Better Outcomes, Lower Costs: Evidence from Competitive Bidding in WIC

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Summer 2025

The importance of WIC and its role in the infant formula market

1. The Women, Infant, and Children (WIC) program is a key player in the infant formula market
   - WIC provides food for low-income pregnant and postpartum women, children, and infants; US's largest food-as-medicine program.
   - WIC serves more than 40% of infants and purchases 50% of the nation's infant formula

2. WIC uses a competitive bidding system—or rebates—to acquire formula at below-market prices
   - Hailed as a cost-saving success in WIC – In 2024, rebates funded 26% of participants
   - Recent policy hot topic amid the 2022 Infant Formula Shortage

→ This paper provides the first causal evidence on how the adoption of competitive bidding in WIC impacted program participation and infant health.

Cost-containment through infant formula

- **Infant formula costs WIC a lot of money**
  - In 1989, congress mandates that states adopt a cost-containment approach
    - Some adopted early
- **Cost-containment approaches**
  1. *Sole-source contract:* companies bid to be the sole-provider of formula for WIC.
     → High cost savings
  2. *Open-market contract:* companies offer discounts, but no single company wins.
     → Some cost savings

How might cost-savings in WIC affect newborns' birth weight?

- Increase participation of eligible groups, including pregnant women
  - In the 1980s, it was not uncommon for WIC agencies to turn people away or operate waitlists.
- Increase the service quality that enrolled groups receive

Literature & Contribution

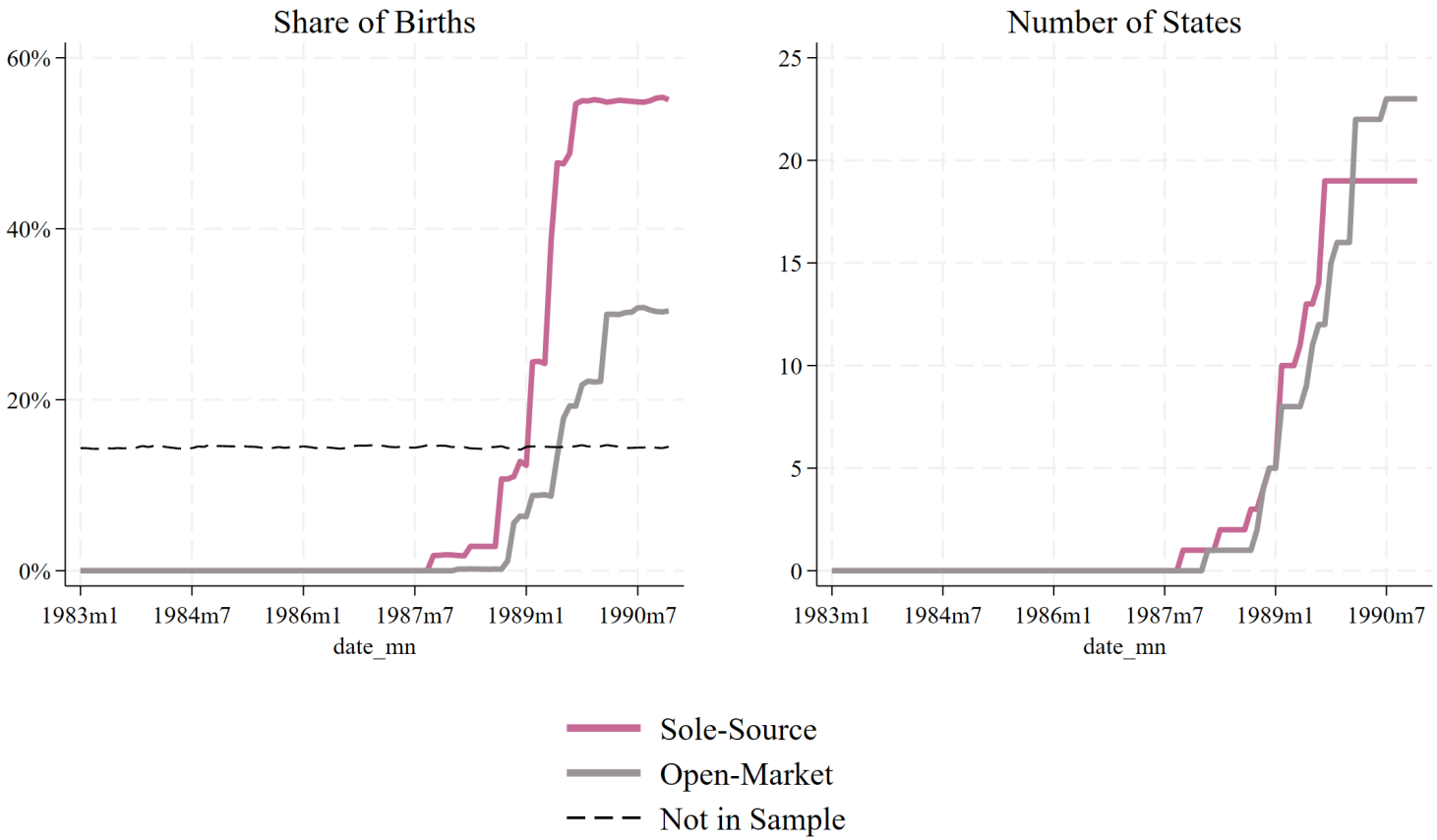
- **Access to resources during pregnancy (or before) improves infant health**
  - Access to safety net programs (Hoynes, Page, and Stevens, 2011; Bitler et al. 2024; Rossin-Slater, 2013; Almond, Hoynes, Schanzenbach, 2011; Currie and Gruber, 1996)
  - Access to cash (Hoynes, Miller, and Simon 2015; Strully, Rehkopf, 2010; Gonzales and Trommlerova, 2022)

  → We consider the effects of *safety net programs'* access to cash on infant health.

