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Promotion effects on household expenditures and budget allocation among shopping basket items.

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Motivation of the study



Market Competition

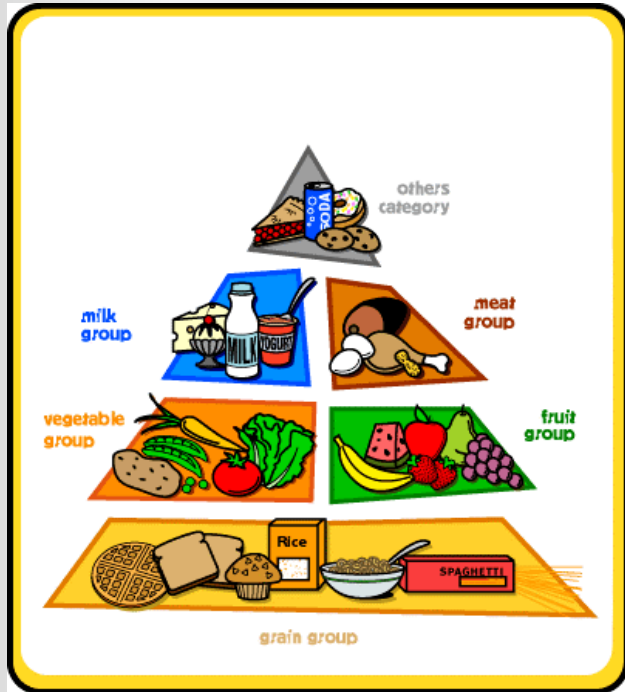


Sales Promotion



53.1 % marketing budget in 2022
1/3 of food products are sold with promotion
36% in volume
34% in value
24% in distributors revenue

Motivation of the study



Bell et al.,(1999)

Putsis & Dhar, (2001)

Dawes, (2004)



Drèze et al., (2004)

Revoredo-Giha et al.,(2018)

- Understanding the interdependency structure among categories purchased jointly by their customers.
- Retailers should know how to allocate their promotional budget across categories.

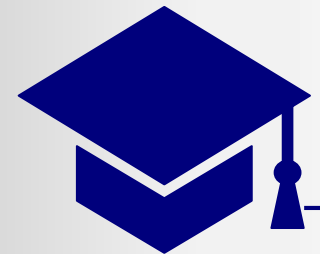


- Understand the consumer behavior in the retail shop,
- How is the shopping budget allocated across categories?
- Do promotion and price induce households to change their shopping expenditures?
- which category is most beneficial when it is sold under promotion?
- Is there a reallocation of expenditures because of the nature of the relationship (complements or substitutes) between categories in the household's shopping basket?



- Profile the consumers of two retailers (“A” & “B”) with different strategies and have a first insight about the influence of promotion on expenditure.
- Analyze the effect of price and promotion on the household expenditures on the shopping basket.
- Determine how the expenditures per shopping trip are allocated between the categories in the shopping basket as a function of prices and promotion.

① Data





Data description



-Consumers' micro panel data
 -December 30th, 2016, to December 30th, 2017
 7,100,012 observations



