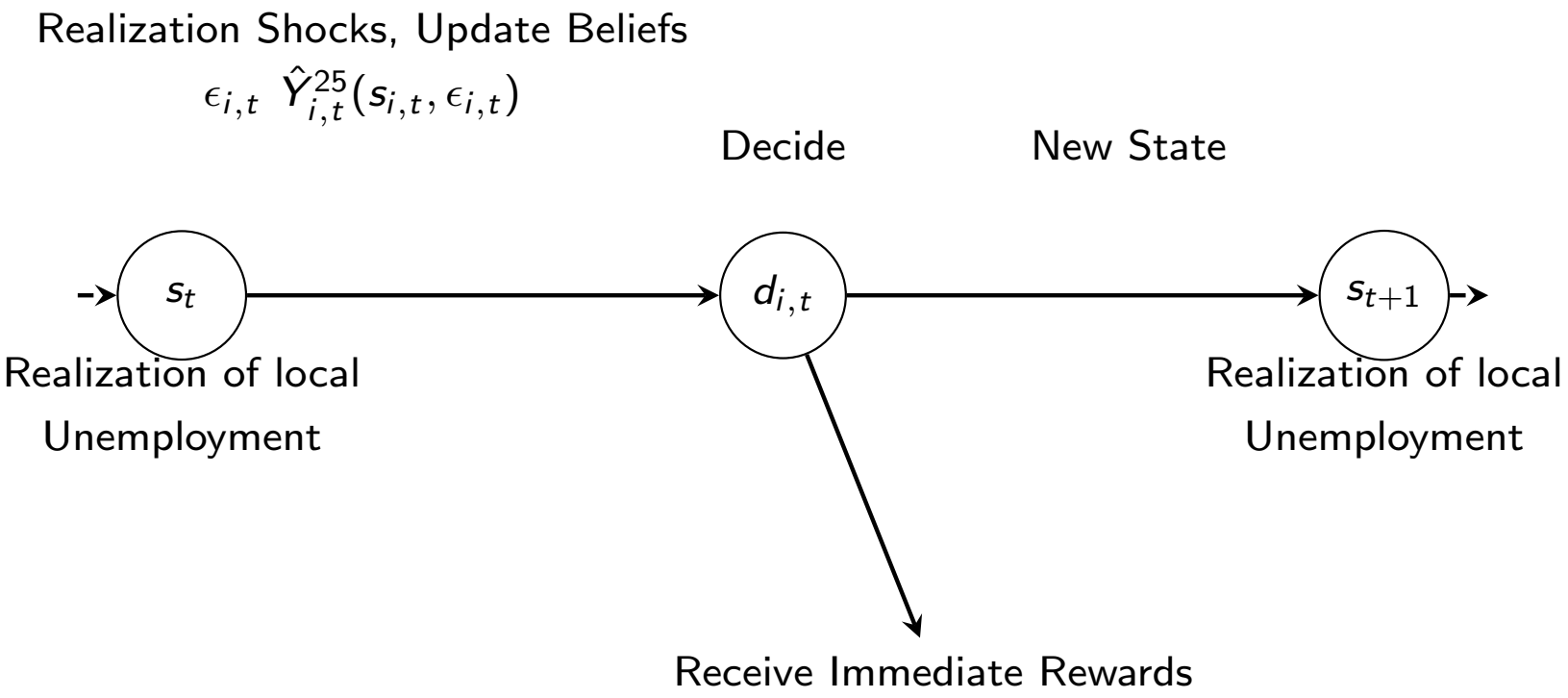
Timing


Realization Shocks, Update Beliefs
$\epsilon_{i,t}$ $\hat{Y}^{25}_{i,t}(s_{i,t}, \epsilon_{i,t})$
Decide
New State
s_t
$d_{i,t}$
s_{t+1}
Realization of local Unemployment
Realization of local Unemployment
Receive Immediate Rewards

Rewards and Expectations

If people decide to dropout and work they receive the discounted lifetime value of their expected primary wage:

$$\sum_{\tau=1} \delta^t \hat{Y}_{i,t}^{prim}$$

Value associated with choosing a certain attendance level:

$$V_{i,t}(d,s) = U_d(s) + \delta * E[max_d\{V_{i,t+1}\}]$$

The utility is specified as follows:

$$U_d^E = \beta_{d,0}^E + \beta_{d,1}^E * H_i + \beta_3^E * d_{i,t-1} + \epsilon_{i,d,t}^E$$

Value of choosing certain attendance in the last period:

$$V_i(d,s_t) = U_d(s) + P_{sec}(d) * \sum_{\tau=1}^{T} \delta^t \hat{Y}_{i,t}^{sec} + (1 - P_{prim}(d)) \sum_{\tau=1}^{T} \delta^t \hat{Y}_{i,t}^{prim}$$

Transitions and Shocks

- Expectation dynamics are derived from distributional regression results
- Derive probability distribution of expectations for each point on the state space: $P(\hat{Y}^{prim}_{i,t-1}, \hat{Y}^{sec}_{i,t-1}, U_{i,t}, H^P)$
- People use expectations as best guess and do not form expectations about how expectations change
- Extreme value taste shocks
- Graduation probability is estimated outside of the model for each attendance level

Solution & Estimation

- Solved with simple backward induction
- Estimated with indirect inference
- M_D is the observed set of moments and $M_S(\theta)$ is the simulated set of moments associated with θ.
- Choose parameters θ to minimize the following criterion function:

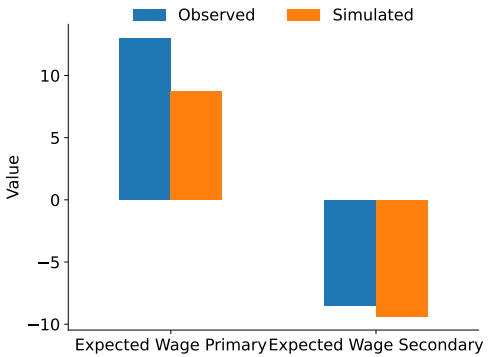
$$\hat{\theta} = argmin_{\theta \in \Theta} \, (M_D - M_S(\theta)) W^{-1} (M_D - M_S(\theta))' \tag{1}$$

Summary of moments used in the estimation

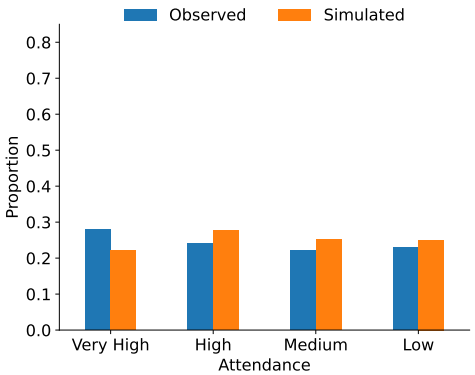
Type of Moment	Number
I. Attendance or dropout by lagged attendance	40
II. Attendance or dropout by tertile of return expectations	15
III. Graduation rates by income, wealth and spatial unit	8
IV. Coefficients of a regression of enrollment on expectations	7
V. Coefficients of a regression of attendance on expectations	2
VI. Average Expectations	2
VII. Average enrollment rate	1

Note: This table summarizes all 85 moments used to estimate the model. The left column indicates a particular category of statistics, and the right column indicates the number of moments the respective category has. Grades always refer to grades at the end of vocational school.