- **Infant formula rebates on consumer and firm behaviour**
  - Effects on wholesale and retail price (Davis, 2012; Betson, 2009; Oliveria et al. 2011; Abito et al. 2022)
  - Often focus on demand spillover to non-WIC populations

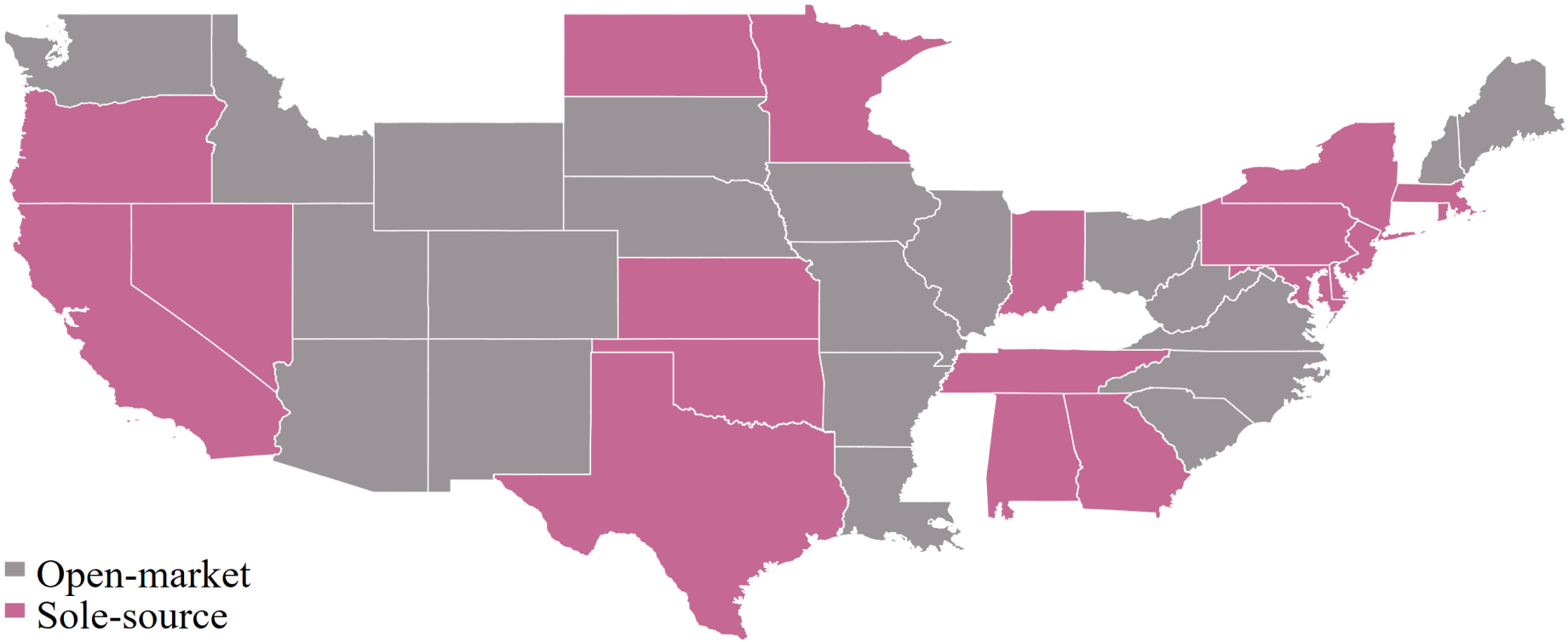
  → We consider the *roll-out* of rebates.

Variation in the adoption of rebate systems



Majority of states adopt when mandated by congress in 1989.

Variation in the adoption of rebate systems by 1990



Sample restricted to 42 states adopting a cost-containment system.

Descriptive Statistics

	(1) Not Sole-Source	(2) Sole-source	(3) Difference (2)-(1)
Panel A. Birth characteristics			
Share Married (1986)	0.204	0.240	0.036
			(0.02)
Share Black	0.103	0.182	0.079
			(0.05)
Share Black	0.823	0.779	-0.044
			(0.05)
Share Other	0.072	0.036	-0.036
			(0.03)
Share of births with HS or less	0.579	0.540	-0.039
			(0.05)
Number of births	51,480	105,956	544,75
			(27,228)
Panel B. WIC Participation characteristics			
Women participants	10,068	17,194	7,125
			(4,861)
Infant participants	13,385	22,686	9,301
			(6,219)
Children participants	23,044	38,557	15,512
			(9,400)
Observations	23	19	42

Data

- **Census of US births: the Natality Detail File 1983-1990**
  - Mother characteristics: education, race, age, marital status, state of residence
  - Infant characteristics: birth weight, gestational age, year and month of birth
    - → Construct a state-month panel of birth weight outcomes among all educ groups.
- **Cost-Containment Roll-Out Data (Davis, 2016)**
  - Information on which states adopted which cost-containment approach in which year-month, with winning and losing bid information from Davis (2016)
- **WIC Program Participation Data**
  - We digitize annual state-level participation data from 1984-1990
  - We digitize 1988 and 1990 Program Characteristic Reports

