The Welfare Effects of WIC Purchasing in the Infant Formula Market

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Motivation

Policymakers sign exclusive contracts to control costs in supplying private goods.

Examples:

* Medicare program in the medical devices markets.
* Nine cities in China implement competitive bidding contracts in the pharmaceutical industry.

→ *This paper:* The Women, Infants, and Children Nutritional Assistance (WIC) program in the infant formula market.

Questions:

1. (*Policy evaluation*) How does the given exclusive contract scheme impact the total welfare?

2. (*Policy design*) What is the optimal policy to subsidize low-income families and meanwhile reduce government expenditures in supplying goods?

Setting

This paper studies the welfare implications of WIC purchasing in infant formula markets.

WIC:

* Serves poor moms and young kids by providing them free food.
* 1.7 million infant participants; 45% of all eligible infants in the U.S.

Infant Formula Market:

* Demand: The WIC program is the major buyer of infant formula.
  - Infant formula products are more expensive than other products supplied by WIC.
  - Controls costs (The WIC program spent $927 million on infant formula alone.) $\rightarrow$

Exclusive contracts $\rightarrow$ Grant market power to contract manufacturer $\rightarrow$ Price $\uparrow$ $\rightarrow$ $\ominus$ Consumers & government

* Supply: The market is highly concentrated and is dominated by Abbott, Nestle, and Mead Johnson.

Trade-off & Intuition

This paper studies the welfare implications of WIC purchasing in infant formula markets.

WIC households: *Distorted Choices towards Contract Manufacturers* shares

* Trade-off: Use vouchers to get the contract manufacturer's products for free, but have to pay full price for other brands.
  - Smith et al. (2023); Smith et al. (2022); Griffith et al. (2018);

Non-WIC households: *Demand Spillover Occurs* spillover

* *Mechanisms*: WIC label signaling; hospital stocking; shelf spaces in retail stores.
  - Wang & Filipski (working paper, 2023); Abito et al. (2022); Huang & Perloff (2014); Oliveira et al. (2011).

Manufacturers: *Distorted Pricing Strategies* policy price detail

* After knowing auction outcomes:
  - Without price restrictions, the contract manufacturers' infant formula products should be expensive.
  - WIC sets price restrictions on contract manufacturers. Davis et al. (working paper, 2023)

This Paper

- Quantifies the welfare trade-off from WIC purchasing.

- Question 1: How does the given exclusive contract scheme impact the total welfare?
  - *Method:* I estimate a structural model and compute a Laissez-faire scenario without any government intervention.

  - *Policy Experiment I:Laissez-faire*

  - Finding #1: The current WIC program leads to a 0.4% ↓ price decrease, resulting in a 0.03% ↑ increase in total welfare.
    → *What do we learn:* Removing the WIC program leads to price increases due to the significant role played by price regulation.

  - Finding #2: Every additional dollar spent by the government, WIC participants receive only 69 cents.

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* Question 2: Are there alternative policies to subsidize low-income families and reduce government expenditures in supplying formula?
  - *Method:* Compare welfare in the current world with the counterfactual simulation.
  - *Policy Experiment II: Discount Coupon*
    - → *Description:* Eliminate exclusive contracts and price regulations, and instead, provide WIC participants with discount coupons on any brands.
  - Finding #1: The aggregate consumer surplus in the counterfactual could never as high as it under the current WIC program.
    - → *Mechanism (i)* If the discount is too low, then WIC participants have to pay more out-of-pocket, which reduce their surplus;
    - → *Mechanism (ii)* If the discount is too high, then manufacturers have incentive to raise prices, which could harm non-WIC households.

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  - Finding #2: Policymaker can achieve government-spending-neutrality by offering each participant a 64% discount.
  - Finding #3: To make the sum of WIC households' consumer surplus and government expenditures to be the same as in the status quo: Give each WIC participant 42% discount.

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Contribution

WIC Competitive Bidding Contracts:

- Davis et al.(working paper, 2023); Abito et al. (2022);Huang & Perloff (2014); Davis (2012); Oliveira et al. (2011).

→ Assesses how the WIC competitive bidding scheme with price restrictions affects overall welfare

WIC Program:

- Bronchetti et al. (2019); Finkelstein & Notowidigdo (2019); Gray (2019); Hanks et al. (2019), and so on.

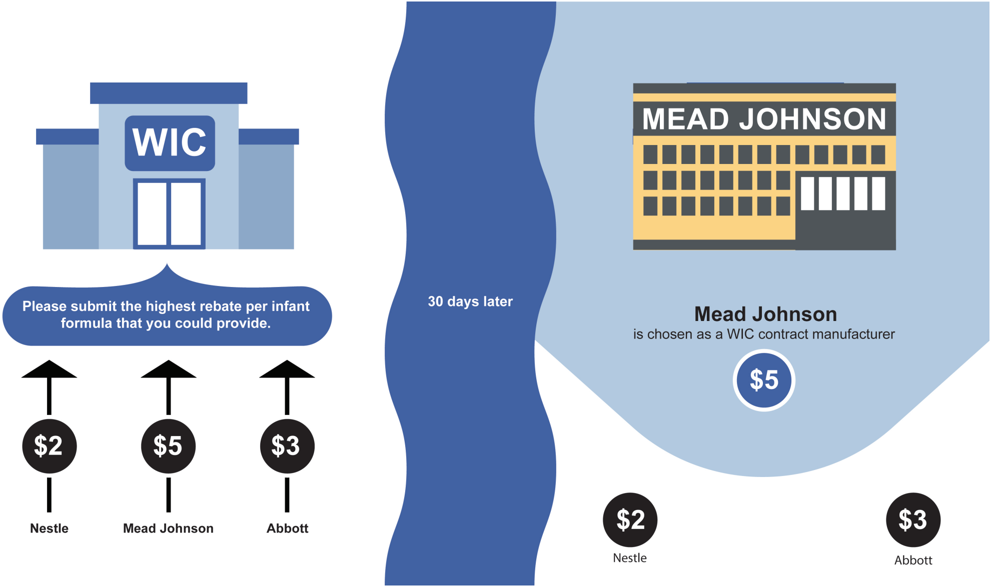
→ Explores the program's interaction with market power in a highly concentrated market.

Exclusive Dealing:

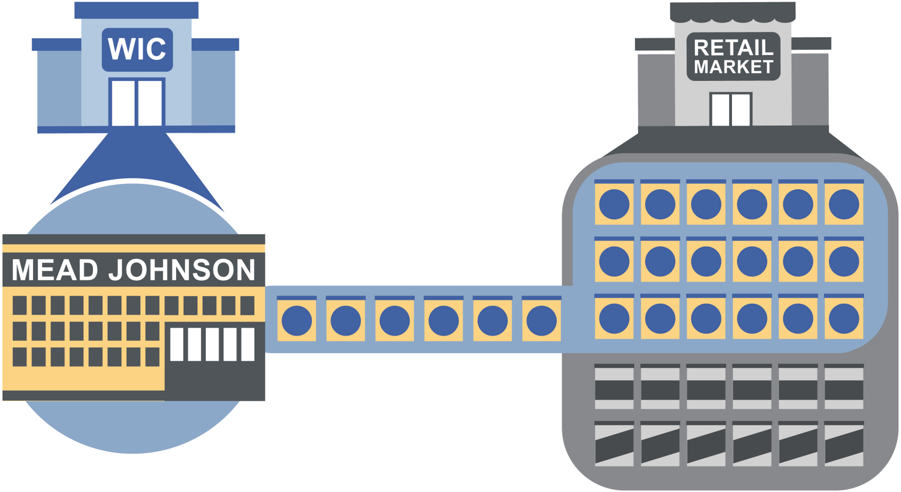
- Jullien & Sand-Zantman (2022); Lee (2013); Cachon & KoK (2010); Armstrong & Wright (2007); Hagiu (2006); Bernheim & Whinston (1998).