289



276



Units of measurement



Expenditure per product



DEMOGRAPHIC





Supermarket A

26.5% market share
Every day low price
Private labels
Little promotion offers

Supermarket B

9.7% market share
High-low price
Frequent promotions
offers



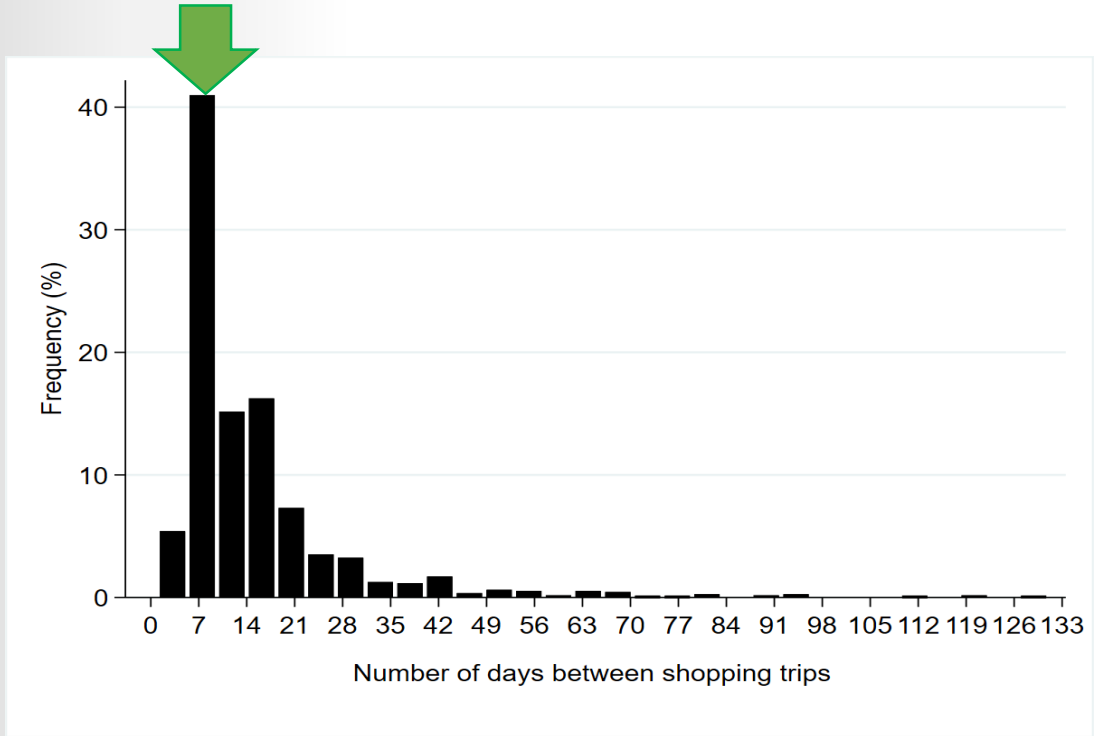
- **Food categories**

- 1) Grains and grain-based products
- 2) Vegetables and vegetable products
- 3) Starchy roots, tubers, legumes, nuts and oilseeds
- 4) Fruit, fruit products and fruit and vegetable juices
- 5) Beef, veal and lamb
- 6) Pork
- 7) Poultry eggs, other fresh meat
- 8) Processed and other cooked meats
- 9) Fish and other seafood
- 10) Milk, dairy products and milk product imitates
- 11) Cheese
- 12) Sugar and confectionary and prepared desserts
- 13) Plant based fats
- 14) Composite dishes (animal and vegetable composite dishes)
- 15) Snacks and other foods
- 16) Drinks
- 17) Residual category

