Free Primary Education, Schooling, and Fertility: Evidence from Ethiopia

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Research Summary

- Use a difference-in-differences framework to identify impact of national level education reforms in Ethiopia

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  - Examine the potential mechanisms driving this relationship

Ethiopia: Introduction

- **Population (1994):** 55 million (2nd largest in SSA)
- **GDP per capita (1990; current USD):** $253
- **Avg. Years of Schooling (1994):** 1.33
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- **Government:**

  Post-Communist Transitional Gov't 1991 to 1995

  Federal Republic from 1995 to today

Ethiopia: Education Reform

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- Mother Tongue Education (MTE)
  - Languages and timing decided by central government
  - In first two years, translated eight languages, spoken by 80% of population.

Boothe and Walker (1997); Zenebe Gebre (2014)

Identifying National Education Reforms: Ethiopia

- Use completed schooling data from pre-reform cohorts to introduce within country variation.
  - Calculate the "maximum potential magnitude" of reform's effect in each zone (Geographic Variation)
  - Distribute this effect across birth cohorts, while taking into the account school entry decision (Temporal Variation)

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  - Use data available for most countries
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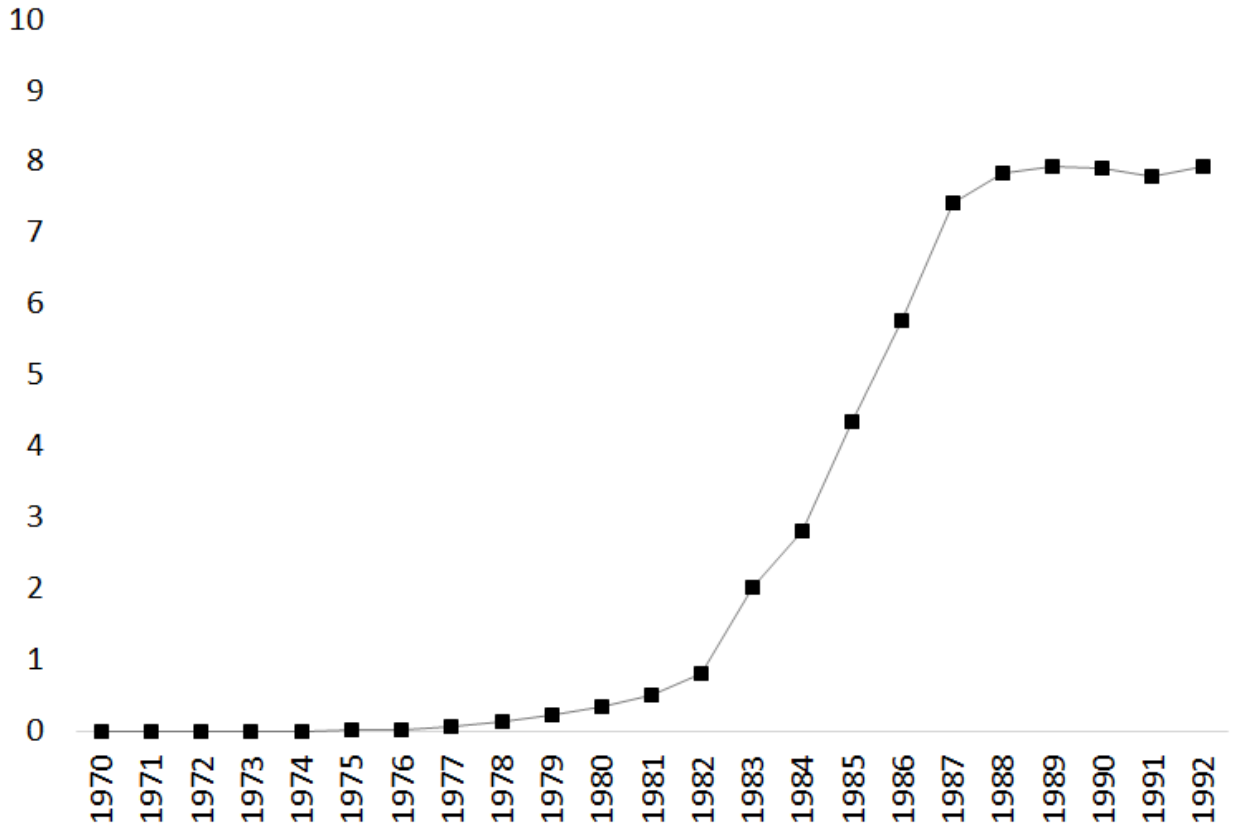
- Apply this concept to Ethiopia

