

**A New Framework for Evaluating Commodity
Promotion Programs:
What Can We Learn from Disaggregate Data?**

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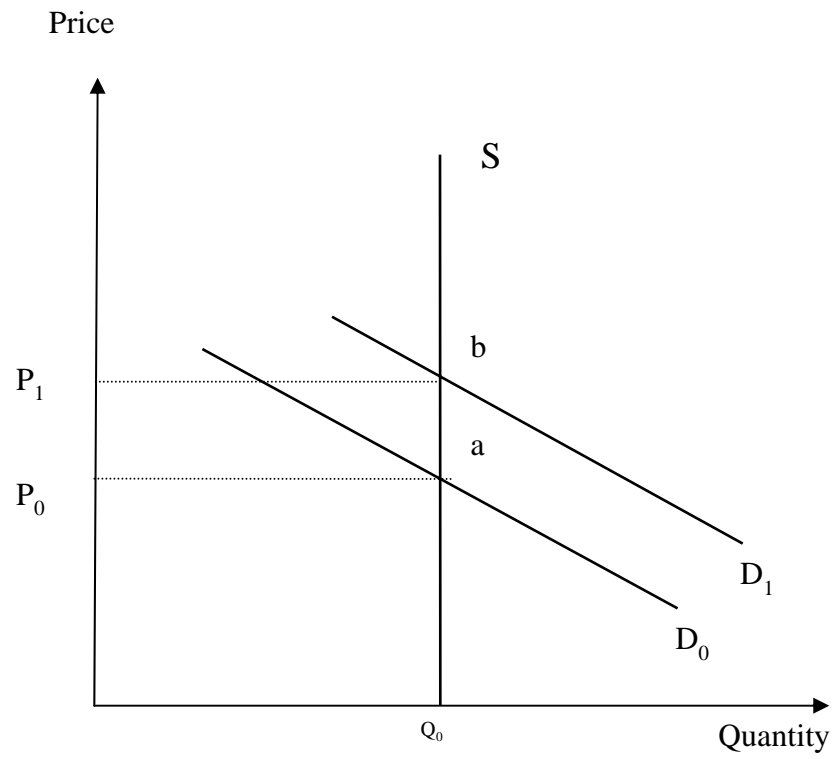
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Motivations

- Importance of promotion evaluation:
 - Help the industry to understand the impacts of its expenditures;
 - Mandated by USDA.
- Increasing availability of disaggregate data, such as retailer scanner data.
- This paper evaluates the industry promotion programs at the retail level in light of retailer pricing behavior.

Review of Promotion Evaluation Research

■ Promotion evaluation under a traditional framework



- Various studies have shown that these programs are often quite successful in generating a high return on the dollars invested (Kaiser, Alston, Crespi, and Sexton, 2005).

HOWEVER,

- Aggregate data make it difficult to identify promotional effects.
- These studies provide little guidance in terms of targeting advertising to cities or retailers, and determining which types of campaigns are more effective.
- Little is known about how the effectiveness of these programs is facilitated or impeded by retailers' own pricing strategies.

Contributions

- Our access to a unique scanner dataset and the natural experiment created by the California Avocado Commission targeting 12 markets for its promotions enables us to better identify the impacts of promotions than studies that rely on aggregate annual data.
- We discuss a method to aggregate the market-level impacts of promotions to discern overall benefits from promotion to producers—the ultimate goal of promotion-evaluation studies.
- Promotion evaluation at the disaggregate level using microdata provides advice to the industry regarding differential impacts of promotion by (i) market/region, (ii) retailer, (iii) media type, and/or (iv) timing of the promotions.