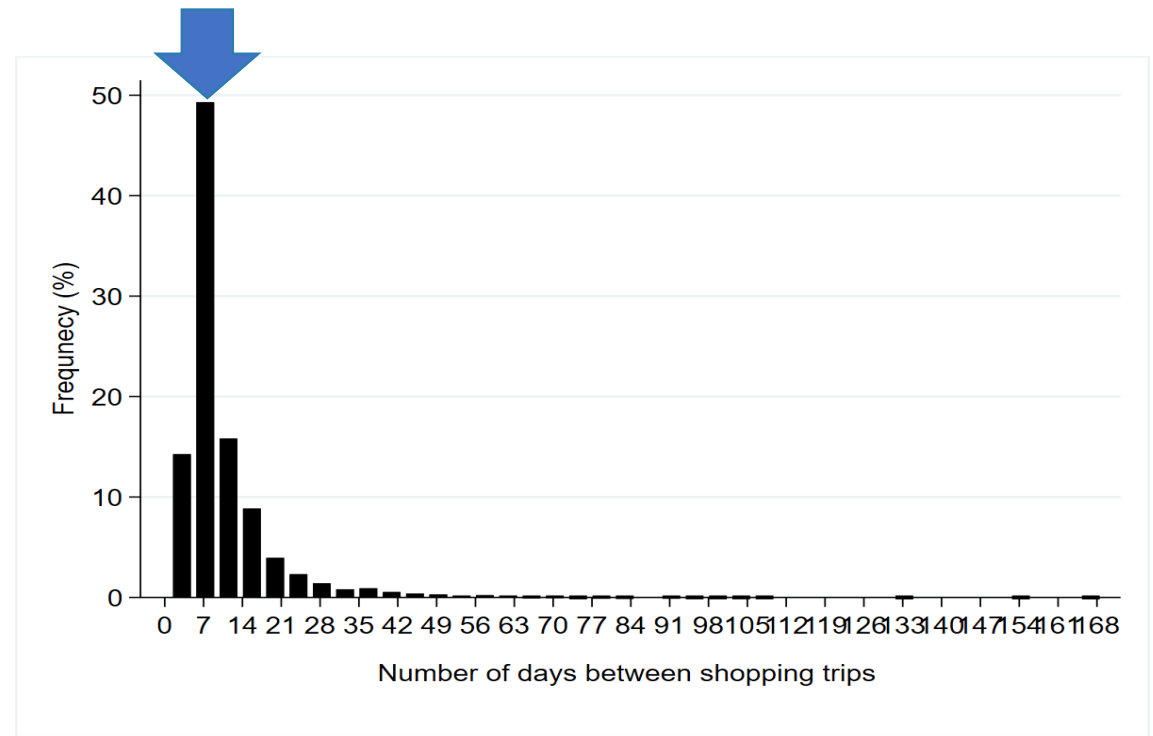


Data: Final dataset

- Households that made at least **two shopping trips** for each **food category**.
- Aggregation across shopping trips per **week**.
- **365 households, 11772 shopping trips (A)**
- **52 households, 1161 shopping trips (B)**



Interpurchase time in days for (A)



Interpurchase time in days for (B)

② Methodology





• Linear fixed effect regression

$$\ln X_t^{(h)} = \alpha_0 + \sum_{g=1}^{17} b_g \ln P_{gt}^{(h)} + \sum_{g=1}^{17} c_g Pm_{gt}^{(h)} + \sum_{l=1}^L f_l Z_l^h + r_t^{(h)}$$

Where:

- $X_t^{(h)}$ is household expenditures per shopping trip (t),
- $P_{gt}^{(h)}$ is the price of category (g) at time (t) for household (h),
- $Pm_{gt}^{(h)}$ takes a value of 1 if there is a promotion on category (g) during a shopping trip (t) made by the household(h), 0 otherwise,
- Z_l^h is the lth demographic variable for household (h),
- $r_t^{(h)} = H^{(h)} + u_t, u_t \sim i.i.d. N(0, \sigma_u^2),$
- $H^{(h)}$ is a fixed effect specification to accommodate heterogeneity across households,
- α_0, b_g, c_g, d_g and f_t are the regression coefficients, \ln denotes natural logarithm



- **Linear version** of the **almost ideal demand system** (AIDS) model (Deaton & Muellbauer, 1980).

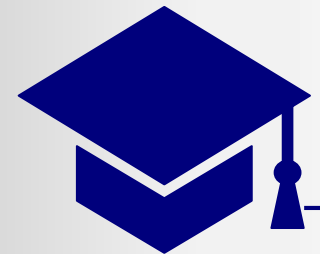
$$w_{gt}^{(h)} = \alpha_g + \sum_{j=1}^n \beta_{gj} \ln P_{jt}^{(h)} + \theta_g \ln \left(\frac{X_t^{(h)}}{\bar{P}_t^{(h)}} \right) + \sum_{j=1}^n \delta_{gj} Pm_{jt}^{(h)} + \varepsilon_{gt}^{(h)}$$

- Imposed restrictions: **Adding-up, Homogeneity and Symmetry**

Estimation of Elasticities:

- **Marshallian owned-price** elasticity of food category g,
- **Marshallian cross-price elasticity** of food category g,
- **Expenditure elasticity** of food category g.