DiD specification used for participation and birth outcomes

Static TWFE Specification

$$Y_{st} = \tau * [SS \times Post]_{st} + \beta_1 * [OM \times Post]_{st} + \delta_t + \gamma_s + X'_{st}\beta + \epsilon_{st} \quad (1)$$

- $[SS \times Post]_{st}$ indicates a state-month (year) observation having a sole-source contract
- $[OM \times Post]_{st}$ indicates a state-month (year) observation having an open-market contract
- X'_{st} is a vector of controls varying at the state-year level

Imputation Estimator (Borusyak et al., 2024)

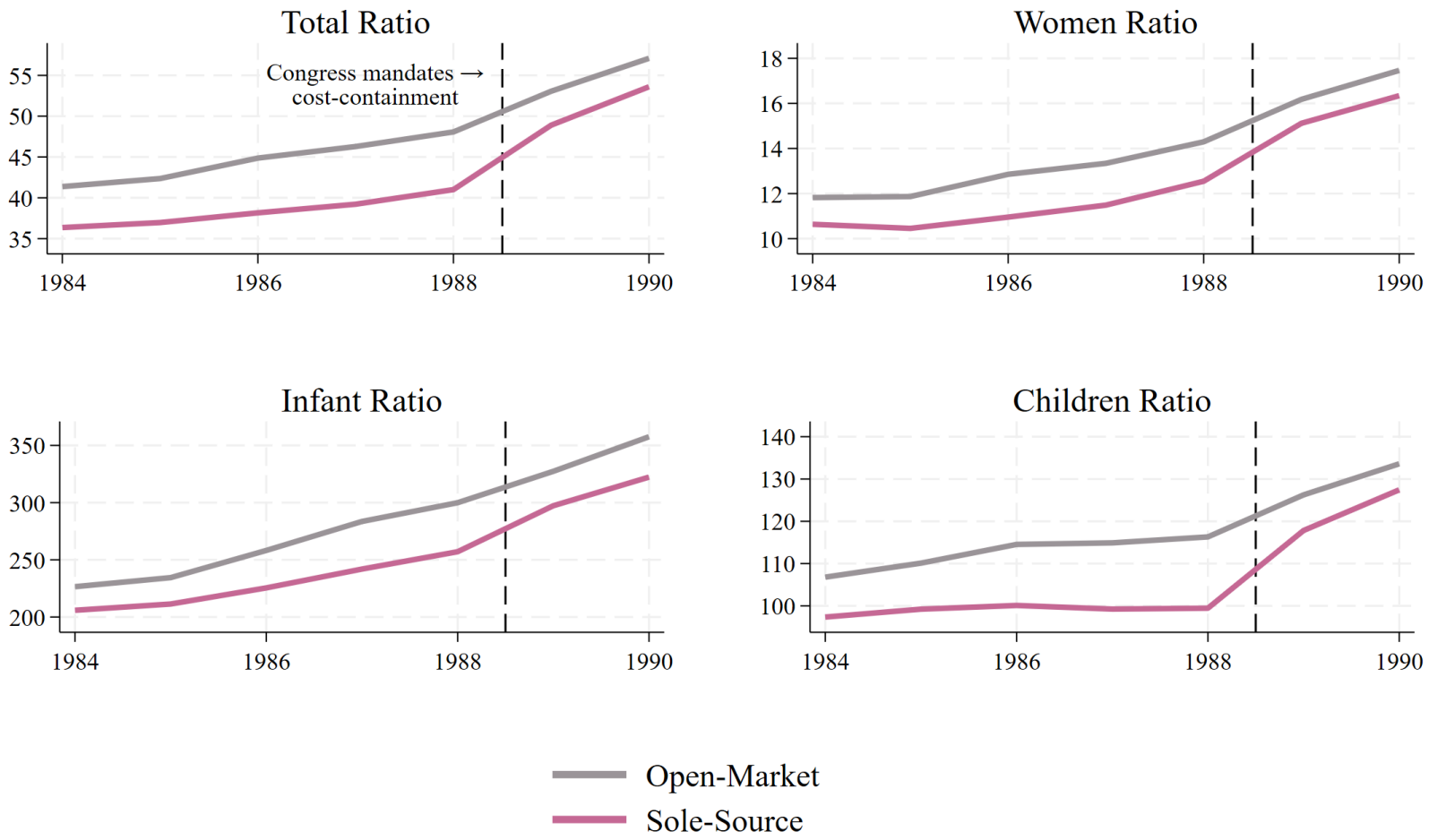
$$Y_{st}(0) = \beta_1 * [OM \times Post]_{st} + \delta_t + \gamma_s + X'_{st}\beta + \epsilon_{st} \quad (2)$$

1. Estimate (2) among untreated state-month units (includes not-yet treated)
2. Use regression estimates to obtain a predicted counterfactual, $\hat{Y}_{st}(0)$, for treated units
3. Treatment effect is the difference between the observed outcome and the predicted counterfactual: $\hat{\tau} = Y_{st}$ - $\hat{Y}_{st}(0)$