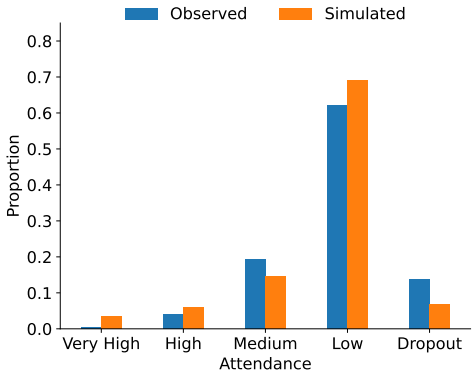
Model Fit: Structural Estimates



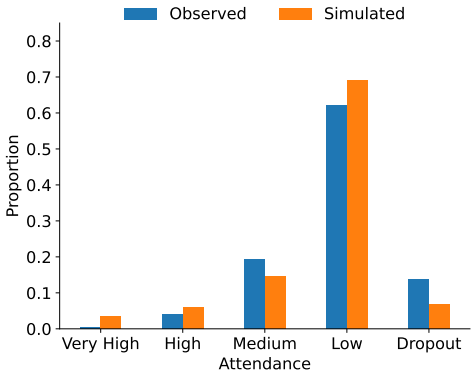
(a) Attendance Coefficient



(b) Initial Choice

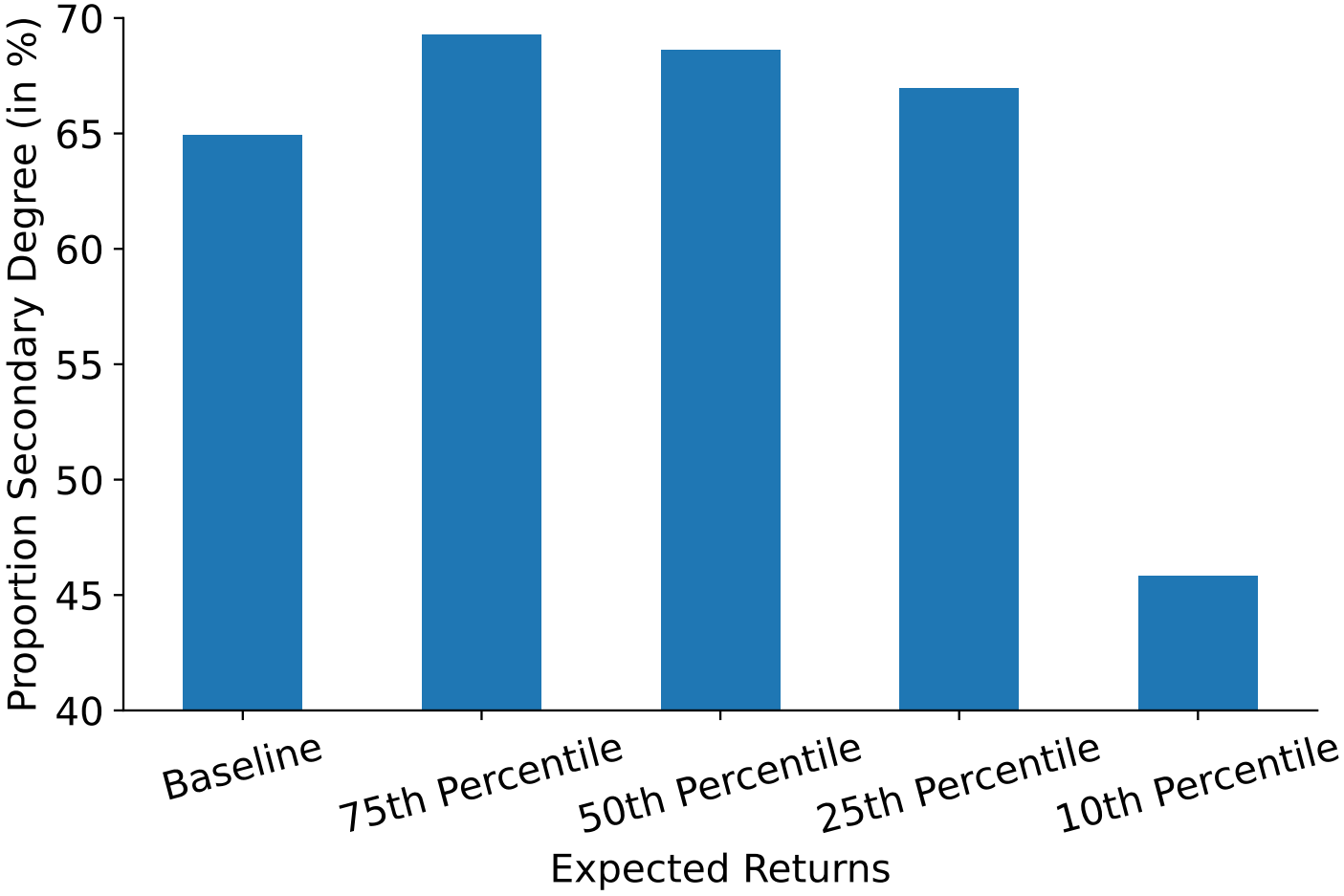


(c) Period 2: Low Attendance Lagged

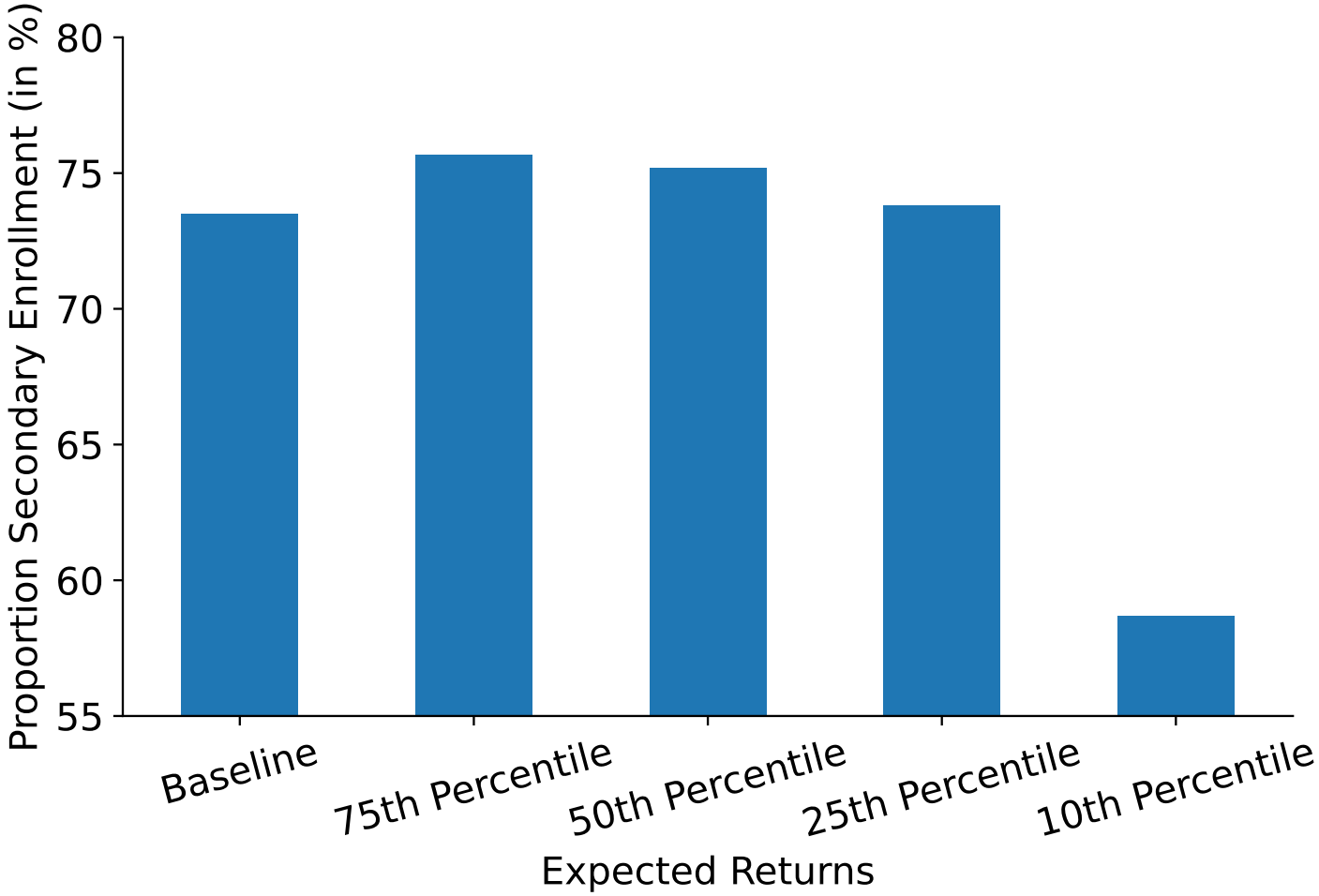


(d) Period 3: Low Attendance Lagged

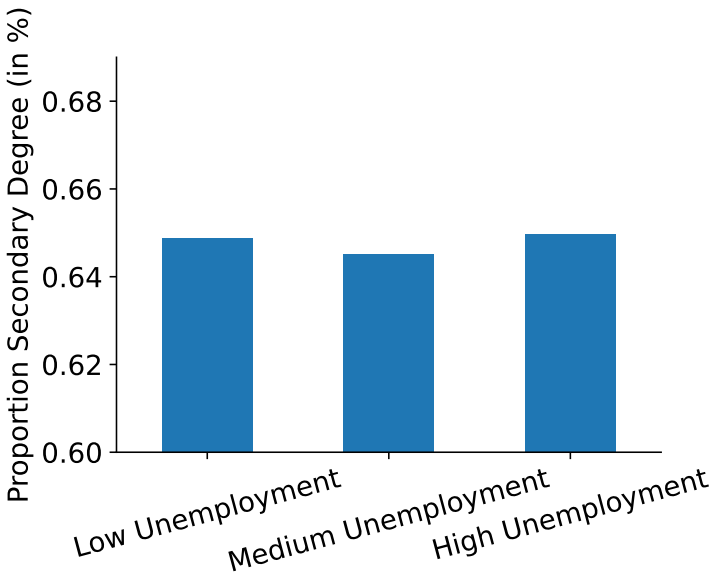
Counterfactual: Fixed return expectations



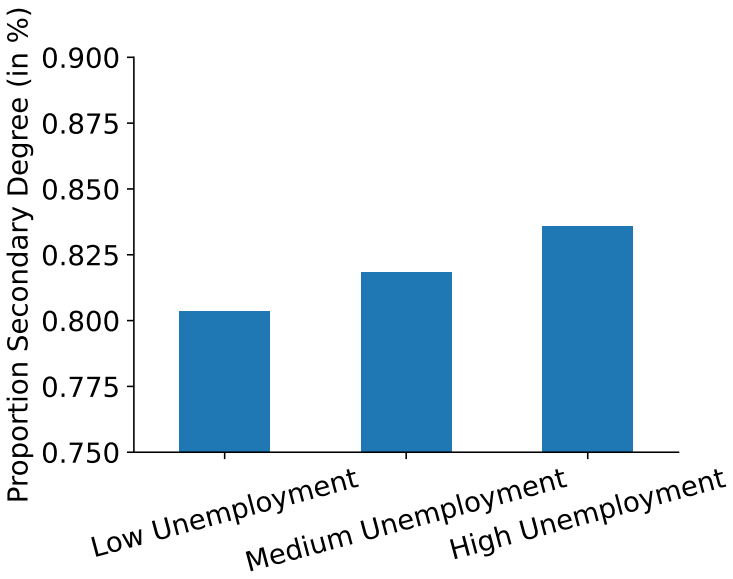
Counterfactual simulation: Fixed return expectations