Ethiopia: Regions

Ethiopia: Zones

Intensity of Reform: FPE



Additional Free Years of Schooling, by Birth Cohort

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- Second Wave (93):
  - Somaligna (3); Hadiyigna (9); Gedeogna (12); Kembatigna (14)

Boothe and Walker (1997); Zenebe Gebre (2014)

Introducing Mother Tongue Education

Language	Year	Region	Grades	Fraction of: MT Speakers Living in Region	Fraction of: Region Speaking Language as MT
Tigrigna	**1991**	Tigray	**1-8**	0.93	0.95
Oromigna	**1992**	Oromia	**1-8**	0.93	0.84
		Dire Dawa	**1-6**	< 0.01	0.47
Sidamigna	**1992**	SNNPR	**1-4**	0.99	0.18
Wolayitigna	**1992**	SNNPR	**1-4**	0.97	0.11
Hadiyigna	**1993**	SNNPR	**1-4**	0.96	0.08
Gedeogna	**1993**	SNNPR	**1-4**	0.73	0.04
Kembatigna	**1993**	SNNPR	**1-4**	0.92	0.04

Data

- Census - 2007
  - Sample size
  - Location Data
- Demographic and Health Survey - 2005 / 2011 / 2016 (DHS)
  - Detailed Health Information (Children, Women, Adult Siblings)
  - GPS Location

Estimating Equation: First Stage

$$Y_{izy} = \alpha + I_{zy}\beta + \tau_y + \delta_z + \delta_z Trend_y + X_{izy}\theta + \epsilon_{izy}$$

- Y_{izy}: Outcome of interest for person i, from zone z, born in year y.

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- $\delta_z Trend_y$: Zone specific linear trends
- X_{izy}: Individual controls that include a cubic for age, dummy variable for sex, or region of birth.

Results: First Stage

Effect of FPE and MTE Reforms on Years of Schooling

	Full Sample	No MTE Regions	Full Sample	Without Tigray
	(1)	(2)	(3)	(4)
Add'l Years of Free Schooling $\left(I_{zy}^{FPE}\right)$	0.065			
	(0.062)			
	[0.301]			
Add'l Years of MTE $\left(I_{zy}^{MTE}\right)$				
N	24,898			

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Add'l Years of Free Schooling $\left(I_{zy}^{FPE}\right)$	0.065	0.112**		
	(0.062)	(0.046)		
	[0.301]	[0.021]		
Add'l Years of MTE $\left(I_{zy}^{MTE}\right)$				
N	24,898	13,922		

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	(0.062)	(0.046)		
	[0.301]	[0.021]		
Add'l Years of MTE $\left(I_{zy}^{MTE}\right)$			-0.041	-0.111
			(0.076)	(0.083)
			[0.589]	[0.185]
N	24,898	13,922	24,898	22,500

Combining FPE + MTE

- For Non-MTE Regions

$$\Delta I_{zy} = I_{zy}^{FPE}$$

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$$\Delta I_{zy} = I_{zy}^{FPE} - I_{zy}^{MTE}$$

Results: First Stage

Effect of FPE and MTE Reforms on Years of Schooling

	Without Tigray	Full Sample	+ Census
	(1)	(2)	(3)
Add'l Years of MTE $\left(I_{zy}^{MTE}\right)$	-0.111	-0.109	-0.090
	(0.083)	(0.082)	(0.059)
	[0.185]	[0.187]	[0.134]
$\mathbb{1}[Tigray] \times I_{zy}^{MTE}$		0.249**	0.242***
		(0.107)	(0.085)
		[0.024]	[0.006]
Effect in Tigray		*0.140*	*0.153**
		(0.098)	*(0.079)*
		[0.155]	*[0.058]*
N	22,500	24,898	205,141