California Avocado Industry

■ Production

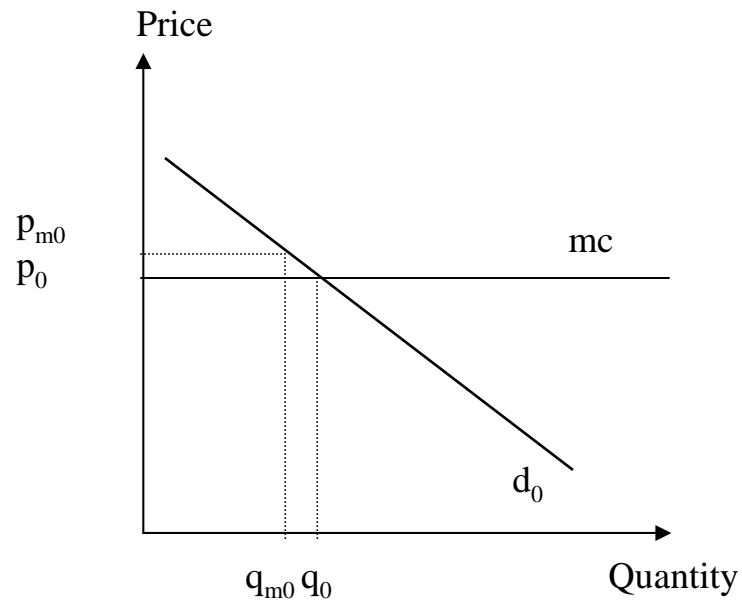
- California produces 88% of the annual U.S. avocado crop with the remainder coming from Florida.
- Hass variety is only produced in California, and accounts for 91% of avocado production in California in the past 10 years.
- Avocado production is seasonal to some extent—advertising is timed to correspond with peak CA production.

■ Industry-funded promotions

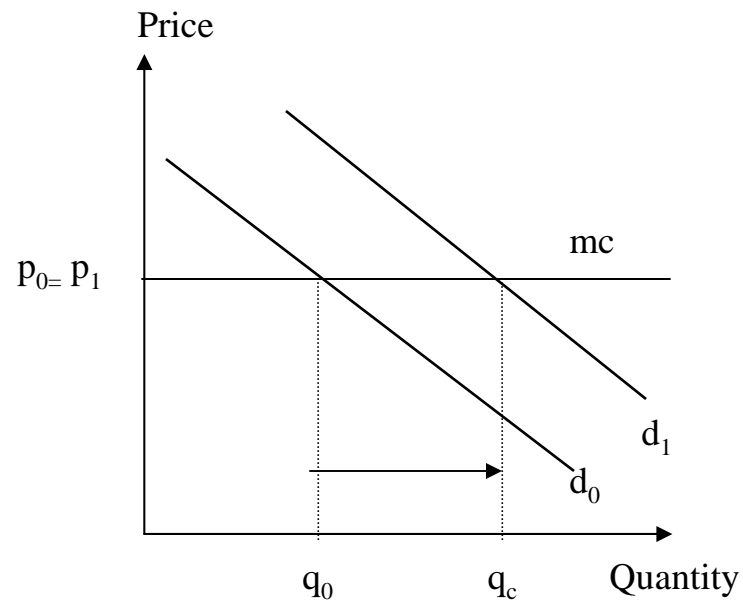
- The industry expended nearly \$5 million annually on consumer advertising programs.
- Promotions are conducted by the California Avocado Commission (CAC).
- Advertising programs by media type:
 - Radio, outdoor, and print advertising programs.
- Promotions are conducted in eleven to twelve selected markets during particular times each year. Promotion markets did not have access to Mexican avocado imports.

The Analytical Framework

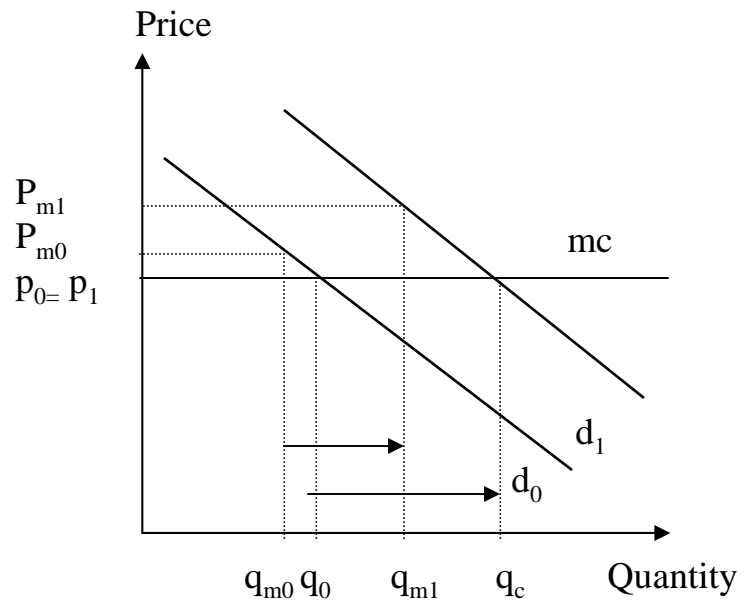
■ The effects of promotion programs at the retail level