→ Offers an application that demonstrates the outcomes of exclusive dealings.

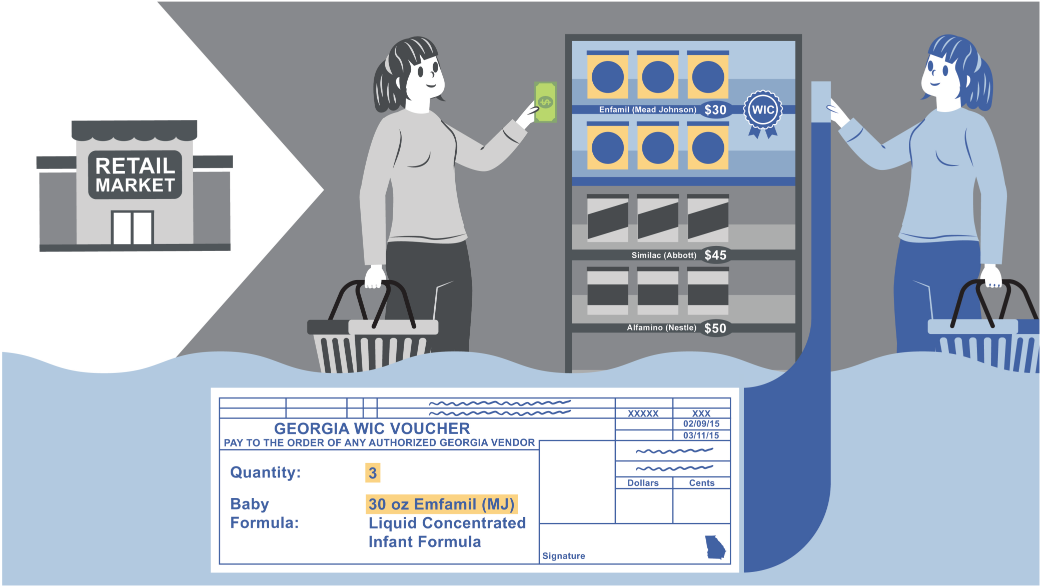
Institutional Background


WIC
Please submit the highest rebate per infant formula that you could provide.
$2
$5
$3
Nestle
Mead Johnson
Abbott
30 days later
MEAD JOHNSON
Mead Johnson
is chosen as a WIC contract manufacturer
$5
$2
Nestle
$3
Abbott

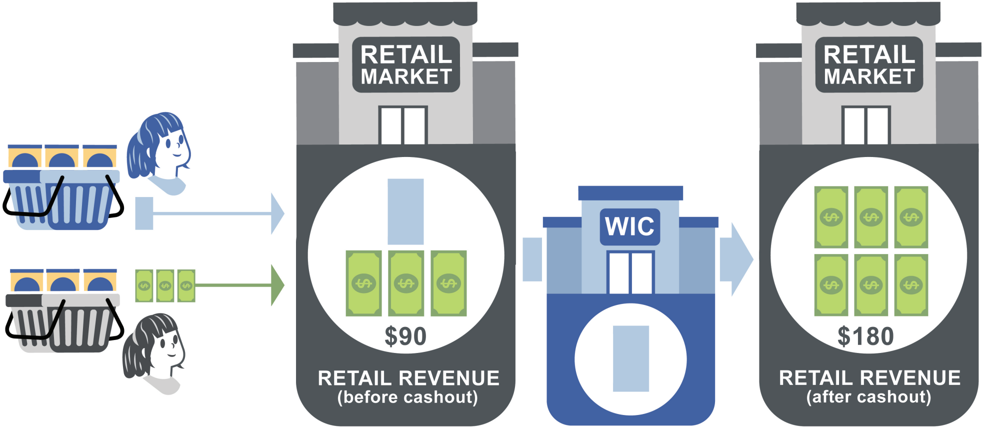
Minimum inventory



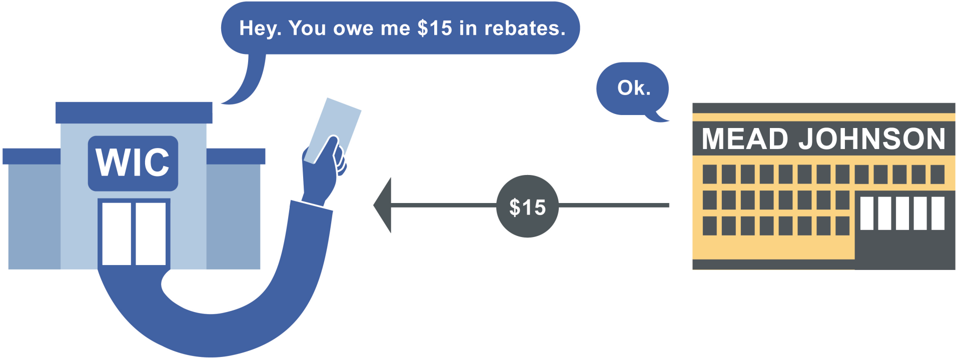
WIC participants use vouchers and pay $0



WIC program reimburses retailers



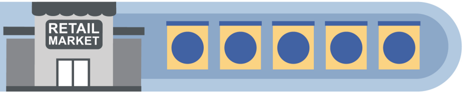
Contract winner pays rebates



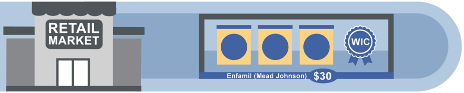
Summary

1. The Manufacturer who offers the highest rebate per product is chosen as a WIC Sponsor

2. The WIC Sponser has a higher saturation of their product in Retail Stores

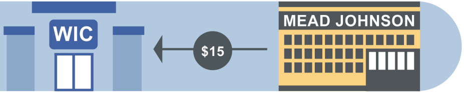


3. WIC regulates the pricing of the WIC Sponsor's product



4. WIC Households use WIC Vouchers to get the WIC Sponsered product

5. WIC recives a rebate per amount of product sold using WIC Vouchers



Model

Setup

Demand: *Mixed Logit Model*

* WIC participants and non-WIC participants.
  - # 1. WIC households obtain the contract manufacturer's infant formula without charge.
  - # 2. Different households have varying preferences for the contract manufacturer's products.

Supply: *Bertrand-Nash with price regulation on the contract winner.*

* A contract manufacturer and non-contract manufacturers.
  - # 1. The contract manufacturer faces price restrictions.
  - # 2. Non-contract manufacturers choose prices in a Bertrand Nash equilibrium.