- All needed parameters are re-weighted versions of $\hat{\tau}$

Participation Trends

Participation appears to increase more in sole-source states

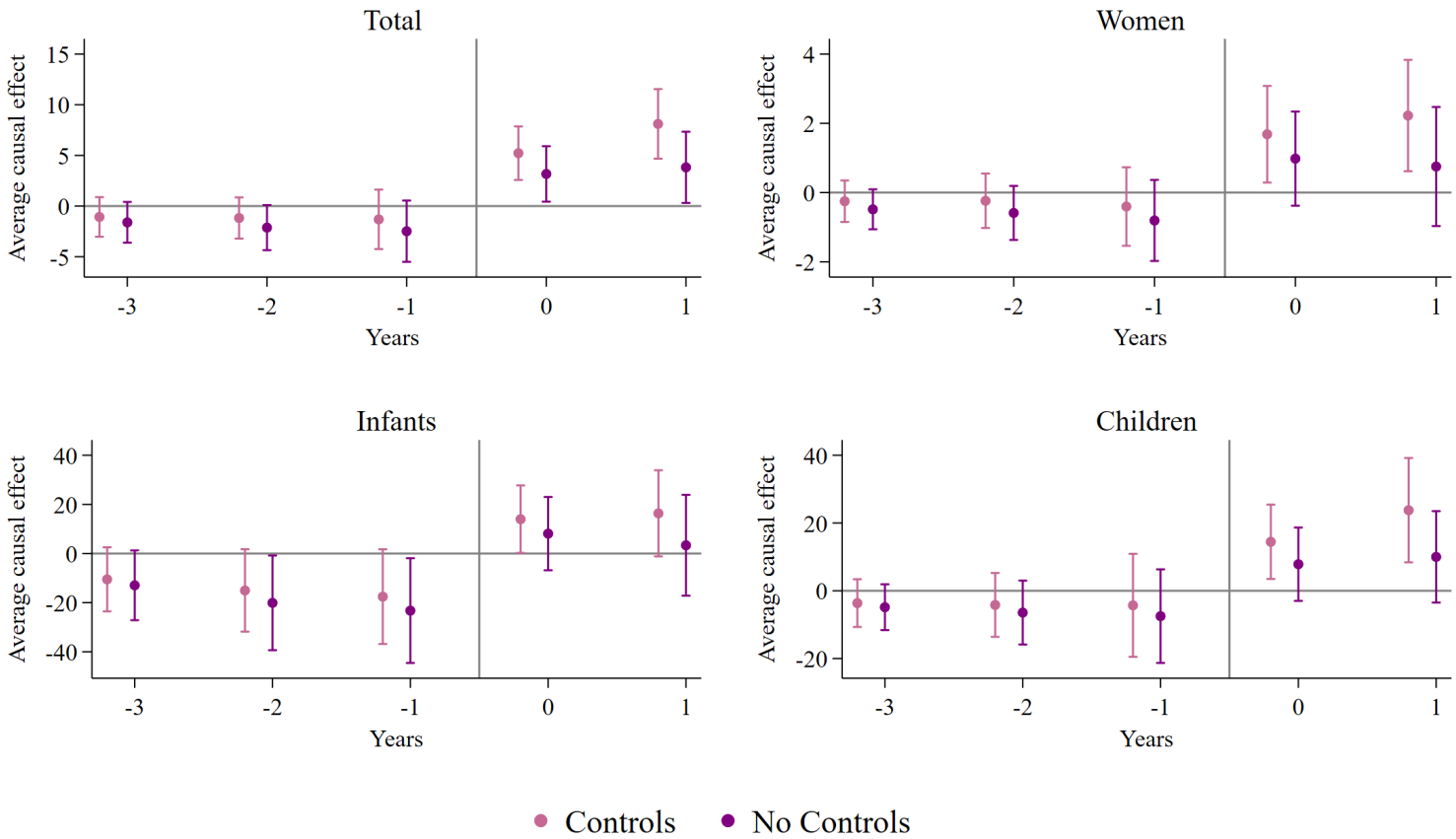


The effects of rebates on WIC participation

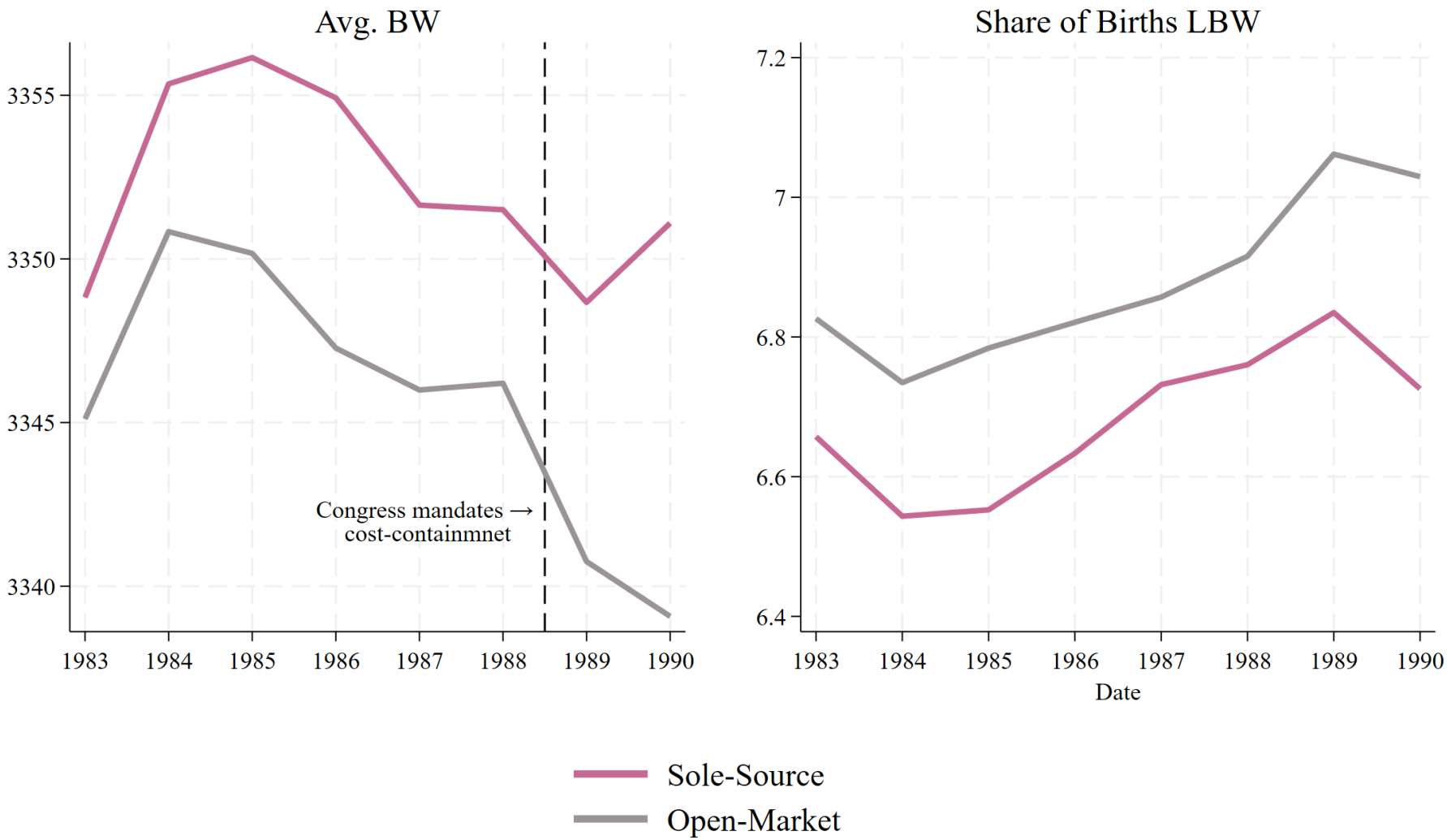
Sole-source contracts increased women's participation by 16%

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Enrollment per 1,000 of relevant population							
	Total		Women		Infants		Children	
Post × Sole-source	3.49**	6.57***	0.87	1.93***	5.53	14.67**	9.06	19.04***