③ Results and Discussion





Results and Discussion: Consumer profile

Shopping trips :27.24



Shopping trips :38.20

Time interval: 15.25 days



Time interval: 10.13 days

40.83 % (children 6-15)



28.65 % (children 6-15)

B

11.02% (children 0-5)



11.98 % (children 0-5)

48.15% (No children)



59.38 % (No children)

A

49.61 % (Middle)



49.48% (Middle)

15.50% (Middle low)



21.88% (Middle low)

24.03% (Middle high)



17.53% (Middle high)



Results and Discussion: Consumer profile

24.20% (Immigrants)

75.80% (Spanish)



30.21% (Immigrants)

69.79% (Spanish)



B

66.32% (3 to 4 members)

25.24% (2 members)



59.81% (3 to 4 members)

25.00% (2 members)



A

30.75% (couples with middle aged children)

8.35% (couples with adult children)

11.02% (couples with small children)



29.17% (couples with middle aged children)

17.71% (couples with adult children)

11.98% (couples with small children)



Results and Discussion : Category expenditures

	Supermarket (B)				Supermarket (A)			
Food categories	Market share (%)	Percent trips with promotion (%)	Category expenditure without promotions (€)	Category expenditure with promotions(€)	Market share (%)	Percent trips with promotion (%)	Category expenditure without promotions (€)	Category expenditure with promotions (€)
Grains and grain-based products	7.39	23.92	2.70 (2.25)	4.40 (2.87)	8.10	2.04	2.51 (2.16)	3.55 (2.27)
Vegetables and vegetable products	6.63	30.94	3.21 (2.83)	7.03 (5.37)	7.45	2.88	3.49 (3.11)	5.12 (3.66)
Starchy roots,...and oilseeds	4.45	24.02	2.60 (2.40)	4.30 (3.73)	4.23	1.64	2.88 (2.65)	4.35 (3.28)
Fruit, fruit products and vegetable juices	8.27	55.82	4.35 (3.73)	7.76 (5.65)	7.47	20.47	4.63 (3.93)	6.26 (4.83)
Beef, veal, and lamb	3.21	18.79	7.96 (7.43)	9.08 (7.47)	3.33	6.35	6.33 (5.51)	6.15 (4.44)
Pork	3.67	30.69	6.84 (7.53)	4.48 (11.37)	4.92	2.52	5.48 (6.28)	7.83 (11.19)
Poultry, eggs, other fresh meats	2.72	30.00	6.47 (4.33)	7.58 (5.13)	3.82	0.28	5.86 (4.03)	6.92 (3.15)
Processed and other cooked meats	5.49	41.42	3.90 (3.95)	7.37 (6.39)	6.53	18.06	4.59 (3.84)	7.20 (5.22)
Fish and other seafood	6.54	43.09	8.16(8.04)	18.58(15.79)	6.36	5.21	9.26 (8.93)	14.66 (14.39)
Milk, dairy products, and milk product imitates	7.72	33.46	5.32(4.58)	7.34(6.15)	7.45	2.37	4.85 (4.29)	7.04 (5.32)
Cheese	6.44	27.75	4.24 (3.70)	6.87(5.49)	6.20	6.72	4.13 (3.92)	5.77 (4.52)
Sugar and confectionary and prepared desserts	7.77	49.75	5.23 (4.74)	9.77 (8.30)	7.77	2.71	4.38 (3.75)	6.64 (4.67)
Plant based fats	3.28	46.45	6.85 (7.95)	10.39 (9.33)	2.56	0.19	5.30 (5.29)	4.65 (6.72)
Composite dishes	6.89	44.15	5.54 (4.67)	9.98 (6.81)	5.73	12.35	5.02 (4.13)	6.90(6.31)
Snacks and other food	4.13	50.59	2.08 (1.79)	4.04 (2.50)	4.06	1.37	2.20 (1.80)	3.15 (2.34)
Drinks	8.75	55.72	6.96 (6.69)	13.23 (12.26)	7.92	20.03	5.52 (5.58)	11.03 (9.52)
Residual category	6.64	21.57	4.48 (3.75)	8.39 (6.30)	6.10	5.60	2.04(2.44)	5.89 (4.79)