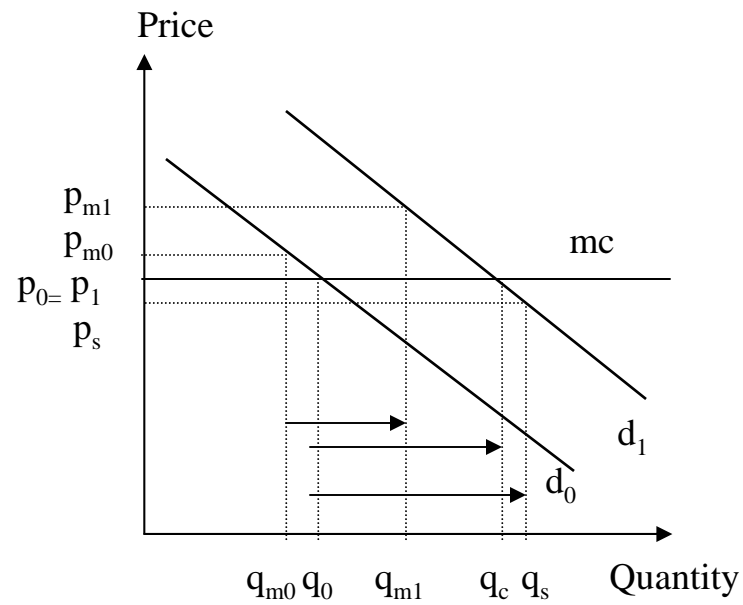
■ The effects of promotion programs at the retail level



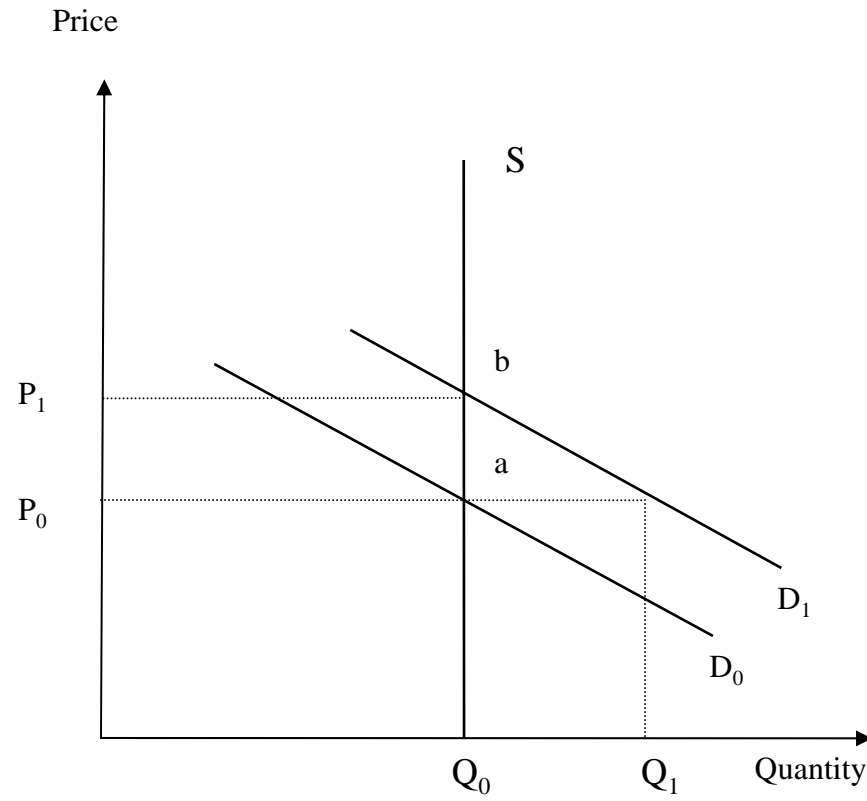
■ The effects of promotion programs at the retail level