	(1.53)	(1.46)	(0.73)	(0.72)	(7.20)	(6.64)	(5.79)	(6.12)
Post × Open-market		3.85**		1.22*		6.15		13.88**
		(1.69)		(0.68)		(9.78)		(6.31)
Control Mean of Y	42.56	42.56	12.44	12.44	254.48	254.48	107.69	107.69
SS as % of Mean	8.20%	15.44%	6.99%	15.51%	2.17%	5.76%	8.41%	17.68%
State FE	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓
Controls		✓		✓		✓		✓
TWFE	3.36*	5.69***	0.86	1.71**	5.94	16.45	8.79	16.53**
N	294	294	294	294	294	294	294	294

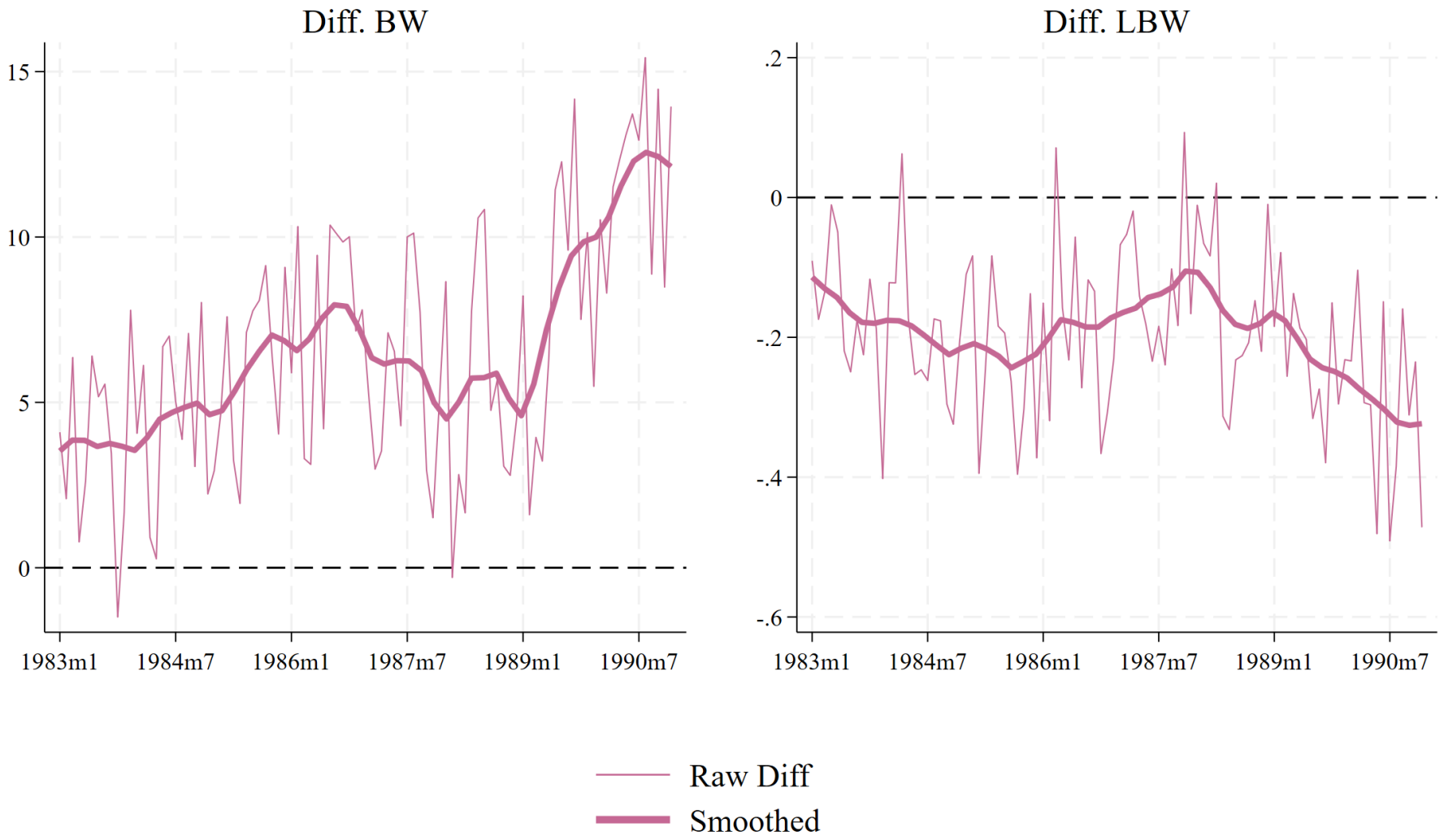
The effects of rebates on WIC participation