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- For Non-MTE Regions

$$\Delta I_{zy} = I_{zy}^{FPE}$$

- For Oromia, Dire Dawa, and SNNPR

$$\Delta I_{zy} = I_{zy}^{FPE} - I_{zy}^{MTE}$$

- For Tigray (approximately)

$$\Delta I_{zy} = I_{zy}^{FPE} + I_{zy}^{MTE}$$

Results: First Stage – Joint Estimator

Effect of FPE and MTE Reforms on Years of Schooling

	DHS Only	+ Census
	(1)	(2)
Add'l Years of Free Schooling without MTE (ΔI_{zy})	0.118***	0.112***
	(0.027)	(0.019)
	[0.000]	[0.000]
F-Stat	19.04	35.92
N	24,898	205,141

Estimation: 2SLS

$$B_{izy} = \alpha + \widehat{Y_{izy}}\beta + \phi_y + \mu_z + \phi_z Trend_y + f(a) + \nu_{izy}$$

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$$Y_{izy} = \theta_0 + \Delta I_{zy}\theta_1 + \tau_y + \delta_z + \delta_z Trend_y + g(a) + \epsilon_{izy}$$

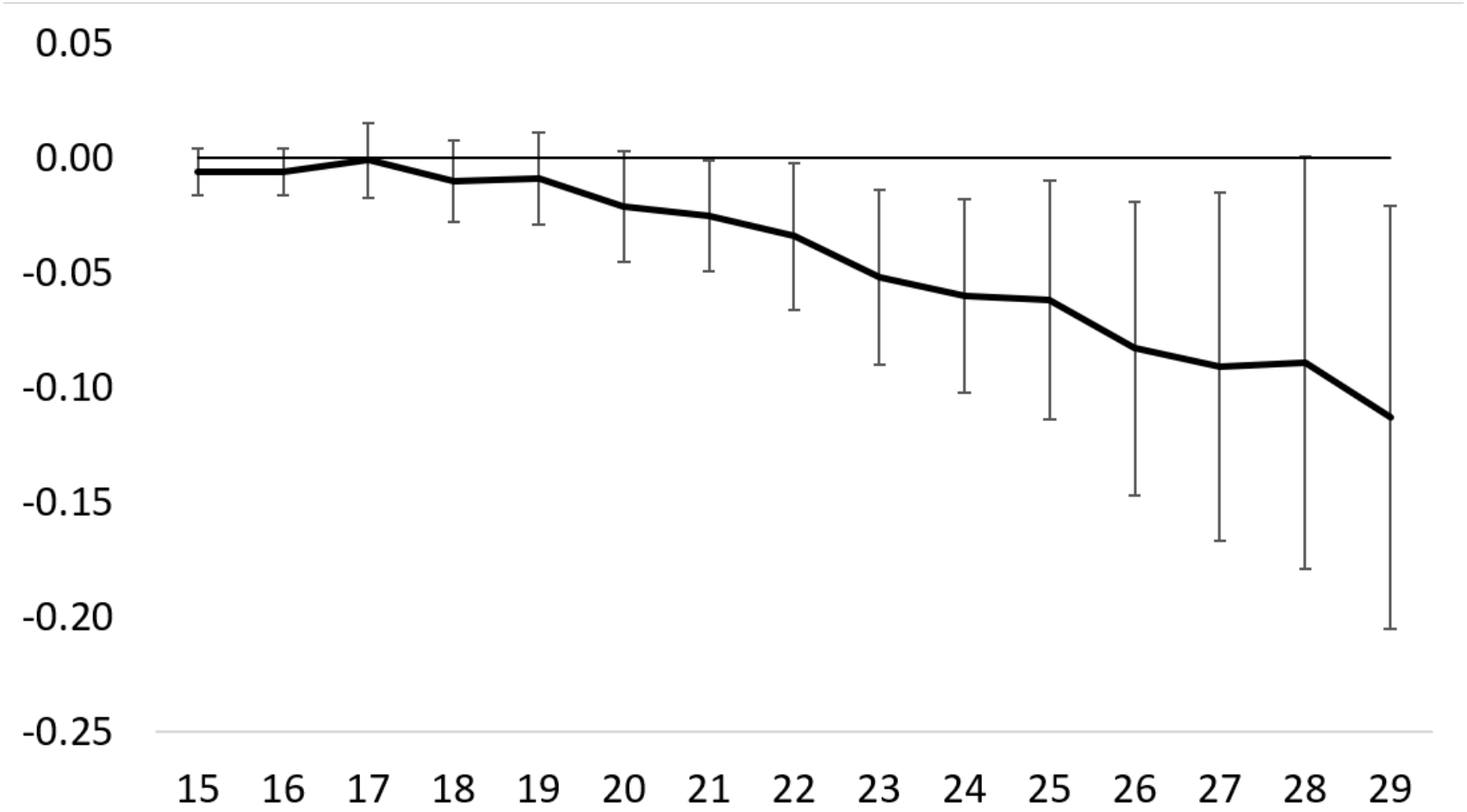
- B_{izy}: Births for women i, from zone z, born in year y.
- Y_{izy}: Years of schooling
- ΔI_{zy}: Years of free schooling beyond MTE
- $\tau_y + \delta_z / \phi_y + \mu_z$: Sets of birth year ($y$) and zone ($z$) fixed effects.
- $\delta_z Trend_y / \phi_z Trend_y$: District specific linear trends
- $f(a) / g(a)$: Cubic for age