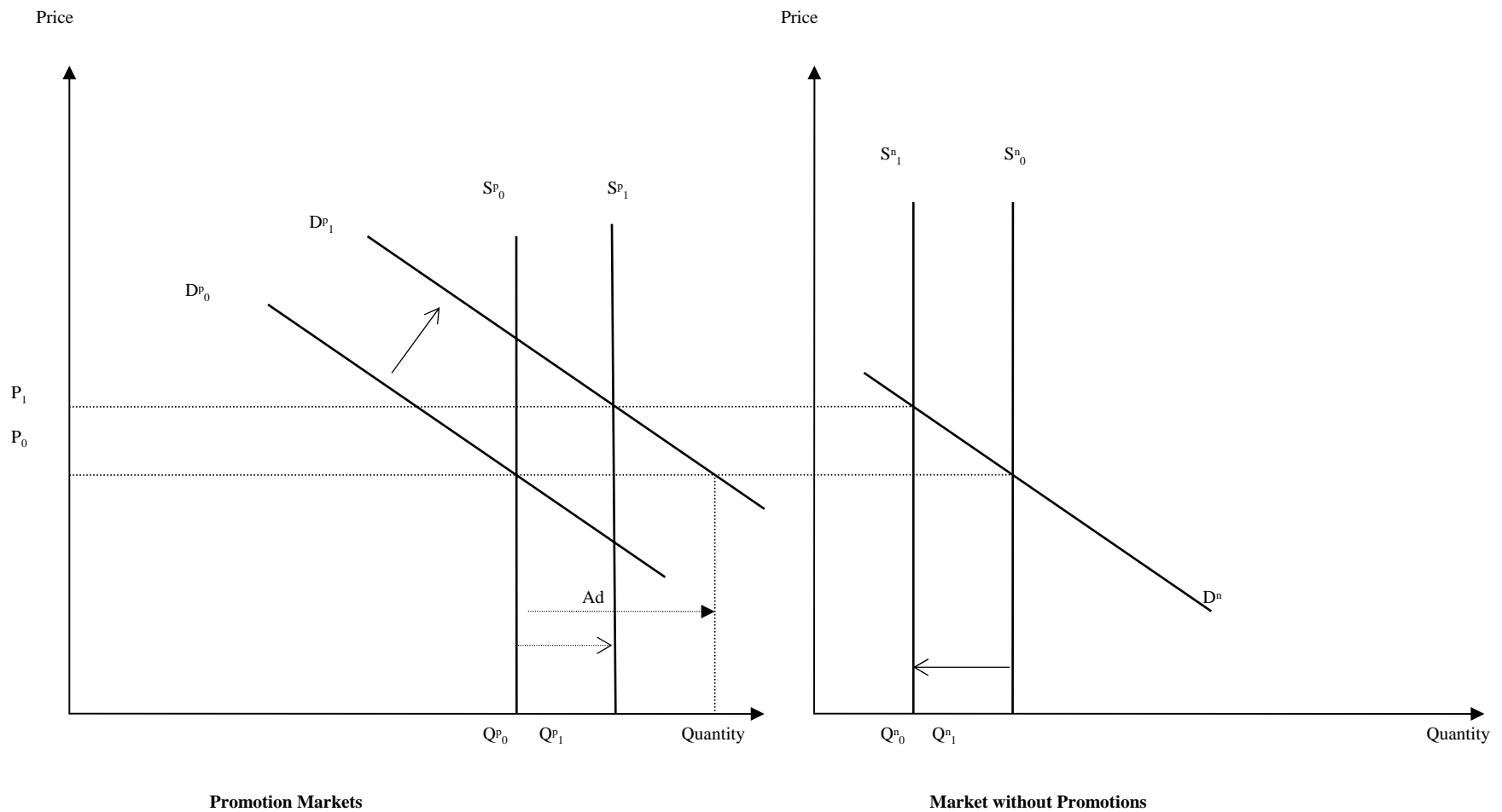
■ The effects of promotion programs at the retail level