Yearly trends in infant health outcomes



Monthly trends in infant health outcomes

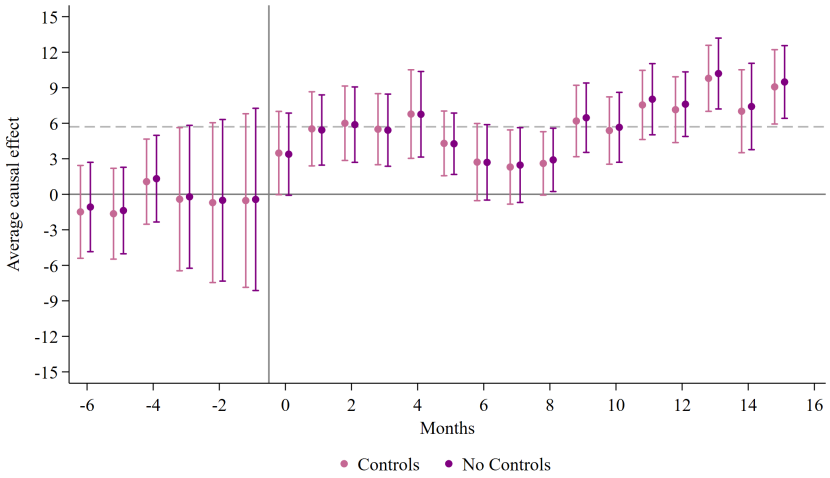


The effects of rebates on infant health

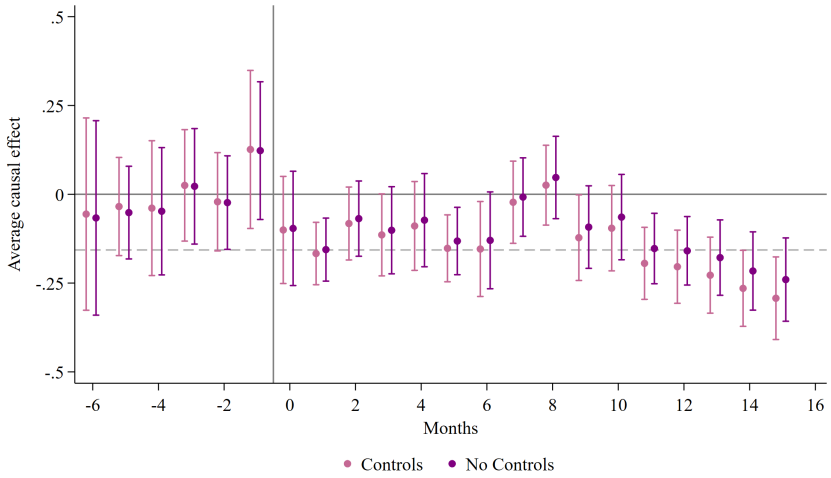
Sole-source contracts increased BW by 3.3-5.7 grams (Treatment on treated of 21-37 grams)

	(1)	(2)	(3)	(4)	(5)	(6)
Variable	Birth Weight (gms)		Black BW	Low Birth Weight		Black LBW
Post × Sole-source	5.91***	5.74***	11.44***	-0.11***	-0.14***	-0.46***
	(1.07)	(1.10)	(2.12)	(0.03)	(0.03)	(0.09)
Post × Open-market		0.17	4.83		-0.07	-0.50**
		(2.18)	(4.33)		(0.06)	(0.22)
Control Mean of Y	3349.90	3349.90	3113.11	6.75	6.75	12.73
SS as % of Mean	0.18	0.17	0.28	-1.63	-2.07	-3.61
State FE	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓
Controls		✓	✓		✓	✓
TWFE	5.52***	3.30*	7.33*	-0.12**	-0.12***	-0.36***
N	3915	3915	3911	3915	3915	3911