Utility:

* Household i's utility from purchasing product j in the market m is given below:

$$u_{ijm} = \alpha \cdot P_{ijm} + \beta_i \cdot \mathbb{1}_{j=g,m} + \eta_c + \eta_{yq} + \eta_j + \underbrace{\xi_{jm}}_{\text{unobserved}} + \underbrace{\epsilon_{ijm}}_{\sim T1EV}$$

* *Market (m)*: state-county-year-quarter level.
* *Product (j)*: Abbott, Nestle, Mead Johnson, Others, or Breastfed.
* Normalize breastfeeding as an outside option.

$$u_{i0m} = \epsilon_{i0m}$$

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* WIC participants obtain contract manufacturers' products for free.

$$P_{ijm} = \begin{cases} 0, & \text{if i } \in \text{WIC households and if j} = \text{contract manufacturer} \\ P_{jm}, & \text{otherwise} \end{cases}$$

* WIC participants can purchase non-contract infant formula products out-of-pocket.

Demand

* Household i's utility from purchasing product j in the market m is given below:

$$u_{ijm} = \alpha P_{ijm} + \beta_i \cdot \mathbb{1}_{j=g,m} + \eta_c + \eta_{yq} + \eta_j + \xi_{jm} + \epsilon_{ijm}$$

* WIC and non-WIC households have heterogeneous preferences on the contract manufacturer.

$$\beta_i = \begin{cases} \beta_n, & \text{if i } \in \text{non-WIC households} \\ \beta_w, & \text{if i } \in \text{WIC participants} \end{cases}$$

* β_n can be interpreted as demand spillover effects on non-WIC households.
  - *Mechanisms:* WIC label signaling; physicians' recommendations; shelf spaces in retailers.
* β_w reflects WIC households preferences on the contract manufacturer's products.

Non-contract Manufacturer:

$$\pi_{jm}^{non-winner}(P_{jm}) = (P_{jm} - MC_{jm}) \times Q_{jm}(P_{jm})$$

- $Q_{jm} = \underbrace{s_{jm}^{wic} \times WIC_m \times \text{Market Size}_m}_{Q_{jm}^{wic}} + \underbrace{s_{jm}^{non-wic} \times (1 - WIC_m) \times \text{Market Size}_m}_{Q_{jm}^{non-wic}}$
- WIC_m: The ratio of WIC households in the market m.

Contract Manufacturer:

$$\pi_{jm}^{winner}(P_{jm}^{reg}) = \overbrace{Q_{jm}^{wic}(\underbrace{P_{ijm}^{wic}}_{=0})}^{\text{WIC HHs' demand as using vouchers}} \times \underbrace{(P_{jm}^{reg} - \text{Rebate}_{jm})}_{\text{Each state's WIC agency pays}} + Q_{jm}^{non-wic}(P_{jm}^{reg}) \times P_{jm}^{reg} - Q_{jm} \times MC_{jm}$$

- Rebate is determined through the competitive bidding process.

Supply

Non-contract Manufacturer:

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Data

Data

1. **Nielsen Retail Scan Data**:
   → Market data about infant formula market and milk market.
2. **NIS-Child Survey Data**:
   → How many parents ever received WIC benefits for their children in a state.
   → How many infants have ever been breastfed exclusively in a state.
3. **WIC Rebates data and USDA WIC Data**:
   → Each auction's winner, the starting date and ending date of each contract.
4. **Others**:
   * FRED St.Louis Data: Commodity Milk Price and CPI;
   * US Census Bureau Data (State, county code)
   * Nielsen Homescan Data

* State-county-year-quarter-manufacturer **panel** sample, from 2006 to 2016. (N: $193,964$)

Prices and Market Shares

		Price ($)		Market Shares (%)		Freq. (%)
		Retail	Rebates	conditional	unconditional	of being WIC-supplier
		(1)	(2)	(3)	(4)	(5)
Abbott	Not contract supplier	16.14		26.46	4.98	
		(1.986)		(0.233)	(0.063)	
	WIC-supplier	15.70	3.61	78.20	19.48	40.3
		(2.108)	(0.395)	(0.181)	(0.083)	(0.491)
Mead Johnson	Not contract supplier	18.47		16.87	3.00	
		(3.494)		(0.176)	(0.042)	
	WIC-supplier	16.83	3.61	66.97	18.83	36.8
		(2.819)	(0.398)	(0.253)	(0.093)	(0.483)
Nestle	Not contract supplier	15.50		9.72	1.36	
		(2.630)		(0.117)	(0.021)	
	WIC-supplier	16.42	3.60	53.09	17.35	22.9
		(2.165)	(0.397)	(0.214)	(0.065)	(0.420)
Others	Not contract supplier	15.33		6	1	0
		(2.834)		(0.075)	(0.020)	(0.000)
Breastfeeding					75	
					(0.088)	

rebate winner map ms price distribution price dist over time price over states

Identification and Estimation

Demand Estimation I

Demand Parameters: $\theta = \{\alpha, \beta_w, \beta_{nw}\}$

* Price estimate (α)

$$u_{ijm} = \alpha \cdot \boxed{P_{ijm}} + \beta_i \cdot \mathbb{1}_{j=g} + \eta_c + \eta_{yq} + \eta_j + \boxed{\xi_{jm}} + \epsilon_{ijm}$$

- Instrument for the price of infant formula with milk, a significant input cost.
- Identification relies on the covariation between the instrument (milk) and market shares.

Demand Estimation II

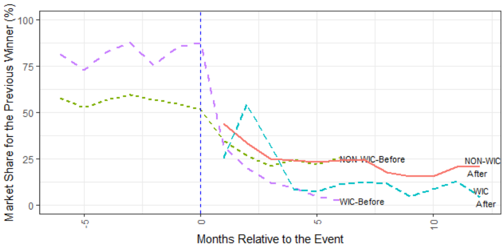
Demand Parameters: $\theta = \{\alpha, \beta_w, \beta_{nw}\}$

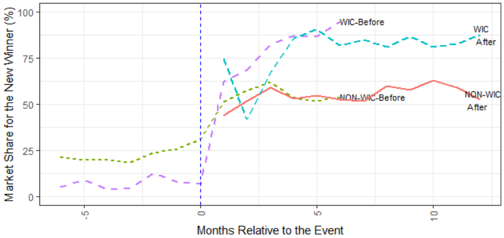
* Heterogeneous preferences estimates (β_w)

$$u_{ijm} = \alpha \cdot P_{ijm} + \beta_i \cdot \mathbb{1}_{j=g,m} + \eta_c + \eta_{yq} + \eta_j + \xi_{jm} + \epsilon_{ijm}$$

  - Distinguish β_w from β_{nw}, by relying on the corvariation in market share and WIC percentage when the contract manufacturer changes.
  - $\hat{\beta}_w = f(\triangle \text{winner}, \triangle MS^{wic})$
  - Similarly, $\hat{\beta}_{nw} = f(\triangle \text{winner}, \triangle MS^{non-wic})$, which quantifies the potential spillover effect.

Demand Estimation II: Spillovers





explain

Demand Estimation III

I estimate demand parameters using the standard BLP model with micro moments.

Unobserved Product Attributes:

* During the estimation, I denote $\beta_{nw} = \beta_0$ (non-WIC households), and $\beta_w = \beta_0 + \beta_1$ (WIC households).
* Common part shared across consumers, δ_{jm}

$$\delta_{jm} = \beta_0 \times \mathbb{1}_{j=g} + \eta_c + \eta_{yq} + \eta_j + \xi_{jm} \tag{1}$$

Inside-loop:

$$\delta_{jm}^{t+1} = \delta_{jm}^{t} + ln(s_{jm}) - ln(s_{jm}^{model}(\hat{\alpha}, \hat{\beta}, \mathbf{p}_m, \mathbb{1}_{j=g}))$$

- Using $\{\delta^*_{jm}\}_{j=1..,J,m=1,\dots,M}$, estimated $\hat{\beta}_0$, and fixed effects in equation (1) to back out $\hat{\xi}_{jm}$.