Results and Discussion : Effects on household expenditures

• Prices

Variables	Supermarket (B)			Supermarket (A)		
	Coef.	Std. Err.	Sig.	Coef.	Std. Err.	Sig.
Intercept	1.3645	0.1414	**	0.5453	0.04586	**
Prices						
Grains and grain-based products	0.14682	0.0349	**	0.08708	0.0139	**
Vegetables and vegetable products	0.06331	0.0267	*	0.03563	0.0104	**
Starchy roots, tubers, legumes, nuts, and oilseeds	0.03792	0.0201		0.07548	0.0083	**
Fruit, fruit products and fruit and vegetable juices	0.09288	0.0329	**	0.02053	0.0109	*
Beef, veal, and lamb	0.17322	0.0227	**	0.2005	0.0958	**
Pork	0.09875	0.0289	**	0.1939	0.0117	**
Poultry, eggs, other fresh meats	0.06647	0.0223	**	0.2370	0.0100	**
Processed and other cooked meats	0.15768	0.0348	**	0.2171	0.0145	**
Fish and other seafood	0.18620	0.0350	**	0.3076	0.0127	**
Milk, dairy products, and milk product imitates	0.04398	0.0317		0.08671	0.0126	**
Cheese	0.17797	0.0382	**	0.2816	0.0143	**
Sugar and confectionary and prepared desserts	0.07525	0.0375	*	0.1144	0.0122	**
Plant based fats	0.07290	0.0240	**	0.1732	0.0082	**
Composite dishes (animal and vegetable composite dishes)	0.09117	0.0296	**	0.1364	0.0100	**
Snacks and other food	0.05939	0.0312		0.2021	0.0107	**
Drinks	0.06320	0.0233	**	0.02980	0.0080	*
Residual category	-0.01415	0.0219		0.04285	0.0082	**
N	1161			11772		
R ²	0.54630			0.6349		

Notes: Prices are in logarithms and *p < .05, **p < .01.



Results and Discussion: Effects on household expenditures

• Promotions

Promotions	Supermarket (B)			Supermarket (A)		
	Coef.	Std. Err.	Sig.	Coef.	Std. Err.	Sig.
Grains and grain-based products	0.08769	0.0440	*	0.15335	0.0412	**
Vegetables and vegetable products	0.14985	0.0439	**	0.13337	0.0372	**
Starchy roots, tubers, legumes, nuts, and oilseeds	0.19628	0.0535	**	0.13320	0.0645	*
Fruit, fruit products and fruit and vegetable juices	0.17511	0.0339	**	0.17924	0.0151	**
Beef, veal, and lamb	0.07229	0.0746		0.15097	0.0374	**
Pork	-0.00978	0.0642		0.10264	0.0532	
Poultry, eggs, other fresh meats	0.14739	0.0639	*	0.27479	0.1652	
Processed and other cooked meats	0.12969	0.0441	**	0.20309	0.0187	**
Fish and other seafood	0.30316	0.0386	**	0.24799	0.0298	**
Milk, dairy products, and milk product imitates	0.11001	0.0388	*	0.16013	0.0411	**
Cheese	0.08567	0.0442	**	0.16967	0.0286	**
Sugar and confectionary and prepared desserts	0.18260	0.0364	**	0.11613	0.0368	**
Plant based fats	0.16823	0.0502	**	-0.66399	0.2412	
Composite dishes (animal and vegetable composite dishes)	0.17466	0.0382	**	0.26803	0.0272	**
Snacks and other food	0.11526	0.0488	*	-0.02013	0.0717	
Drinks	0.17742	0.0336	**	0.23799	0.0153	**
Residual category	0.16382	0.0414	**	0.19223	0.0279	**

Notes: *p < .05, **p < .01.