Counterfactual Simulation: Unemployment Shocks

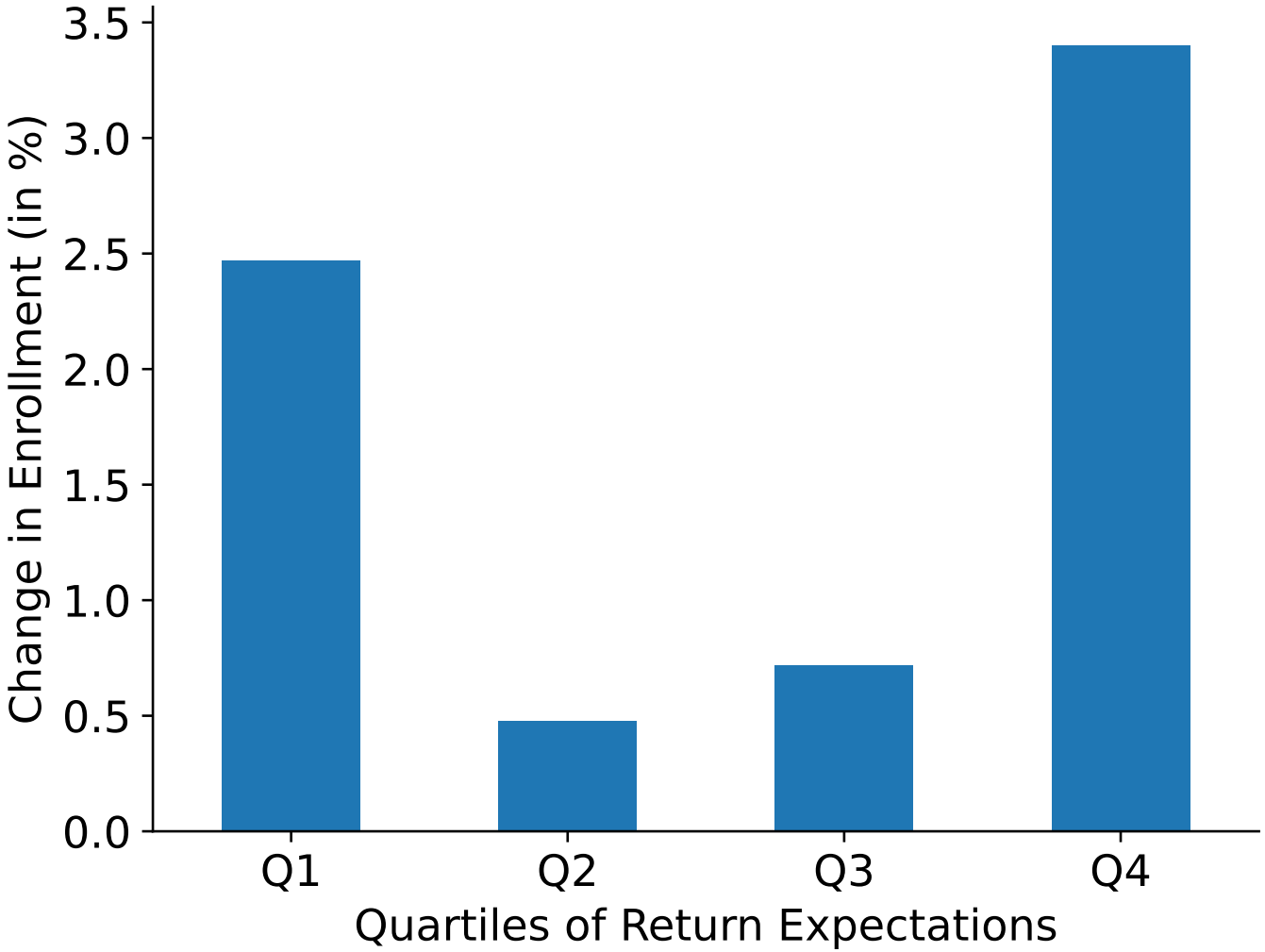


(a) Period 1

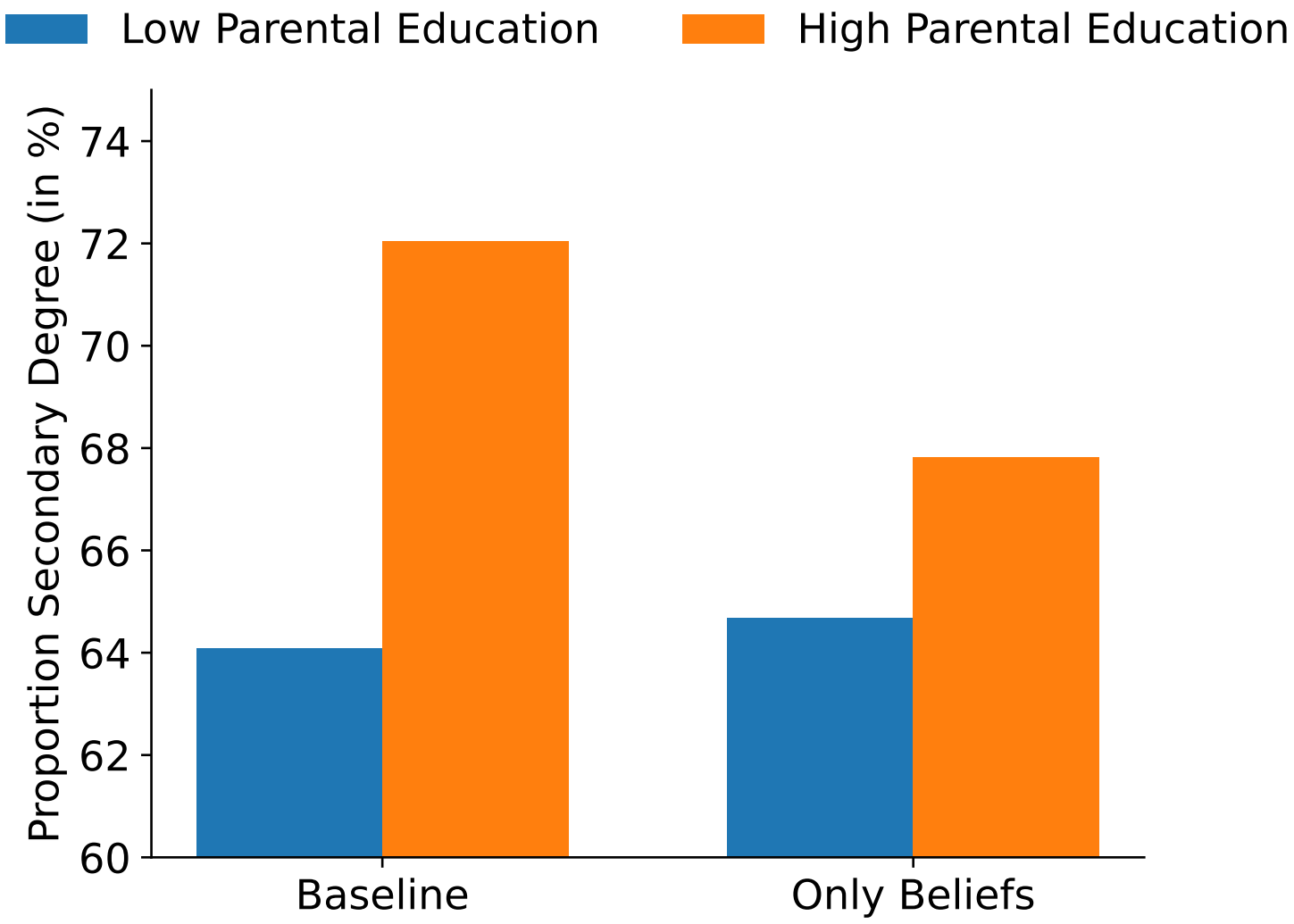


(b) Period 2

Counterfactual simulation: effect of increased subsidies by return expectations



Decomposing graduation gradient by parental education



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Local labor market shocks → Perceived returns to secondary education → Educational investment

Approach: Reduced-form and dynamic structural model, using:

1. Longitudinal survey data on expected returns to education
2. Administrative data: local unemployment rates & secondary school records

Findings:

1. Local labor market variation influences parental expectations
2. Expectation updating drives educational investment decisions over time

Work-in-progress:

1. Additional counterfactual simulations (e.g., info campaigns)

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Learning equation estimates back

Dependent variable:	Expected income (prim.)			Expected income (sec.)		
	(1)	(2)	(3)	(4)	(5)	(6)
L.Expected income (prim.)	0.041	0.054**	0.013	-0.022	-0.026	-0.077*
	(0.025)	(0.024)	(0.047)	(0.022)	(0.022)	(0.042)
L.Expected income (sec.)	0.017	0.011	0.206***	0.120***	0.123***	0.282***
	(0.029)	(0.028)	(0.068)	(0.027)	(0.028)	(0.061)
Local unemployment rate	-0.026***	-0.025***	-0.004	-0.012***	-0.004	0.020
	(0.004)	(0.006)	(0.021)	(0.004)	(0.005)	(0.020)
Return to Schooling	0.004	-0.041***	-0.202	-0.014***	-0.033***	-0.231
	(0.006)	(0.012)	(0.191)	(0.005)	(0.010)	(0.187)
Observations	2387	2387	2387	2512	2512	2512
R^2	0.024	0.088		0.027	0.047	
Individual FE	No	No	Yes	No	No	Yes
Year FE	No	Yes	Yes	No	Yes	Yes
Other controls	No	Yes	Yes	No	Yes	Yes
Year x Macro-region FE	No	Yes	Yes	No	Yes	Yes
Blundell-Bond	No	No	Yes	No	No	Yes