GMM:

$$\min_{\alpha,\beta_1} \overrightarrow{g}'(\xi_{jm}, Z_{jm}, X_{jm}) \times W \times \overrightarrow{g}(\xi_{jm}, Z_{jm}, X_{jm})$$

Non-contract Manufacturer:

$$\pi_{jm}^{non-winner}(P_{jm}^{*}) = \max_{P_{jm}^{*}}(P_{jm} - MC_{jm}) \times \underbrace{Q_{jm}(P_{jm})}_{size_m \times s_{jm}}$$

* Back out non-contract manufacturers' marginal costs by solving the profit-maximization problem.

$$\hat{MC}_{jm}^{non-winner} \equiv P_{jm} + \frac{\overbrace{wic_m \times s_{jm}^{wic} + (1 - wic_m) \times s_{jm}^{non-wic}}^{s_{jm}}}{\hat{\alpha} \times \left(wic_m \times s_{jm}^{wic} \times (1 - s_{jm}^{wic}) + (1 - wic_m) \times s_{jm}^{non-wic} \times (1 - s_{jm}^{non-wic})\right)}$$

* All variables on the right-hand-side are observed from the data.

Contract Manufacturer:

$$\pi_{jm}^{winner}(P_{jm}^{reg}, \hat{MC}_{jm}^{winner}) = \overbrace{Q_{jm}^{wic}(P_{ijm}^{wic})}^{\text{WIC HHs' demands as using vouchers}} \times \underbrace{(P_{jm}^{reg} - \text{Rebate}_{jm})}_{\text{Each state's WIC agency pays}} + Q_{jm}^{non-wic}(P_{jm}^{reg}) \times P_{jm}^{reg} - Q_{jm}^{all}(P_{jm}) \times MC_{jm}$$

* However, contract manufacturer is not choosing a price to maximize their profits in practice. Instead, its price is regulated by the WIC program.
* $P^{reg} = P^{obs}$

Method: I estimate contract manufacturer j's marginal costs from other markets that it loses the contract.

Results

Demand Results

Meaning	Parameters	Estimates
Price coefficient	α	-0.098
WIC households' preferences on contract manufacturers	β_w	1.420
Non-WIC households' preferences on contract manufacturers	β_{nw}	1.318
Price elasticity of demands for non-WIC	ϵ_d	-1.509

* The demand for the product is responsive to changes in price.
* WIC and non-WIC households have slightly different preferences for the WIC-supplemented infant formula products.

Supply Results

	Abbott		Mead Johnson		Nestle		Others
	Not contract supplier	WIC supplier	Not contract supplier	WIC supplier	Not contract supplier	WIC supplier	Not contract supplier
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(a) Cost							
Cost per bottle	5.203	5.595	7.798	7.091	4.923	5.326	4.802
	(2.145)	(2.089)	(3.607)	(3.176)	(2.623)	(1.763)	(2.761)
(b) Implied Margins and Markups							
margins $(p - c)$	10.934	10.109	10.672	9.736	10.578	11.094	10.527
	(0.977)	(1.110)	(1.148)	(1.657)	(0.815)	(1.176)	(0.700)
markup $(\frac{p-c}{p})$	0.688	0.631	0.599	0.571	0.700	0.682	0.709
	(0.103)	(3.273)	(0.130)	(3.224)	(0.119)	(0.084)	(0.132)

* Estimated marginal costs range from \$4.8 to \$7.8 per 12-ounce bottle of infant formula, which equates to approximately 65 cents per ounce. This result aligns with the estimate of 54 cents per ounce found in the existing literature, i.e. Simon (2023).

Counterfactual Simulations

Policy Experiments

Experiment I: *Laissez-faire*

* *Description*: No government $\rightarrow$ The absence of subsidization/ price regulations/ exclusive contracts

* *Motivation*: Economists usually care about the total welfare when there is no government intervention.

Experiment II: *Discount Coupon Policy*

* *Description*: WIC participants can purchase whichever brands they want; but must pay a certain percentage of the unit price of infant formula products.

* *Motivation*: Explore a feasible alternative policy that could achieve the following goals:
  1. No exclusive contracts, nor price regulations. reason
  2. Allow WIC participants to choose whatever brands they prefer.
  3. Keep the government expenditure being as low as the current world.

Policy Experiment I: Laissez-faire

* Decompose from the full policy to the *lassize-faire*; and evaluate the welfare by relaxing each policy setting:
  - # 1. Exclusive selling right or extra preferences
  - # 2. Subsidizing WIC
  - # 3. Rebates
  - # 4. Price restrictions

* To make sure all products being neutral after removing the competitive bidding contract, I re-compute equilibrium for the current policy.

	A. Subsidize	B. Price Restriction on the winner	C. Have rebates
Benchmark (Policy)	WIC HHs pay 0	The winner faces P^{reg}	The winner pays rebates

	Price	Gov Spend	CS(wic)	CS(non-wic)	CS	profit	Total Welfare	CS(wic) and Gov
Benchmark	16.22	$\mid -151.0 \mid$	203.5	78.9	282.4	220.7	352.2	52.5

Policy Experiment I: Laissez-faire

	A. Subsidize	B. Price Restriction on the winner	C. Have rebates
Benchmark (Policy)	WIC HHs pay 0	The winner faces P^{reg}	The winner pays rebates
Case 2	WIC HHs pay 0	The winner faces P^{reg}	No rebates

	Price	Gov Spend	CS(wic)	CS(non-wic)	CS	profit	Total Welfare	CS(wic) and Gov
Benchmark	16.22	$\lvert -151.0 \rvert$	203.5	78.9	282.4	220.7	352.2	52.5
Case 2	16.22	$\lvert -196.1 \rvert \uparrow$	203.5	78.9	282.4	265.8 $\uparrow$	352.2	7.4 $\downarrow$

$$\pi_{jm}^{winner} = Q_{jm}^{wic}(P_{ijm}^{wic}) \times (P_{jm}^{obs} \cancel{-Rebate_{jm}}) + Q_{jm}^{non-wic}(P_{jm}^{obs}) \times P_{jm}^{obs} - Q_{jm}^{all}(P_{jm}) \times MC_{jm}$$

* $Rebate_{jm}(p_{jm}, \mathbf{p}_{-j,m}, \mathbf{Rebates}_{-j,m}) = Rebate_{j,m}^{obs}$. Here, rebates are independent with prices.
* Suppliers' profits increase due to the absence of additional costs, rebates, and meanwhile government's expenditure increase.