The effects of rebates on infant health

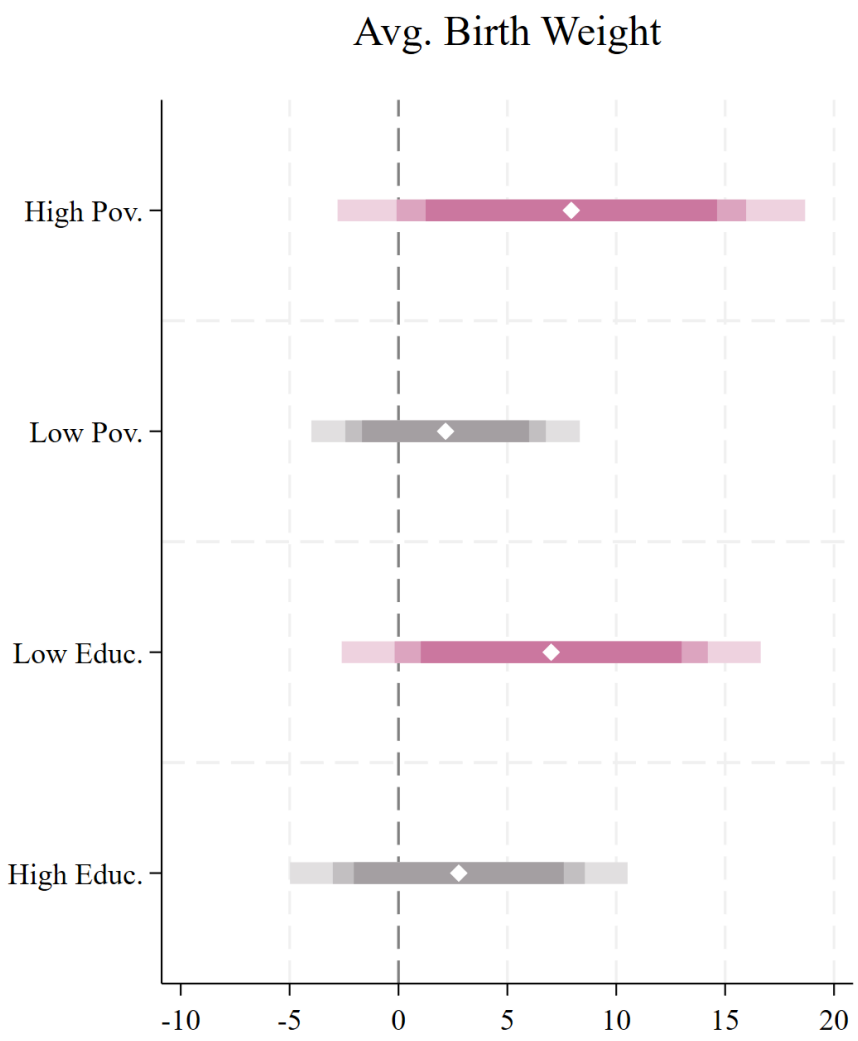


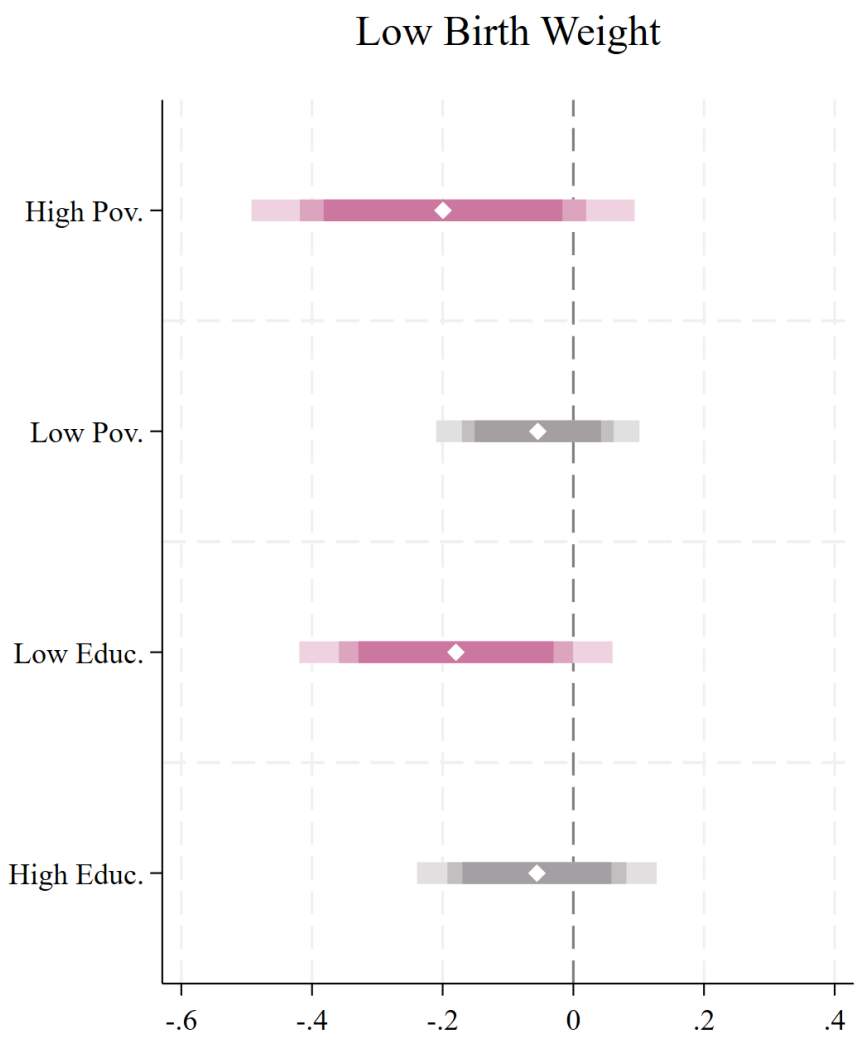
Birth Weight



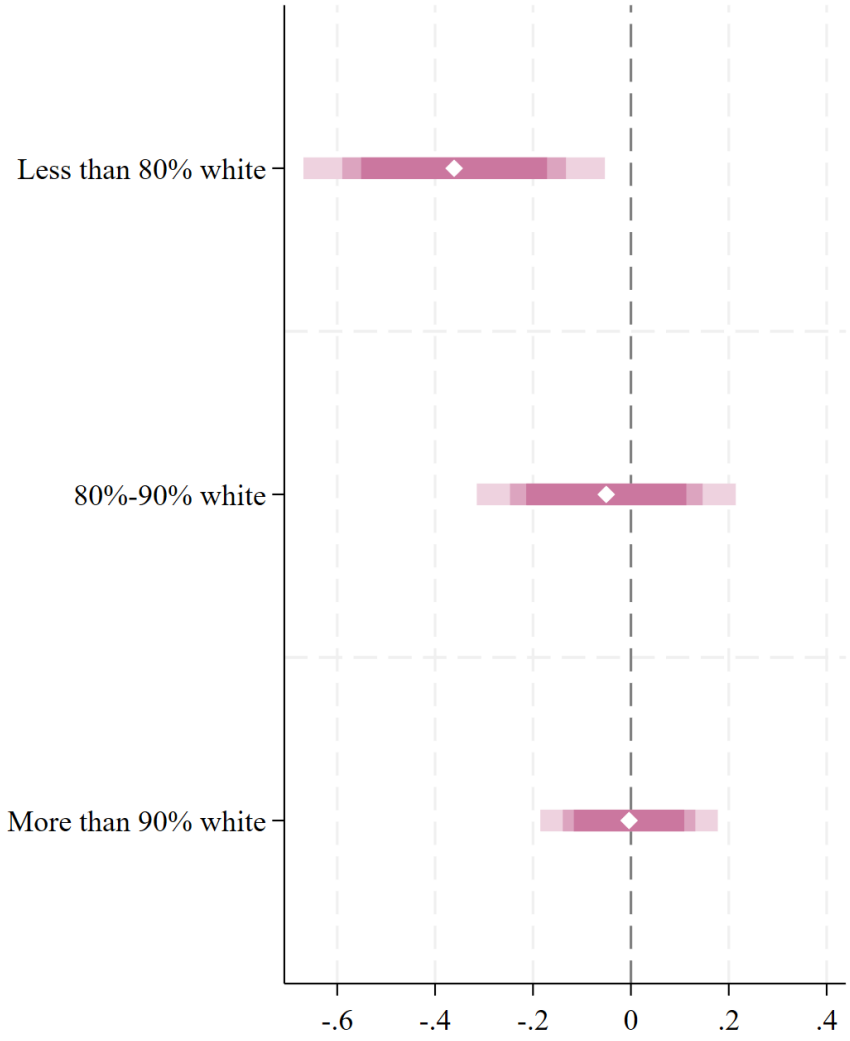
Low Birth Weight

Heterogeneity by county characteristics





Heterogeneity by county race



Benchmarking magnitudes

Reduced form estimates are large

- Effects are larger than the introduction of WIC
  - Among low-ed pop, decreased LBW by 1.6%; increased BW on average by 7 grams (Hoynes, Page, Stevens, 2011)
  - Increased BW for black infants by 10 grams; and for whites by 5 grams (Bitler et al., 2024)
- Effects are smaller than $1,000 of EITC (Hoynes et al., 2015)
  - Decreased LBW among low-ed mothers by 0.35 p.p. (overall) and 0.75 p.p. (black)
- Effects are smaller/ish than residing in same ZIP-code as WIC clinic
  - Decreased LBW by 15% (not precise); increased BW by 32 grams (Rossin-slater, 2013)

Rough and lower-bound cost-benefit analysis

1. Cost calculation: $510 million
   - National rebates totalled $510 million between 1988-1990
   - Using this as a "cost" is an extreme over estimate
   - Likely that rebate spending crowded out spending that would have occurred otherwise (e.g. state funds)
2. Benefit calculation: $116.4 million
   - We calculate the "average effect" of cost containment as 1.9 grams
     - Remove sample restrictions to estimate on all states
     - Replace Sole-Source and Open-Market dummies with a dummy for "any cost containment"
     - Will under estimate the value of "sole source" contracts by mixing with "open market"
   - 7.4 million infants born in cost-containment regimes in 1988-1990
   - Assume, each additional gram in BW saves $8.29 (East, Miller, Page, Wherry (2024) based on Almond et al. (2005)

$\rightarrow$ $1,000 in rebates, saves $230 in hospital expenses.

Conclusion

- Infant formula rebates significantly increased participation in WIC and improved health outcomes newborns.
- The most likely channel driving our results is increased participation, rather than any change in the quality of WIC services.
- Our magnitudes on newborn health are large when benchmarked to existing literature (Hoynes, Page and Stevens, 2011).
  - This suggests that expanding the WIC program was as important for infant health as the program's initial rollout.
  - This observation is not obvious, as in highly targeted programs with priority enrollment schemes, we might expect marginal beneficiaries served through program expansions to be less vulnerable than those who originally benefit from program access.

Future Work

- Our paper identifies and provides a framework for future work to study the effects of WIC rebates on other outcomes and populations:
  - Children ages 1–4, who saw the greatest enrollment gains from cost-containment
  - Infant outcomes beyond birth weight, such as other health or developmental metrics