Effect of Schooling on Total Children Born

Effect of Years of Schooling on Total Number of Children Born

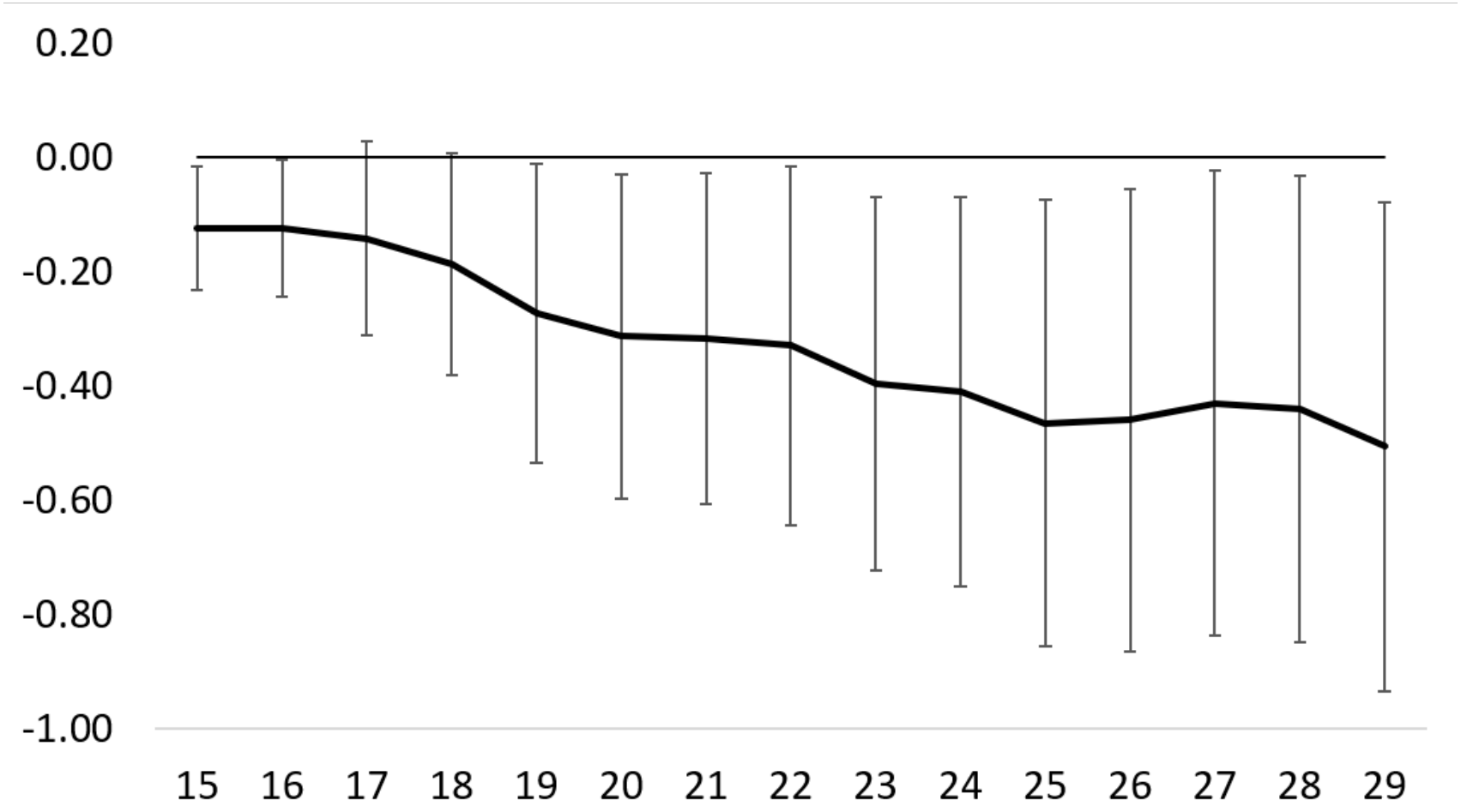
	DHS Only	+ Census
	(1)	(2)
Add'l Years of Free Schooling	-0.335**	-0.272**
without MTE (ΔM_{zy})	(0.157)	(0.118)
	[0.033]	[0.022]
F-Stat	19.04	35.92
N	24,898	205,141