Policy Experiment I: Laissez-faire

	A. Subsidize	B. Price Restriction on the winner	C. Have rebates
Benchmark (Policy)	WIC HHs pay 0	The winner faces P^{reg}	The winner pays rebates
Case 2	WIC HHs pay 0	The winner faces P^{reg}	No rebates
Case 3	WIC HHs pay prices	The winner faces P^{reg}	No rebates

	Price	Gov Spend	CS(wic)	CS(non-wic)	CS	profit	Total Welfare	CS(wic) and Gov
Benchmark	16.22	-151.0	203.5	78.9	282.4	220.7	352.2	52.5
Case 2	16.22	$\mid -196.1 \mid$	203.5	78.9	282.4	265.8	352.2	7.4
Case 3	16.23	0 ↓	100.1 ↓	78.9	179.0 ↓	174.8 ↓	353.8 ↑	100.1 ↑

* Now, WIC households respond to prices and opt out for the outside option, breastfeeding, which causes suppliers' revenues from WIC households to decline.

explain

Policy Experiment I: Laissez-faire

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Case 4 (Lassize Faire)	WIC HHs pay price	Bertrand Nash without P^{reg}	No rebates

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Case 3	16.23	0	100.1	78.9	179.0	174.8	353.8	100.1
Case 4	16.29 $\uparrow$	0	99.0 $\downarrow$	78.0 $\downarrow$	177.0 $\downarrow$	175.1 $\uparrow$	352.1 $\downarrow$	99.0 $\downarrow$

* Removing the price regulation leads to a 0.4% $\uparrow$ price, resulting in a 1.1% $\downarrow$ in aggregate consumer surplus.

* Two opposite forces impact prices:
  - Remove P^{reg} $\rightarrow$ The original contract manufacturer now has ability to $\uparrow$ P. $\rightarrow$ P^{mean} $\uparrow$
  - Remove P^{reg} $\rightarrow$ If the original contract manufacturer $\uparrow$ P, others respond to lower prices to compete $\rightarrow$ P^{mean} $\downarrow$

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* Every additional dollar spent by the government, WIC participants receive only 69 cents, and the left is captured by suppliers.

Policy Experiment I: Laissez-faire

* Decompose from the full policy to the *Laissez-faire*; and evaluate the welfare by relaxing each policy setting:
  # 1. Exclusive selling right or extra preferences
  # 2. Subsidizing WIC
  # 3. Rebates
  # 4. Price restrictions

Finding 1 Consumer surplus for WIC participants declined 50%.

→ This is because there is no subsidization to WIC participants in the *Laissez-faire*.

Finding 2 Removing the WIC program, in a *Laissez-faire* counterfactual, raises prices.

→ This is because price regulation forces the contract manufacturer to set a lower price which strengthens competition.

Policy Experiment II: Discount Policy

Definition: WIC participants can purchase whichever brands as they want; but must pay a certain percentage of the unit price of infant formula products.

* WIC Household i's utility from purchasing product j in the market m is given below:

$$u_{ijm}^{wic} = \alpha P_{ijm} \times x\% + \eta_{county} + \eta_{yq} + \eta_j + \xi_{jm} + \epsilon_{ijm}$$

* Non-WIC Household i's utility from purchasing product j in the market m is given below:

$$u_{ijm}^{non-wic} = \alpha P_{ijm} + \eta_{county} + \eta_{yq} + \eta_j + \xi_{jm} + \epsilon_{ijm}$$

* There is no exclusive winner any longer. Manufacturer j's profit:

$$\pi = Q_{jm}^{wic}(P_{jm} \times x\%) \times P_{jm} + Q_{jm}^{non-wic}(P_{jm}) \times P_{jm} - Q_{jm}^{all}(P_{jm}) \times MC_{jm}$$

Policy Experiment II: Consumers

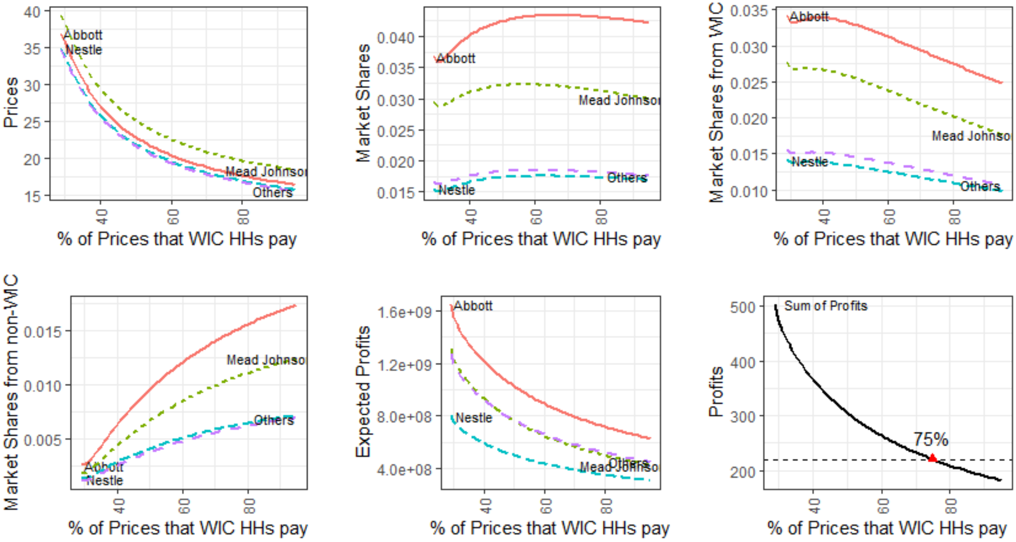
\# 1. As WIC participants pay less, their CS goes up.

\# 2. However, as WIC participants pay less, their demand elasticity goes down, so manufacturers raise prices.

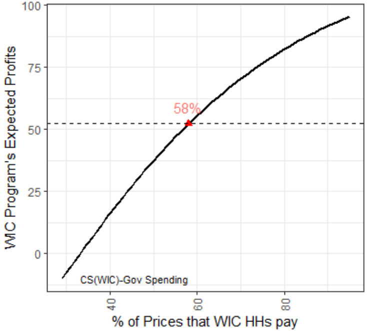
\# 3. Therefore, as WIC participants pay less, non-WIC participants pay more.

\# 4. Overall, cannot achieve higher combined WIC and non-WIC CS.

Policy Experiment II: Firms



Policy Experiment II: Government



* Policymakers can achieve government spending neutrality by offering each participant $(1 - 36\%) = 64\%$ discount on any brands.
* To make the the sum of WIC households' consumer surplus and government expenditures to be the same as in the status quo: Give each WIC participant $(1 - 58\%) = 42\%$ discount for each unit of infant formula.

Policy Experiment II: Discount Policy

* WIC participants can purchase whichever brands as they want; but must pay a certain percentage of the unit price of infant formula products.

Finding 1 The aggregate consumer surplus in the counterfactual could never as high as it under the current WIC program.

Policy Experiment II: Discount Policy

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→ This is because: *(i)* If the discount is too low, then WIC participants have to pay more out-of-pocket, which reduce their surplus; *(ii)* If the discount is too high, then manufacturers have incentive to raise prices, which could harm non-WIC households.

Policy Experiment II: Discount Policy

- WIC participants can purchase whichever brands as they want; but must pay a certain percentage of the unit price of infant formula products.

> **Finding 1** The aggregate consumer surplus in the counterfactual could never as high as it under the current WIC program.

→ This is because: *(i)* If the discount is too low, then WIC participants have to pay more out-of-pocket, which reduce their surplus; *(ii)* If the discount is too high, then manufacturers have incentive to raise prices, which could harm non-WIC households.

> **Finding 2** Policymakers can achieve government spending neutrality by offering each participant 64% discount on any brands.

Policy Experiment II: Discount Policy

* WIC participants can purchase whichever brands as they want; but must pay a certain percentage of the unit price of infant formula products.