Note. Robust standard errors in parenthesis (*** p<0.01, ** p<0.05, * p<0.1). Unemployment is measured from 1 to 100 percent. Panel of 3 years.

Learning equation estimates by gender back

Dependent variable:	Expected income (prim.)		Expected income (sec.)	
	Female	Male	Female	Male
	(1)	(2)	(3)	(4)
L.Expected income (prim.)	0.113	0.141**		
	(0.088)	(0.060)		
L.Expected income (sec.)			0.162*	0.155**
			(0.086)	(0.067)
Unemployment	-0.021***	-0.038***	-0.003	-0.015**
	(0.008)	(0.009)	(0.007)	(0.008)
Constant	7.961***	7.796***	7.785***	7.876***
	(0.801)	(0.571)	(0.816)	(0.669)
Observations	1116	1282	1214	1374
Mean	8.725	8.803	9.159	9.227
Individual FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes
Year x Macro-region FE	Yes	Yes	Yes	Yes
Blundell-Bond	Yes	Yes	Yes	Yes

Note. Robust standard errors in parenthesis (*** p<0.01, ** p<0.05, * p<0.1). Unemployment is measured from 1 to 100 percent. Panel of 3 years. Moment conditions: $E(\Delta\epsilon_{it}y_{it-2}) = 0$ and $E(\epsilon_{it}\Delta y_{it-1}) = 0$.

Learning equation estimates by parental education

back

Dependent variable:	Expected income (prim.)		Expected income (sec.)	
Education	Low	High	Low	High
	(1)	(2)	(3)	(4)
L.Expected income (prim.)	0.150**	0.097		
	(0.061)	(0.090)		
L.Expected income (sec.)			0.103	0.235***
			(0.073)	(0.081)
Unemployment	-0.029***	-0.031***	-0.015**	-0.001
	(0.009)	(0.009)	(0.008)	(0.008)
Constant	7.607***	7.980***	8.337***	6.940***
	(0.541)	(0.851)	(0.681)	(0.809)
Observations	1286	984	1388	1067
Mean	8.748	8.785	9.170	9.231
Individual FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes
Year x Macro-region FE	Yes	Yes	Yes	Yes
Blundell-Bond	Yes	Yes	Yes	Yes

Note. Robust standard errors in parenthesis (*** p<0.01, ** p<0.05, * p<0.1). Unemployment is measured from 1 to 100 percent. Panel of 3 years. Moment conditions: $E(\Delta\epsilon_{it}y_{it-2}) = 0$ and $E(\epsilon_{it}\Delta y_{it-1}) = 0$.