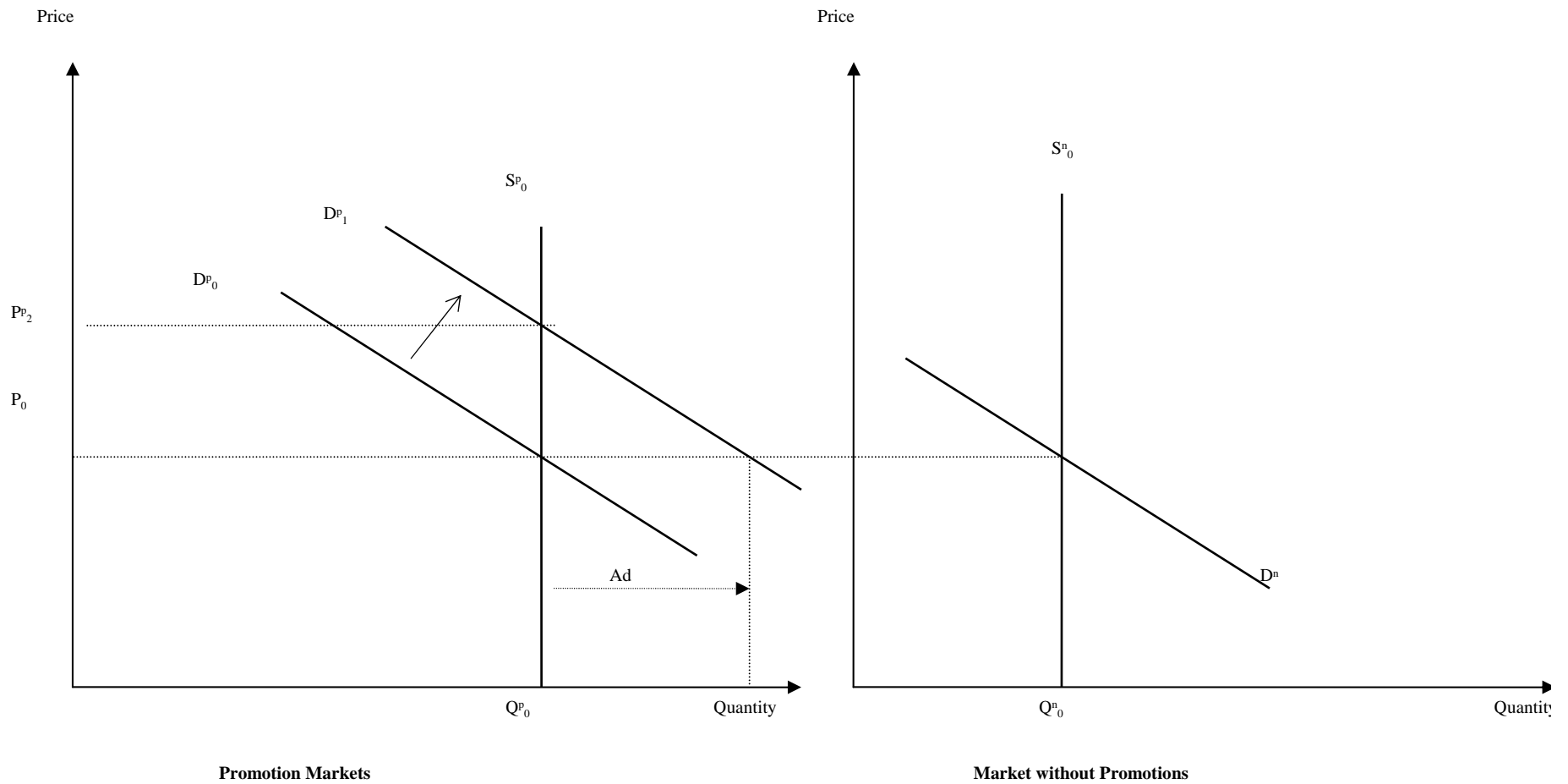
■ The effects of promotion programs at the farm level



■ The effects of promotion programs at the shipment level in the case of efficient arbitrage



■ The effects of promotion programs at the shipment level in the case of no arbitrage



The Data

- **Study Period:** Aug. 2002—Oct. 2004 (short-panel data); Nov. 1996-Oct.2004 (long-panel data).
- **Retailer Scanner Data:** weekly retail sales and prices for large and small avocados at 90 major retail accounts in 38 markets in the U.S.
- **Shipment Data:** weekly shipping-point prices and shipment volumes of Californian Hass avocados from California to each of the 38 destination markets for short- and long-panel data; in addition, shipment data for imported avocados for the short-panel data.
- **Import Data:** monthly import volumes of Hass avocados from Mexico and Chile to the U.S. (USITC).
- **Promotion data:** promotion expenditure for the short-panel data; information on promotion programs for the long-panel data. Promotions: media types (radio and outdoor), markets, and the timing of advertising programs.

Identification of Promotion Effects at the Retail Level

- **Experiment design of the promotion programs**
 - **Markets that receive promotions and markets that do not.**
 - **Differences in promotion expenditure across markets.**
- **Case 1: promotion expenditure data at the market level**
 - **Promotion variable in a panel models that varies both over time and in cross-section**
- **Case 2: promotion information but not expenditure at the market level**
 - **“Difference-in-Differences” (DID)**

■ A framework of “Difference-in Differences”

$$q(a, t) = \delta(t) + \eta(a) + \psi D(a, t) + \beta p(a, t) + \nu(a, t)$$

$q(a, t)$: retail sales for avocados sold at retail account a at time t ;

$\delta(t)$: the time-specific component;

$\eta(a)$ represents the account-specific effects;

$t=1$: period with promotion;

$t=0$: period without promotion;

$D(a, 1)=1$: the “treated”;

$D(a, 1)=0$: the “controls”;

$D(a, 0)=0$ for both the “treated” and “controls” in $t=0$.