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→ This is because: *(i)* If the discount is too low, then WIC participants have to pay more out-of-pocket, which reduce their surplus; *(ii)* If the discount is too high, then manufacturers have incentive to raise prices, which could harm non-WIC households.

Finding 2 Policymakers can achieve government spending neutrality by offering each participant 64% discount on any brands.

Finding 3 To make the the sum of WIC households' consumer surplus and government expenditures to be the same as in the status quo: Give each WIC participant 42% discount.

Conclusion

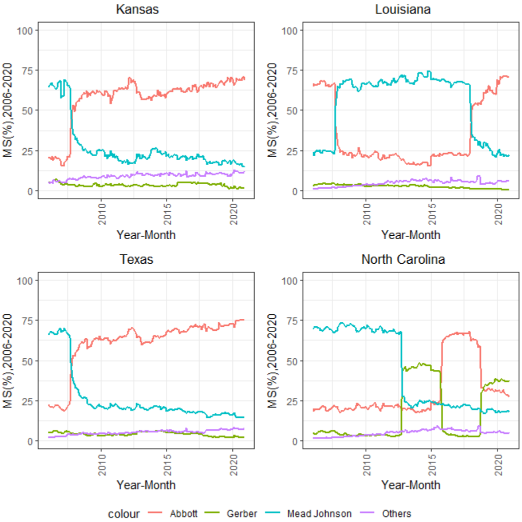
Policy Implications

* The current WIC program
    + Pros: Bring higher consumer surplus for WIC participants than two alternative policy experiments.
    - Cons: It is expensive.
        → *Finding*: Every additional dollar spent by the government, WIC participants receive only 69 cents.
* Counterfactual policies
    + Pros: Decreases the government expenditures, and increases the total welfare, compared with the current world.
    - Cons: Could never reach the aggregate consumer surplus in the current world.

Thanks!

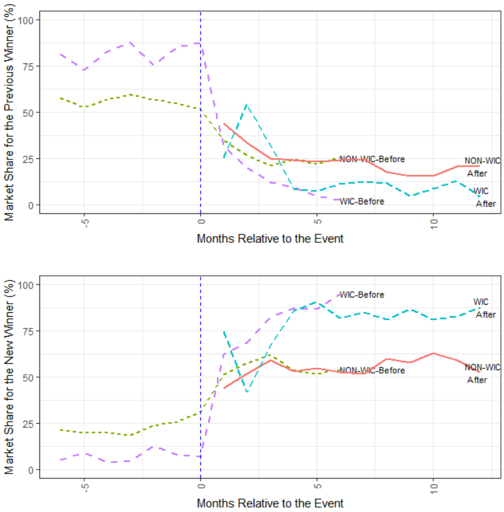
Questions or comments? ☞ xwang975@uga.edu

WIC contract and Market Shares 1 [1]



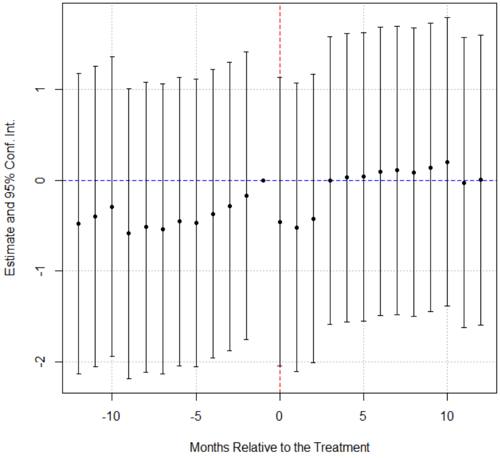
[1] Data sources: Nielsen Retail Scan Data, 2006-2020

Demand Spillovers 2 [2]



[2] Data sources: Nielsen Home Scan Data, 2006-2020

Price Restrictions on Contract Winners 3 [3]



[3] Data sources: Nielsen Retail Scan Data, 2006-2020

Price Restrictions 4 [4]

Net price means the difference between an infant formula manufacturer's lowest national wholesale price per unit for a full truckload of infant formula and the rebate level or the discount offered or provided by the manufacturer under an infant formula cost containment contract.

(4) ***Vendor selection criteria: competitive price***. The State agency must establish a vendor peer group system and distinct competitive price criteria and allowable reimbursement levels for each peer group. The State agency must use the competitive price criteria to evaluate the prices a vendor applicant charges for supplemental foods as compared to the prices charged by other vendor applicants and authorized vendors, and must authorize vendors selected from among those that offer the program the most competitive prices. The State agency must consider a vendor applicant's shelf prices or the prices it bids for supplemental foods, which may not exceed its shelf prices. In establishing competitive price criteria and allowable reimbursement levels, the State agency must consider participant access by geographic area. The State agency must inform all vendors of the criteria for peer groups, and must inform each individual vendor of its peer group assignment.

[4] Sources: 7 CFR Part 246: SNAP-WIC

Price Restrictions 5

Policy Details:

* *"Bid solicitations must require the manufacturer to adjust rebates for price changes subsequent to the bid opening. Price adjustments must reflect any increase and decrease, on a cent-to-cent basis, in the manufacturer's lowest national wholesale prices for a full truckload of infant formula."*[5]

Example:

* Suppose Mead Johnson wins the competitive bidding contract in Georgia, by submitting the highest rebate, \$5. (determined)
* Assume the unit price of the infant formula of Mead Johnson now is \$30.
* WIC program only pays $30 - 5 = \$25$
* If Mead Johnson wants to set a price $P = \$35$, it is forbidden by the WIC program's price regulation.

[5] *Source*: Federal Regulation Code for WIC, title 7, subtitle B, Chapter II, subtitle A, Part 246.

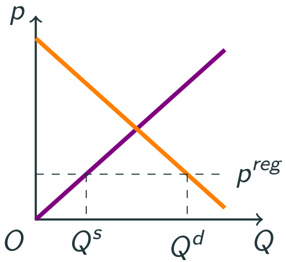
Non-contract Manufacturer:

$$\pi_{jm}^{non-winner}(P_{jm}) = (P_{jm} - MC_{jm}) \times Q_{jm}(P_{jm})$$

Contract Manufacturer:

$$\pi_{jm}^{winner}(P_{jm}^{reg}) = \overbrace{Q_{jm}^{wic}(\underbrace{P_{ijm}^{wic}}_{=0})}^{\text{WIC HHs' demand as using vouchers}} \times \underbrace{(P_{jm}^{reg} - \text{Rebate}_{jm})}_{\text{Each state's WIC agency pays}} + Q_{jm}^{non-wic}(P_{jm}^{reg}) \times P_{jm}^{reg} - Q_{jm} \times MC_{jm}$$

* Rebate is determined through the competitive bidding process.