Learning equation estimates - expected income by ethnicity

Dependent variable:	Expected income (prim.)		Expected income (sec.)	
Macedonian	Yes	No	Yes	No
	(1)	(2)	(3)	(4)
L.Expected income (prim.)	0.100	0.164**		
	(0.073)	(0.070)		
L.Expected income (sec.)			0.168**	0.157**
			(0.072)	(0.078)
Unemployment	-0.045***	-0.020**	-0.021**	-0.002
	(0.009)	(0.009)	(0.008)	(0.007)
Constant	7.932***	7.343***	7.874***	7.718***
	(0.660)	(0.675)	(0.688)	(0.762)
Observations	1364	1034	1497	1091
Mean	8.769	8.764	9.195	9.196
Individual FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes
Year x Macro-region FE	Yes	Yes	Yes	Yes
Blundell-Bond	Yes	Yes	Yes	Yes

Note. Robust standard errors in parenthesis (*** p<0.01, ** p<0.05, * p<0.1). Unemployment is measured from 1 to 100 percent. Panel of 3 years. Moment conditions: $E(\Delta\epsilon_{it}y_{it-2}) = 0$ and $E(\epsilon_{it}\Delta y_{it-1}) = 0$.

Expectation elicitation back

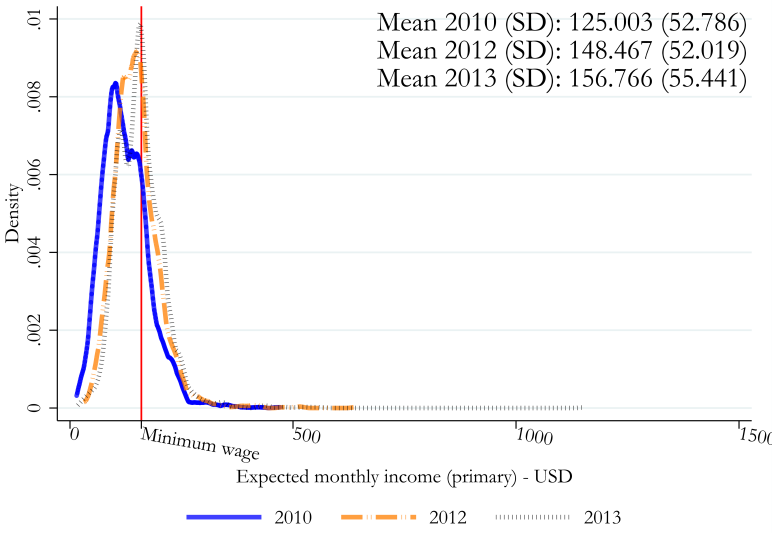
First, a 0-100 ruler was used as visual aid and was initially presented using an example linking the chances of rain with the chosen scale to help respondents.

Second, the responded was asked the following:

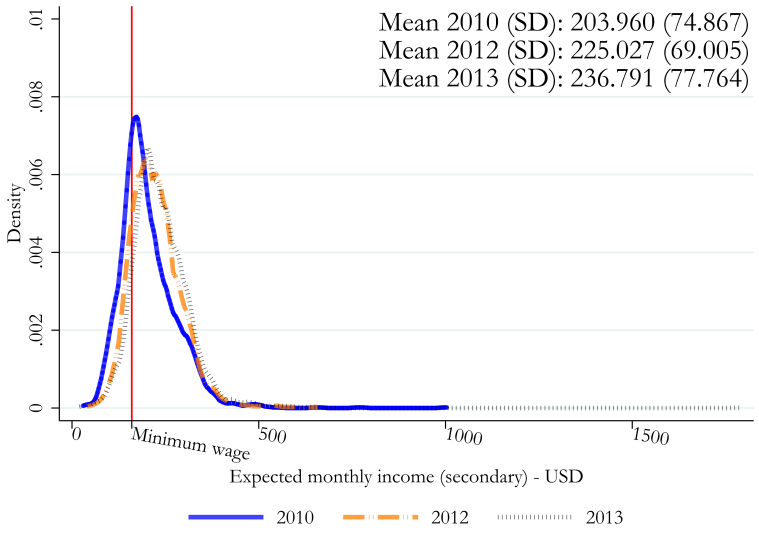
1. Imagine that at age 25, your child's highest level of education attained is primary (secondary).
   1. How likely it is that at age 25, he/she will be employed?
2. Now imagine that, at age 25, your child completed only primary (secondary) school and he/she finds a job. Try to imagine which possible job could he/she be employed in and imagine which could be the maximum and the minimum that he/she could earn, given
   1. In the worst of the cases, how much do you think he/she could earn per month?
   2. In the best of the cases, how much do you think he/she could earn per month?
   3. Now using the ruler, could you indicate how likely it is that:
      1. he/she is going to earn at least (equal or less) than $[(2a) + (2b)]/2$ Denars?
      2. he/she is going to earn more than $[(2a) + (2b)]/2$ Denars?

Expected income from primary and secondary school

Primary



Secondary

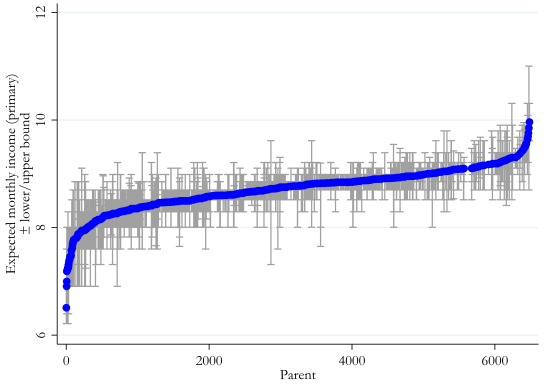


back

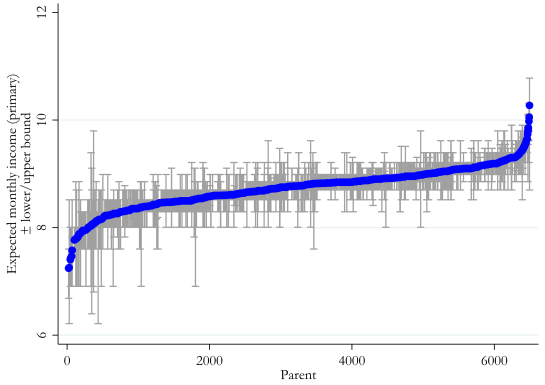
Expected income from primary with uncertainty

Expected income (primary)