Effect of Reform on Births, by Age



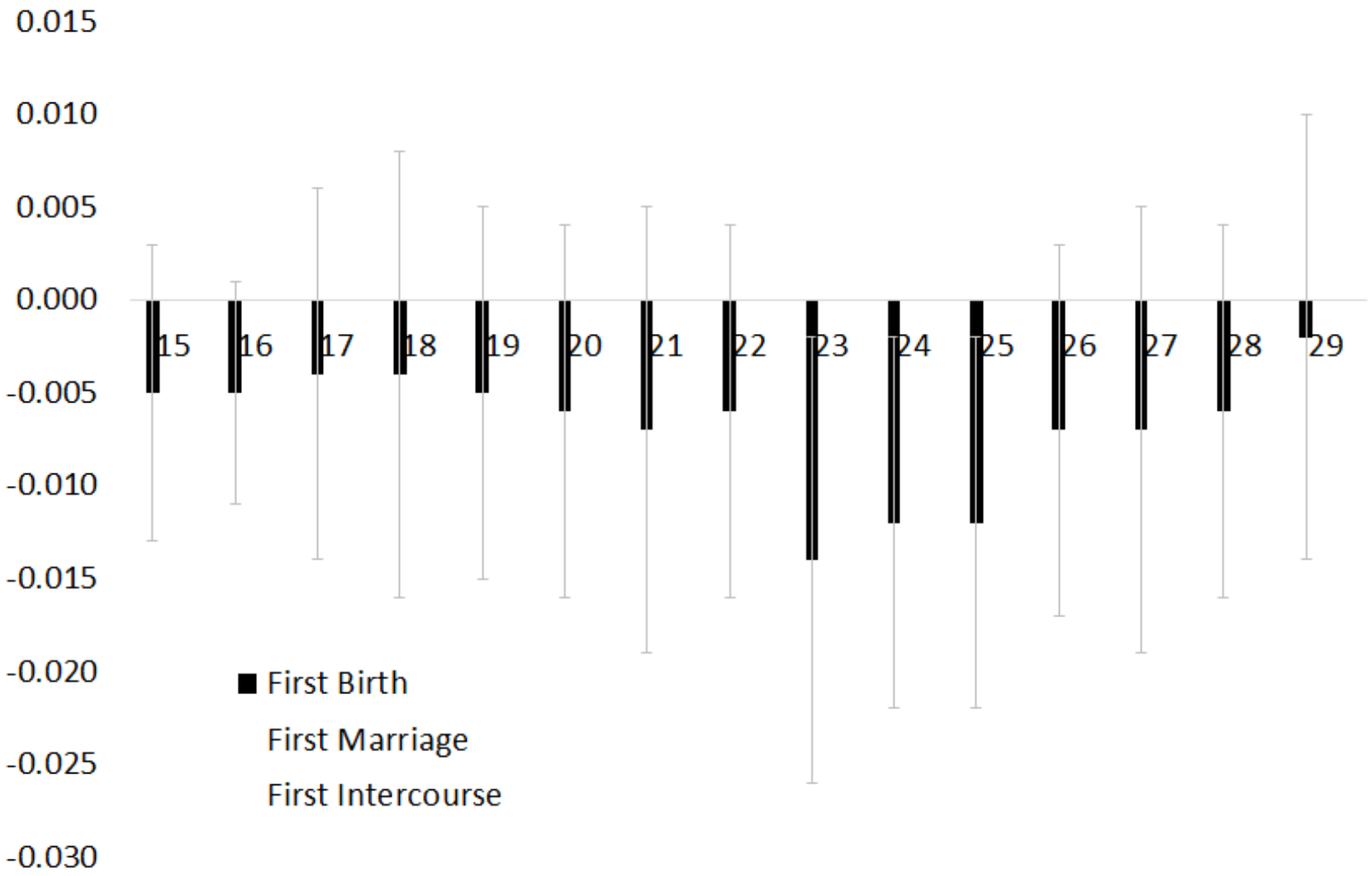
Effect of Reform on Number of Births by Age