- Prevent the government grant a manufacturer market power $\rightarrow$ No exclusive contract
- Price ceiling could cause the shortage problem $\rightarrow$ No price regulation

* Suppliers' aggregate profits decrease because:

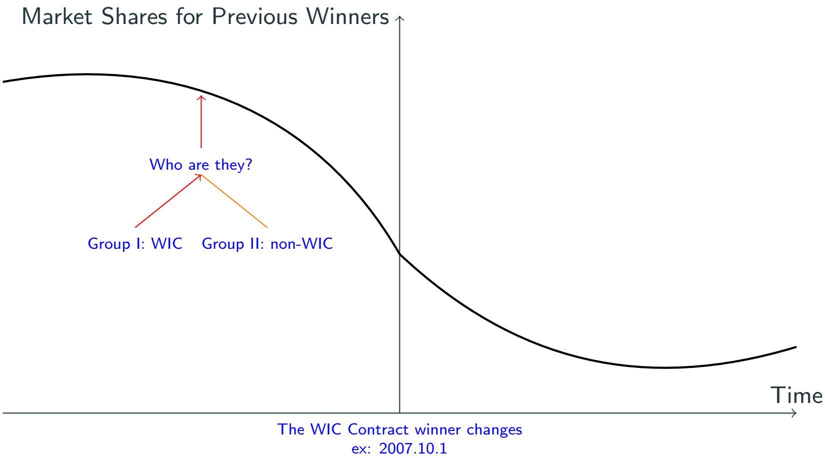
$$\text{Total Revenues} = P \times Q$$

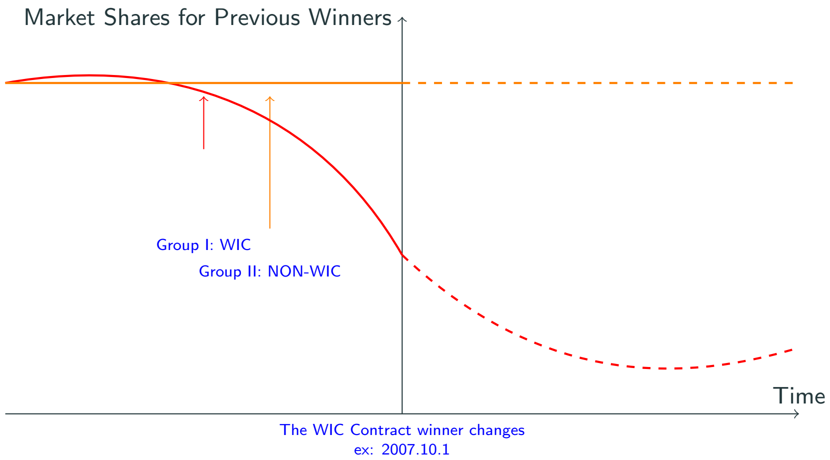
* The estimated elastic demand of prices implies that:

$\rightarrow \mid \epsilon^{d} \mid = \mid \dfrac{\%\triangle Q}{\%\triangle P} \mid > 1$

$\rightarrow \underbrace{\mid \%\triangle Q \mid}_{\downarrow} > \underbrace{\mid \%\triangle P \mid}_{\uparrow}$

Expected Consumption Behaviors





Market Shares for Previous Winners
Time
Group I: WIC
Group II: NON-WIC
The WIC Contract winner changes
ex: 2007.10.1

Are there any spillover effects? 12

- To disentangle the newborn's consumption from previous-babies' consumption, I look at 4 groups' consumption pattern:
  1. WIC babies born before contract changed
     * WIC babies should always choose bidding winner's products.
  2. Non-WIC babies born before contract changed
     * Unknown.
  3. WIC babies born after contract changed
     * WIC babies should choose new winner's products.
  4. Non-WIC babies born after contract changed
     * Unknown. If there is spillover, then they should choose new winner's products.

Summary Statistics for the WIC Rebate Data

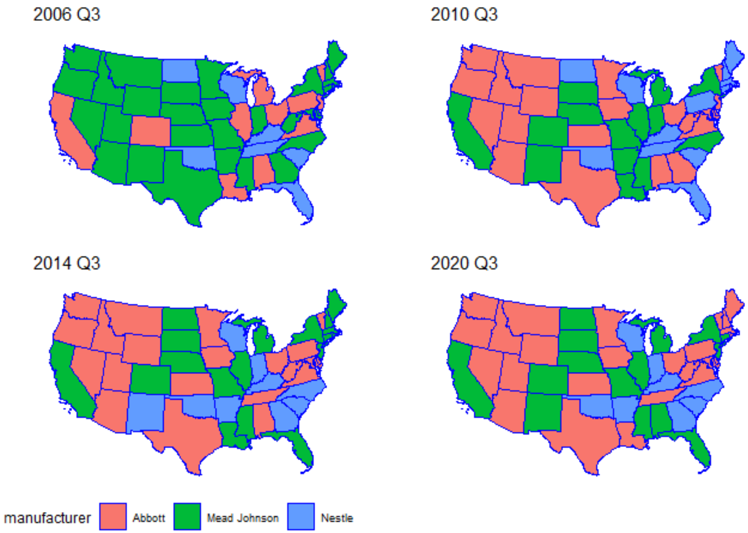
	Mean ($)	SD	Min($)	Median($)	Max($)
Rebate					
Mead Johnson	5	4	0	3.2	15.7
Abbott	4.7	3.8	0	3.2	14.9
Gerber	3.1	4.2	0	1.1	14.9
Wholesale price					
Mead Johnson	6.5	4.6	1.3	4.1	15.8
Abbott	6.4	4.5	1.3	4.1	14.9
Gerber	6.1	4.3	1.6	4.2	15.1

Note: WIC Rebate Data: 1986-2016

Summary Statistics for the WIC Rebate Data II

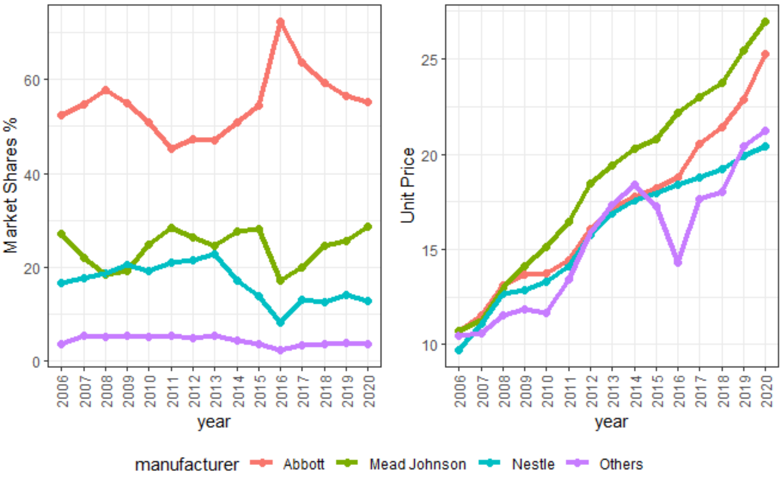
	Frequency
Formula type	
Milk-based liquid concentrate	37.3%
Soy-based liquid concentrate	22.6%
Milk-based powder	16.3%
Soy-based powder	16.9%
Winner	
Mead Johnson	46.5%
Abbott	25.1%
Gerber	19.1%