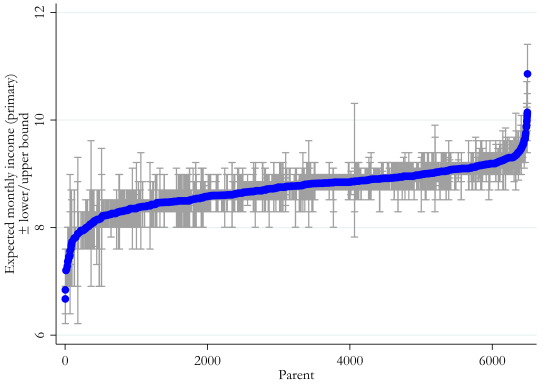
2010



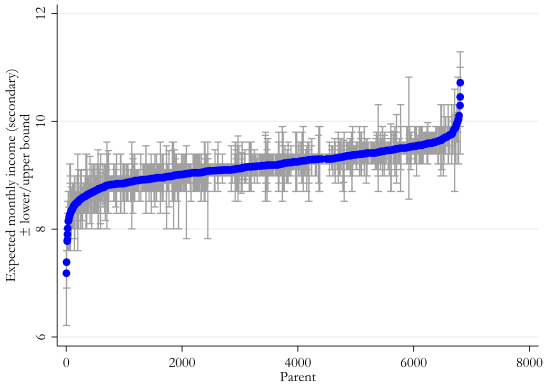
2012

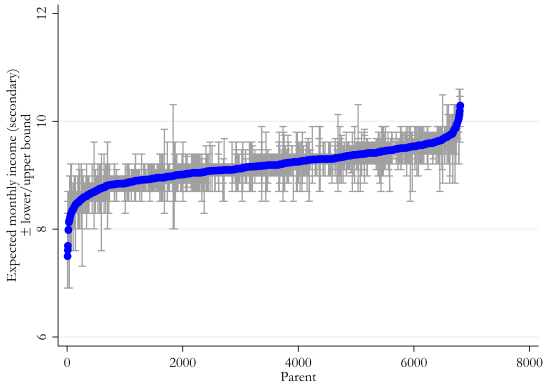


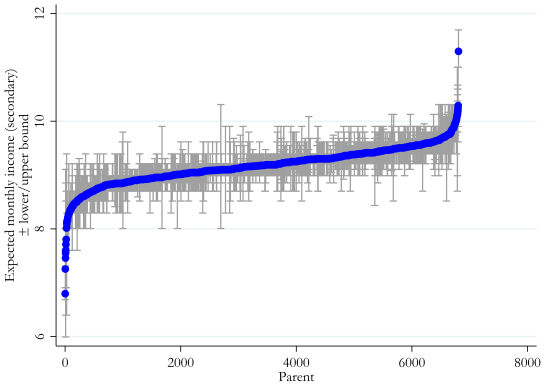
2013



Expected income (secondary)







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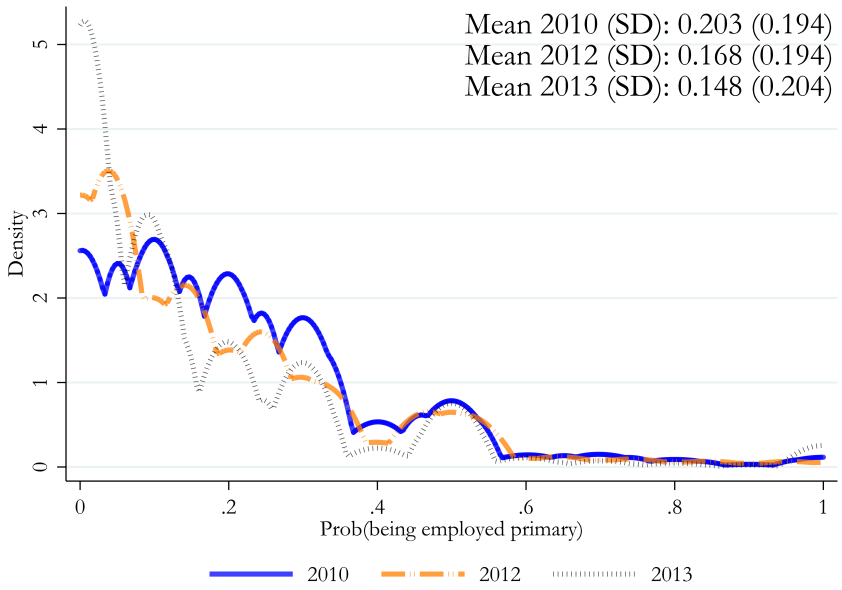
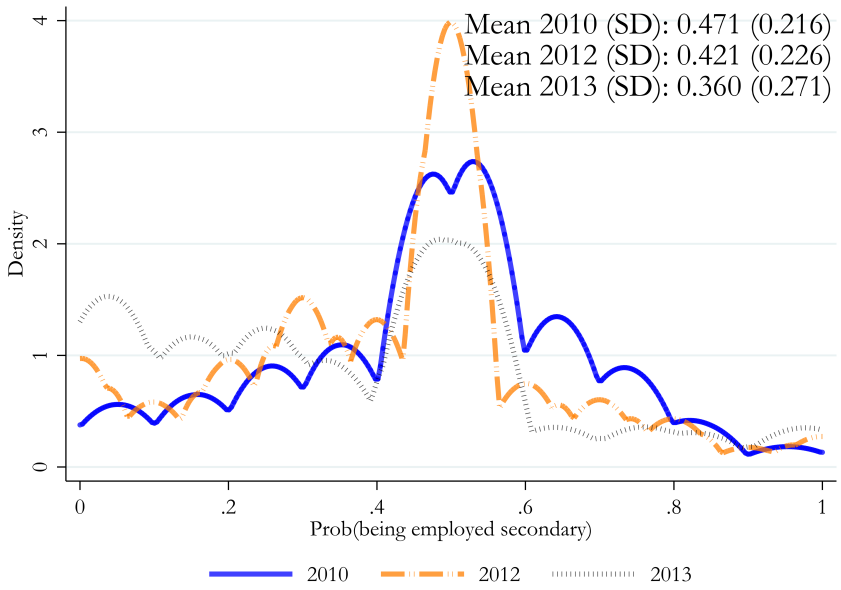
Probability employed conditional on primary and secondary school

Primary



Secondary



back

Expectation formation - unemployment rate definition

Dependent variable:	Expected income (prim.)			Expected income (sec.)		
	(1)	(2)	(3)	(4)	(5)	(6)
L.Expected income (prim.)	0.068***	0.054**	0.022	-0.017	-0.023	-0.077*
	(0.024)	(0.024)	(0.046)	(0.022)	(0.022)	(0.041)
L.Expected income (sec.)	0.017	0.039	0.189***	0.135***	0.134***	0.262***
	(0.028)	(0.027)	(0.065)	(0.027)	(0.027)	(0.057)
Local unemployment rate (0-50km)	-0.015***	-0.009**	-0.011**	-0.010***	0.003	0.001
	(0.003)	(0.004)	(0.005)	(0.003)	(0.004)	(0.004)
Local unemployment rate (50-100km)	0.013***	0.034***	0.022*	-0.008*	0.025***	0.019*
	(0.005)	(0.010)	(0.011)	(0.004)	(0.009)	(0.010)
Local unemployment rate (>100km)	0.006	0.016*	0.022**	0.014***	0.012	0.017*
	(0.006)	(0.009)	(0.010)	(0.005)	(0.008)	(0.009)
Observations	2623	2623	2623	2763	2763	2763
Individual FE	No	No	Yes	No	No	Yes
Year FE	No	Yes	Yes	No	Yes	Yes
Other controls	No	Yes	Yes	No	Yes	Yes
Year x Macro-region FE	No	Yes	Yes	No	Yes	Yes
Blundell-Bond	No	No	Yes	No	No	Yes

Note. Standard errors clustered at the individual level in parentheses (*** p<0.01, ** p<0.05, * p<0.1). Controls: age, population living in the municipality, average net wage in the municipality, precipitation on the day and in the year of the interview, macro-region-specific time fixed effects by introducing interaction terms between the year fixed effects and macro-region indicators.

back

Expectation formation - square

Dependent variable:	Expected income (prim.)			Expected income (sec.)		
	(1)	(2)	(3)	(4)	(5)	(6)
L.Expected income (prim.)	0.052**	0.057**	0.025	-0.016	-0.020	-0.074*
	(0.024)	(0.023)	(0.046)	(0.021)	(0.022)	(0.041)
L.Expected income (sec.)	0.021	0.036	0.191***	0.126***	0.130***	0.266***
	(0.028)	(0.027)	(0.066)	(0.027)	(0.027)	(0.057)
Local unemployment rate	0.017	-0.029	-0.049	0.011	-0.013	0.017
	(0.039)	(0.043)	(0.048)	(0.030)	(0.032)	(0.038)
Local unemployment rate (squared)	-0.001	0.000	0.001	-0.001	0.000	-0.001
	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
Observations	2630	2630	2630	2770	2770	2770
Individual FE	No	No	Yes	No	No	Yes
Year FE	No	Yes	Yes	No	Yes	Yes
Other controls	No	Yes	Yes	No	Yes	Yes
Year x Macro-region FE	No	Yes	Yes	No	Yes	Yes
Blundell-Bond	No	No	Yes	No	No	Yes