Effect of Schooling on Births, by Age



Effect of an Additional Year of Schooling on Number of Births by Age

Effect of Reform on First Birth, by Age



Effect of Reform on First Birth by Age

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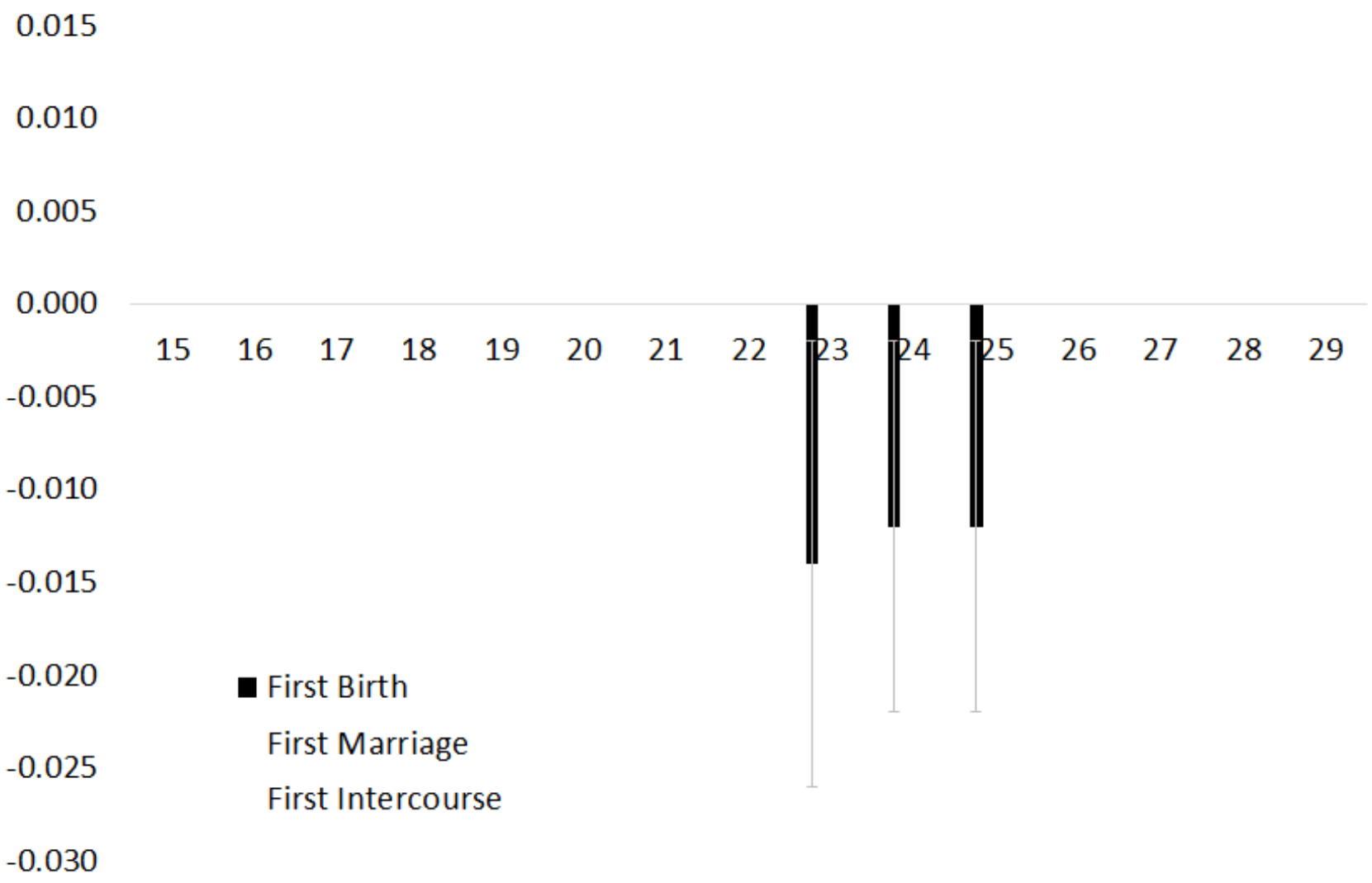
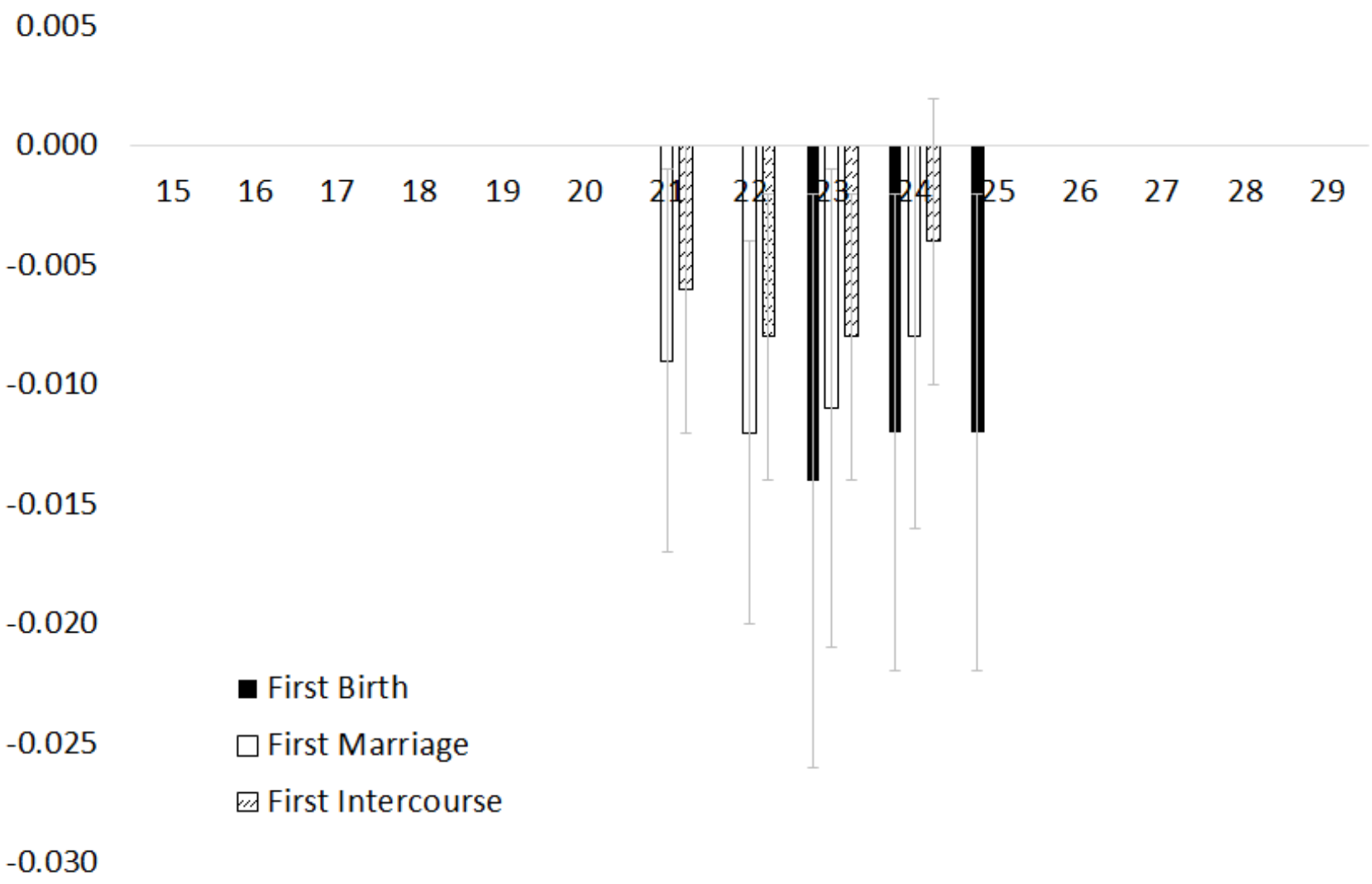