Note: WIC Rebate Data: 1986-2016

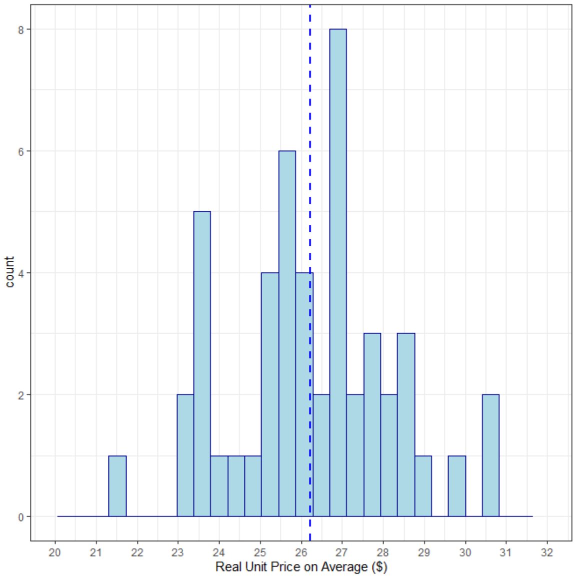


2006 Q3
2010 Q3
2014 Q3
2020 Q3
manufacturer
Abbott
Mead Johnson
Nestle

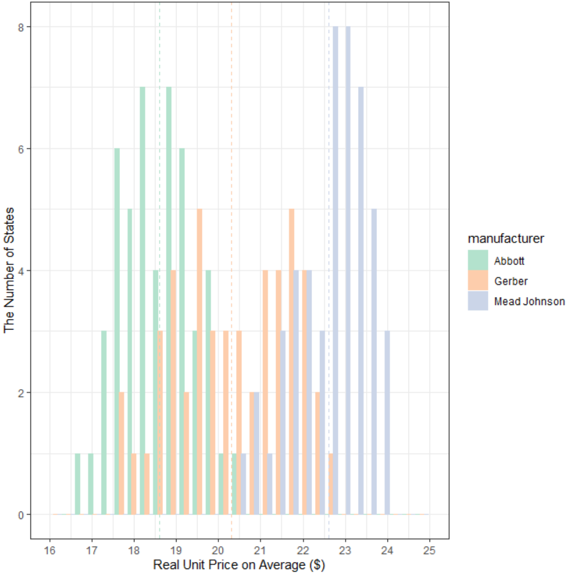
National: Market Shares and Unit Prices



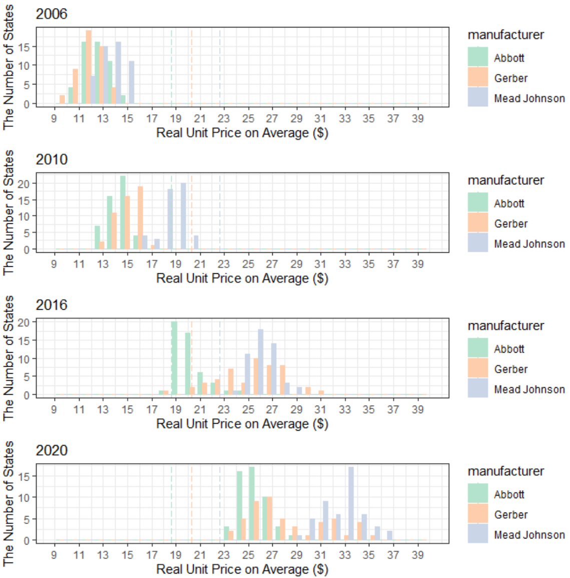
Price Dispersion in the U.S. for all brands, 2006-2020



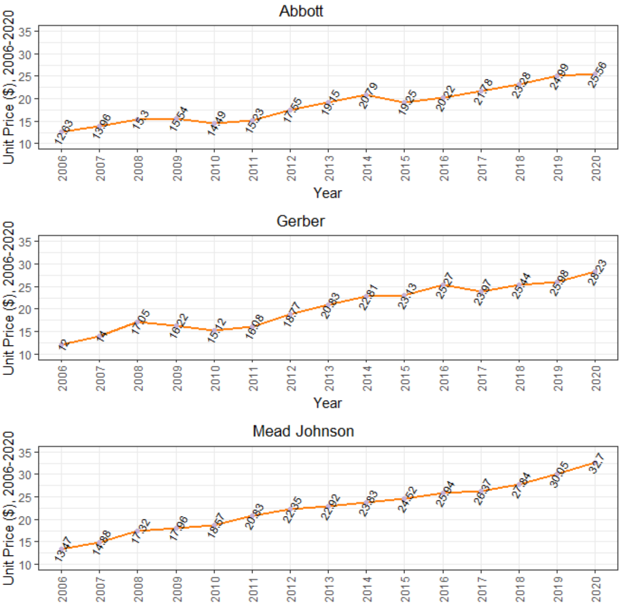
Price Dispersion in the U.S. for Top 3 brands



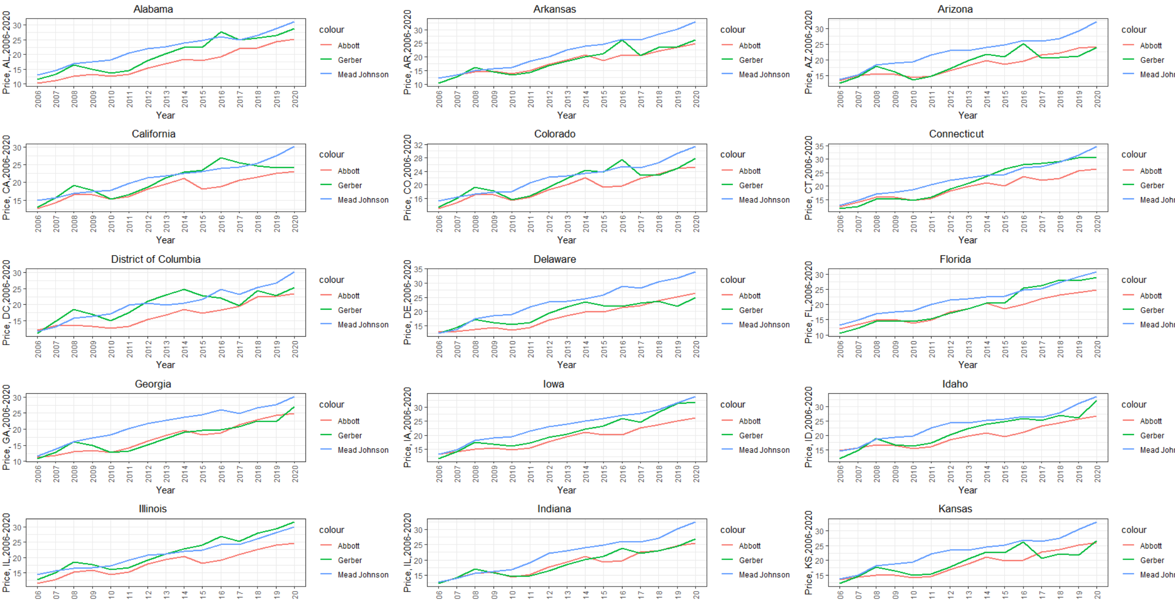
The impact of Winning WIC Contracts on Winner's Price



Stylized Facts: Real Unit Price



Stylized Facts: Real Price Changes



Colluding in Auctions [6]

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Agency investigating whether formula manufacturers coordinated before bidding for state contracts

By Liz Essley Whyte Follow , *Jesse Newman* Follow and *Kristina Peterson* Follow

Updated May 24, 2023 9:38 am ET

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A nationwide baby-formula shortage has some desperate parents driving hours in search of supplies. Dr. Steven Abrams, a pediatrician at the University of Texas at Austin, explains what parents should and shouldn't do amid the crisis. Photo illustration: Laura Kammermann

The Federal Trade Commission is investigating whether baby-formula makers colluded on bids for lucrative state contracts.

[6] Sources: The Wall Street Journal, 2023