Note. Standard errors clustered at the individual level in parentheses (*** p<0.01, ** p<0.05, * p<0.1). Controls: age, population living in the municipality, average net wage in the municipality, precipitation on the day and in the year of the interview, macro-region-specific time fixed effects by introducing interaction terms between the year fixed effects and macro-region indicators.

back

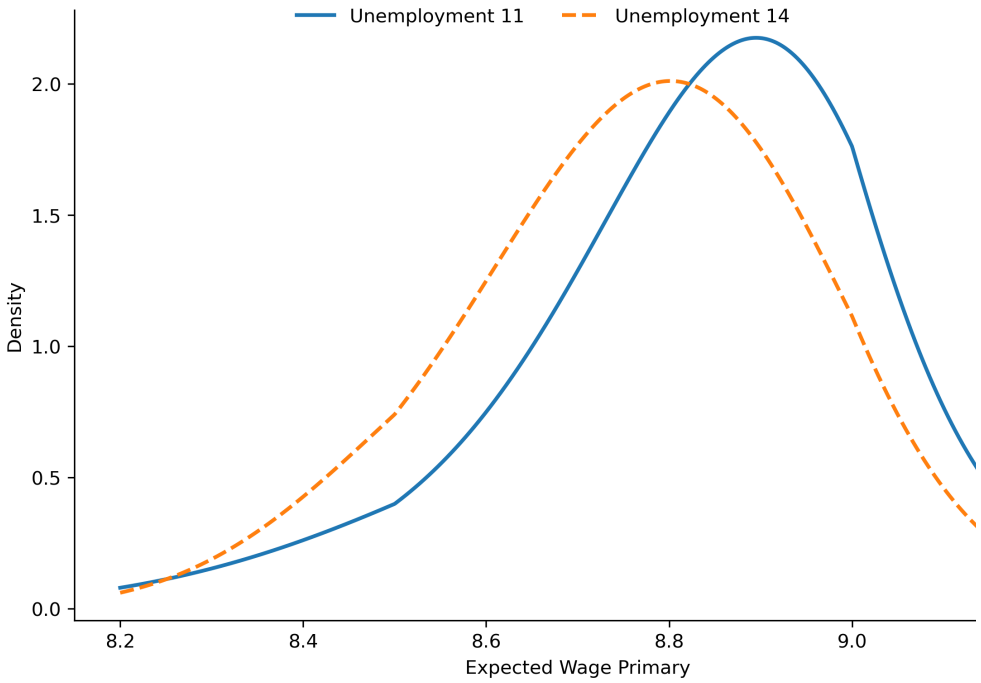
Expectation formation - bounds

Dependent variable:	Expected income (prim.)			Expected income (sec.)		
	Mean	Worst	Best	Mean	Worst	Best
	(1)	(2)	(3)	(4)	(5)	(6)
L.Expected income (prim.)	0.025			-0.076*		
	(0.046)			(0.041)		
L.Expected income (sec.)	0.191***			0.266***		
	(0.066)			(0.057)		
L.Log Salary (worst case, primary)		0.023			-0.077*	
		(0.053)			(0.041)	
L.Log Salary (best case, primary)			0.043			-0.033
			(0.053)			(0.060)
L.Log Salary (worst case, secondary)		0.221***			0.265***	
		(0.085)			(0.066)	
L.Log Salary (best case, secondary)			0.180**			0.201***
			(0.071)			(0.068)
Local unemployment rate	-0.023***	-0.021***	-0.025***	-0.005	0.004	-0.017***
	(0.006)	(0.007)	(0.006)	(0.005)	(0.005)	(0.005)
Observations	2630	2641	2737	2770	2777	2838
Individual FE	No	No	Yes	No	No	Yes
Year FE	No	Yes	Yes	No	Yes	Yes
Other controls	No	Yes	Yes	No	Yes	Yes
Year x Macro-region FE	No	Yes	Yes	No	Yes	Yes
Blundell-Bond	Yes	Yes	Yes	Yes	Yes	Yes

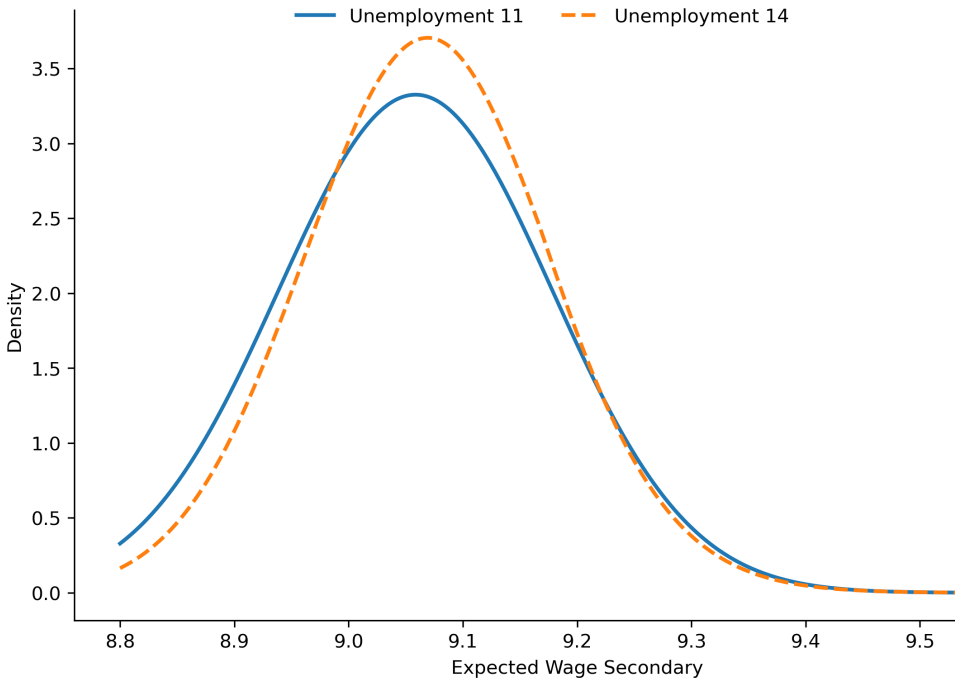
Note. Standard errors clustered at the individual level in parentheses (*** p<0.01, ** p<0.05, * p<0.1). Controls: age, population living in the municipality, average net wage in the municipality, precipitation on the day and in the year of the interview, macro-region-specific time fixed effects by introducing interaction terms between the year fixed effects and macro-region indicators.