■ Before-and-after promotions

$$\begin{aligned} & E[q(a,1) | D(a,1) = 1] - E[q(a,0) | D(a,1) = 1] \\ &= E[q(a,1) - q(a,0) | D(a,1) = 1] \\ &= [\delta(1) - \delta(0)] + [\eta(a) - \eta(a)] + \psi[D(a,1) - D(a,0)] \\ &\quad + E[p(a,1) - p(a,0) | D(a,1) = 1] \\ &= \delta(1) - \delta(0) + \psi + \beta E[p(a,1) - p(a,0) | D(a,1) = 1] \end{aligned}$$

$$\begin{aligned} & E[q(a,1) | D(a,1) = 0] - E[q(a,0) | D(a,1) = 0] \\ &= E[q(a,1) - q(a,0) | D(a,1) = 0] \\ &= [\delta(1) - \delta(0)] + [\eta(a) - \eta(a)] + E[p(a,1) - p(a,0) | D(a,1) = 0] \\ &= \delta(1) - \delta(0) + \beta E[p(a,1) - p(a,0) | D(a,1) = 0] \end{aligned}$$

■ Identification of promotion effects by DID

$$\begin{aligned} & \{E[q(a,1) | D(a,1) = 1] - E[q(a,0) | D(a,1) = 1]\} \\ & - \{E[q(a,1) | D(a,1) = 0] - E[q(a,0) | D(a,1) = 0]\} \\ & = \psi \\ & + \beta \{E[p(a,1) - p(a,0) | D(a,1) = 1] - E[p(a,1) - p(a,0) | D(a,1) = 0]\} \end{aligned}$$

Empirical Models

■ Retail sales Model

- Dependent variable: $Sales_{i,a,t}$
 - i =size i ; a =retail account a ; t =week t .
- Explanatory variables:
 - Time-control variables-weekly fixed effects;
 - Retail account-size fixed effects;
 - The CAC's promotions;
 - Retail price and its lags.

■ Retail pricing model

- Dependent variable: $P_{i,a,t}$
- Explanatory variables:
 - Weekly fixed effects;
 - Retail account-size fixed effects;
 - Lags of retail prices (dynamics in retail pricing);
 - Shipping-point price and its lags;
 - Long-panel data: import volumes of avocados from Chile and Mexico;
 - The CAC's promotions.

■ Shipping price model

- Dependent variable: Shipping price_{i,m,t}
- Explanatory variables:
 - Time-control variables;
 - Market-size fixed effects;
 - Import volumes of avocados from Chile and Mexico;
 - Shipment volume;
 - The CAC's promotions.

■ Estimation

- Panel models:
 - The main model: fixed-effects model.
 - Other models: random-effects, between-effects models.
- Estimation approach:
 - Panel GMM and dynamic panel models
- Specification tests:
 - Heteroskedasticity;
 - Overidentifying restrictions, exogeneity;
 - Arellano-Bond autocorrelation tests;
 - Weak IV tests.

Results

Short-panel	Retail Sales (1000 units)	Retail Price (cents/unit)	Shipping Price (cents/unit)
Promotion (pooled)	0.030 (0.071)	-0.019 (0.020)	0.006 (0.024)
Radio	0.033 (0.077)	-0.019 (0.021)	0.028 (0.018)
Outdoor	-0.061 (0.187)	-0.023 (0.079)	0.083 (0.062)

Long-panel	Retail Sales (1000 units)	Retail Price (cents/unit)	Shipping Price (cents/unit)
Promotion (pooled)	3.438*** (1.386)	-0.150 (0.229)	0.068 (0.564)
Radio	3.920* (2.265)	0.042 (0.411)	0.136 (0.350)
Outdoor	1.903 (1.387)	-0.245 (0.311)	0.087 (0.442)

Discussion

- The analysis demonstrates that the radio campaign and outdoor advertisements were successful in raising avocado sales.
- There is no evidence that retailers charged higher prices during the CAC's promotions.
- Nonetheless, the CAC's promotion programs could be enhanced if retailers were better informed about the advertising campaigns.

- The impacts of the promotions on both retail price and sales differed significantly across the ten selected markets where the CAC focused its efforts.
- The effects of the CAC's promotions on retail sales were enhanced in those markets where retail price decreased significantly.