Effect of Reform on First Birth by Age

Effect of Reform on First Marriage/Intercourse, by Age



Effect of Reform on First Birth by Age

Effect of Schooling on Knowledge and Health

	Literacy	Know HIV Test Location	Read about Fam. Planning	Know About Modern FP
	(1)	(2)	(3)	(4)
$\widehat{\text{Years of Schooling}}_{izy}$	0.120***	0.091*	0.047**	0.021
	(0.019)	(0.050)	(0.022)	(0.022)
	[0.000]	[0.072]	[0.032]	[0.358]
F-Stat	19.65	19.80	19.04	19.04
N	24,480	22,863	24,885	24,898

Effect of Schooling on Knowledge and Health

	BMI (Z-Score)	Height (Z-Score)	Test for HIV	Using Modern Contraception	Using Hidden Contraception
	(1)	(2)	(3)	(4)	(5)
$\widehat{\text{Years of Schooling}}_{izy}$	0.248*	0.026	0.110	-0.009	-0.037
	(0.138)	(0.143)	(0.070)	(0.031)	(0.042)
	[0.073]	[0.855]	[0.115]	[0.775]	[0.382]
F-Stat	8.89	7.603	9.36	19.04	19.04
N	19,491	19,879	19,632	24,898	24,898

Effect of Schooling on Work and Wealth

	Working	Non-Agricultural Work	Non-Subsistence Agricultural Work	Wealth (Z-Score)	Ideal Number of Children
	(1)	(2)	(3)	(4)	(5)
$\widehat{\text{Years of Schooling}}_{izy}$	0.019	0.039	0.052	0.149***	-1.146**
	(0.043)	(0.037)	(0.035)	(0.052)	(0.465)
	[0.662]	[0.294]	[0.140]	[0.004]	[0.014]
F-Stat	19.17	19.51	19.51	19.04	19.03
N	24,882	24,802	24,802	24,898	24,888

Effect of Schooling on the Marriage Market

	Husband's Age	Husband's Years of Schooling	Husband's Non-Agricultural Work	Husband's Non-Subsistence Agricultural Work	Husband Wants More Children
	(1)	(2)	(3)	(4)	(5)
$\widehat{\text{Years of Schooling}}_{izy}$	-0.186	0.896*	0.061	0.094**	-0.071
	(0.997)	(0.483)	(0.060)	(0.041)	(0.079)
	[0.852]	[0.064]	[0.307]	[0.023]	[0.366]
F-Stat	5.029	6.375	6.539	6.539	5.633
N	24,882	24,802	24,802	24,898	24,888

How has the Fertility Decision Changed?

- Household fertility decision is jointly made by husband and wife
- Both have moved to bargaining position to demand fewer children
- But do women actually have more control over the decision?

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- Both have moved to bargaining position to demand fewer children
- But do women actually have more control over the decision?
  - No evidence for an increase in empowerment.
  - No change in six “empowerment” measures from the DHS
  - No change in likelihood of contraception use when married, or when husband wants more children

Alternative Assumptions, Samples, Specifications,

Results hold for (25):

- 12 Different Birth Year Ranges
- Two Alternative Patterns of MTE Implementation
- Two Different Data Sets for School Entry Calculations
- Three Alternative Cohort Trends Specifications
- Restricting to Districts in All Rounds of DHS
- Removing:
  - Tigray
  - MTE Regions
  - Districts at Two Conflict Thresholds
  - Famine Affected Regions

Conclusion

- Removal of school fees in Ethiopia generated an increase in schooling.
- The increase in schooling led to:
  - increased literacy and healthcare knowledge
  - lower rates of fertility for Ethiopian women
    - due to lower demand for children from both women and their husbands
    - no evidence of a change in empowerment for Ethiopian women