back

Marginal Distributions with Low Lagged Expectations



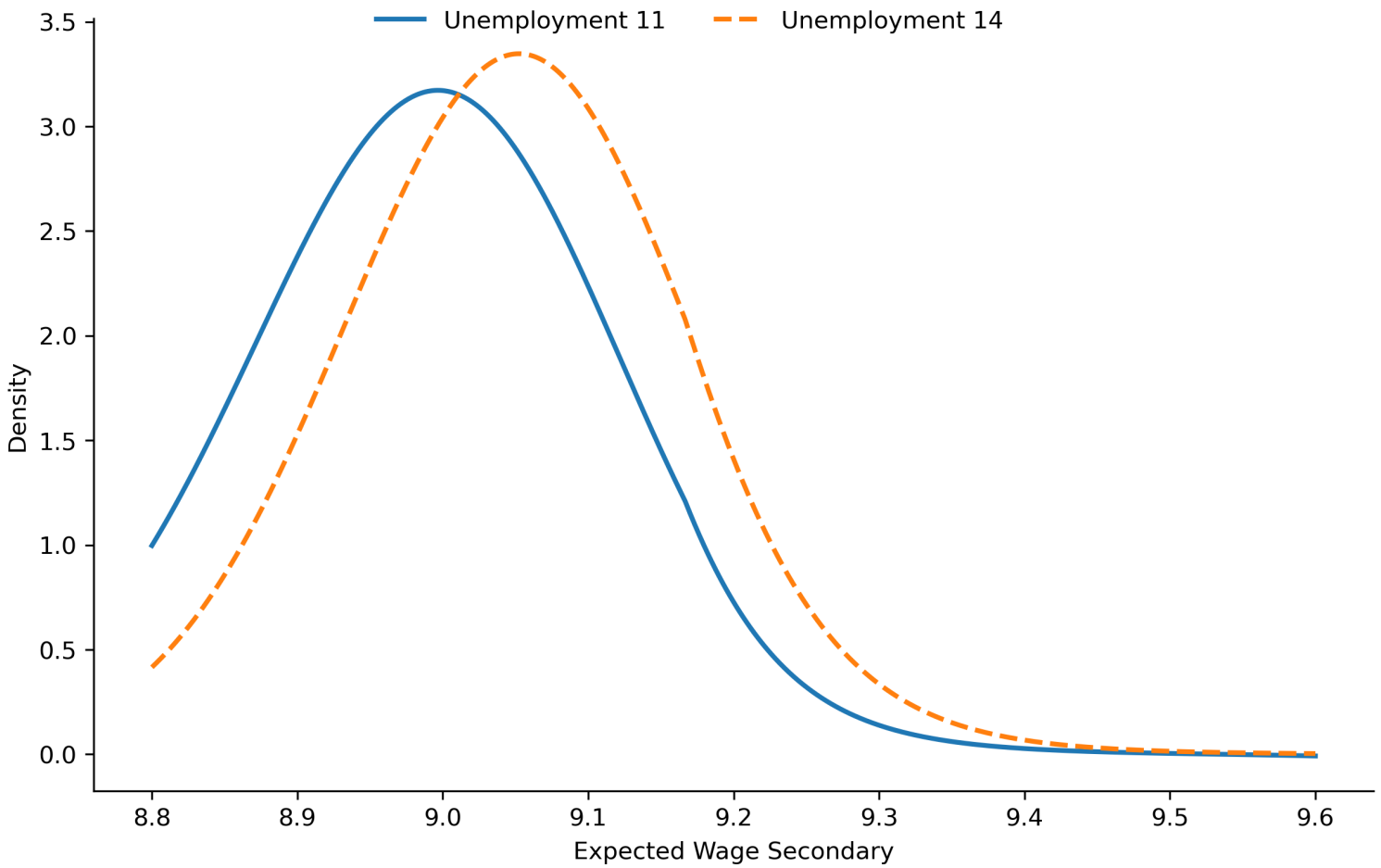
(a) Primary Estimation 2



(b) Secondary Estimation 2

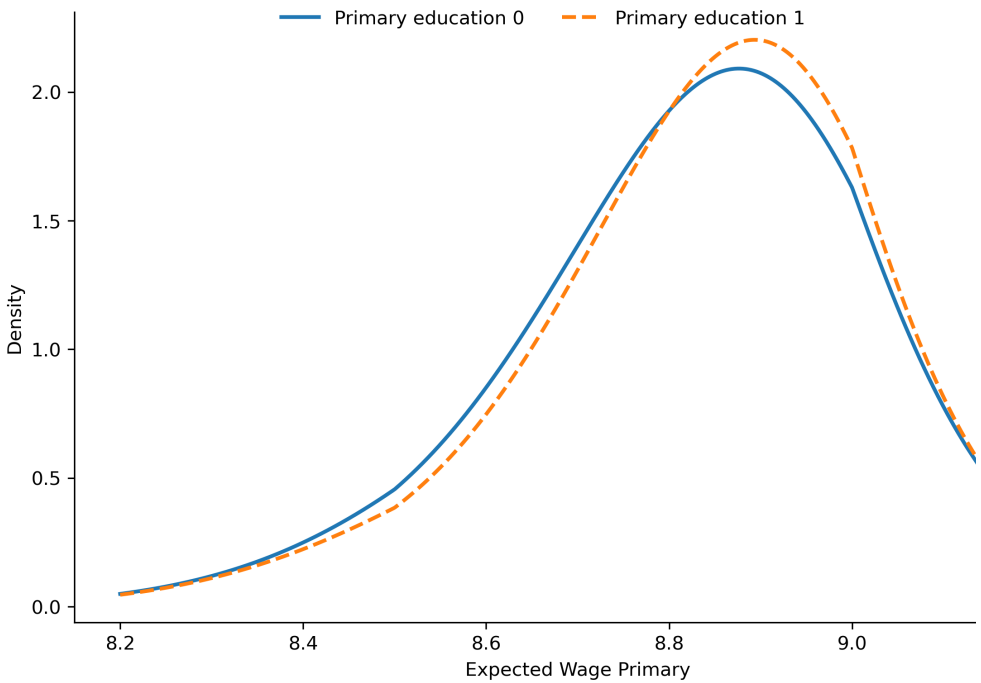
The Effect of Unemployment on Secondary if Primary Expectations are low

Figure: Unemployment Shock on Secondary Expectations with low Realization of Primary Expectations

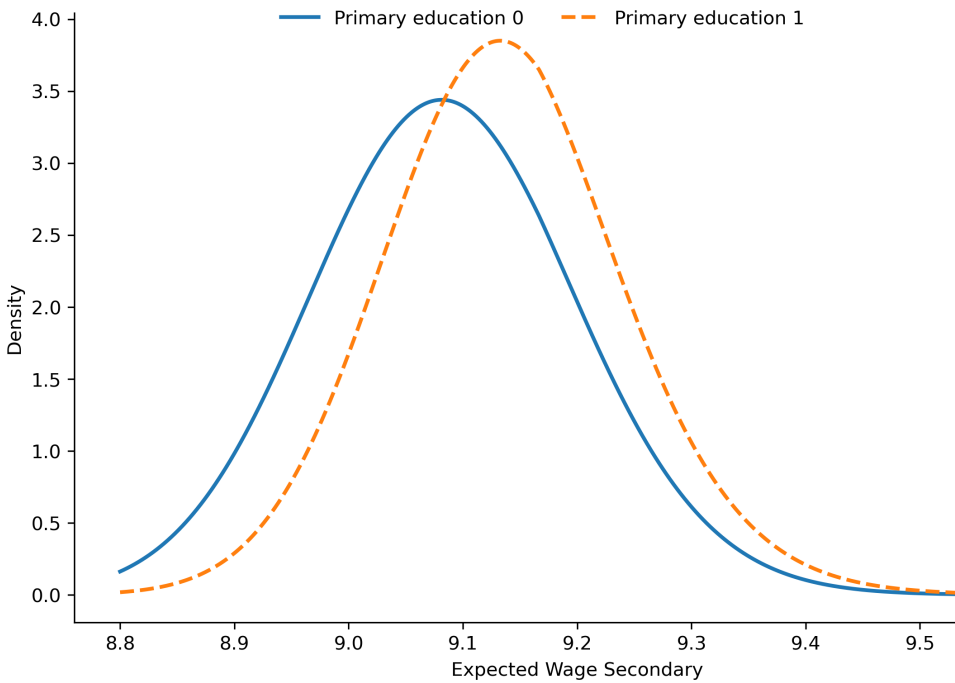


Expectations by Parental Education

Figure: Effect of Parental Education on Expected Wages



(a) Primary Expectations



(b) Secondary Expectations

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