Results and Discussion : Expenditure's allocation (AIDS)

Supermarket B

Food categories	Own- promotion
Grains and grain-based products	0.05231**
Vegetables and vegetable products	0.06705**
Starchy roots, tubers, legumes, nuts, and oilseeds	0.04415**
Fruit and fruit products	0.09070**
Beef, veal, and lamb	0.10290**
Pork	0.04761**
Poultry, other fresh meats	0.09625**
Processed meats products	0.08769**
Fish and seafood	0.16124**
Milk and dairy products	0.07563**
Cheese	0.07361**
Sugar and confectionary and prepared desserts	0.10757**
Plant based fats	0.00190
Composite dishes	0.10330**
Snacks and other foods	0.06341**
Drinks	0.14727**
Residual category	0.09650**

Supermarket A

Food categories	Own- promotion
Grains and grain-based products	0.03531**
Vegetables and vegetable products	0.05419**
Starchy roots, tubers, legumes, nuts, and oilseeds	0.08514**
Fruit and fruit products	0.06363**
Beef, veal, and lamb	0.10290**
Pork	0.06853**
Poultry, other fresh meats	0.03712
Processed meats products	0.07041**
Fish and seafood	0.10488**
Milk and dairy products	0.06379**
Cheese	0.05783**
Sugar and confectionary and prepared desserts	0.07602**
Plant based fats	0.29556**
Composite dishes	0.06814**
Snacks and other foods	0.04081**
Drinks	0.11199**
Residual category	0.06120**

Notes: Price*p < .05, **p < .01.



Results and Discussion : Cross-promotion effects

Supermarket B

Food categories	Vegetables and vegetable products	Beef, veal, and lamb	Fish and seafood products	Composite dishes	Poultry and other fresh meats	Processed and cooked meats	Pork	Fruit, fruit products and vegetable juices
Processed meats products	-0.01264**	-0.01269*	-0.02885**	-0.01430*				
Fish and seafood				-0.0157**	-0.00775*	-0.01165*		
Composite dishes			-0.02894**		-0.00820*	-0.10120**	-0.01203**	
Vegetables and vegetable products							0.01179*	0.01667*

Supermarket A

Food categories	Fruits and fruits products	Beef, veal, and lamb	Fish and seafood products	Poultry and other fresh meats	Processed and cooked meats	Pork	Grains and grain-based products	snacks
Processed meats products	-0.01365**	-0.01269*	-0.02695**	-0.00589*				
Beef, veal, and lamb			-0.03644**					
Fish and seafood products				-0.00867*	-0.00993*	-0.01054*		
Composite dishes			-0.01342					
Cheese							0.00773*	
Drinks								0.00277*

Notes: *p < .05, **p < .01.



Results and Discussion : Own-price and expenditure elasticity

Supermarket B

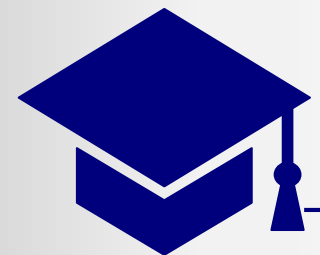
Food categories	Own- price elasticity	Expenditure's elasticity
Grains and grain-based products	-0.684**	0.369**
Vegetables and vegetable products	-0.927**	0.756**
Starchy roots, tubers, legumes, nuts, and oilseeds	-0.499**	1.098**
Fruit and fruit products	-0.954**	0.838**
Beef, veal, and lamb	0.234	1.420**
Pork	-1.663**	1.443**
Poultry, other fresh meats	-0.960**	1.325**
Processed meats products	-0.683**	1.863**
Fish and seafood	-0.615**	1.300**
Milk and dairy products	-1.307**	1.152**
Cheese	-0.869**	1.021**
Sugar and confectionary and prepared desserts	-0.611**	0.724**
Plant based fats	0.156	1.192**
Composite dishes	-1.020**	1.076**
Snacks and other foods	-0.563**	0.790**
Drinks	-0.860**	0.908**
Residual category	-0.802**	0.971**

Supermarket A

Food categories	Own- price elasticity	Expenditure's elasticity
Grains and grain-based products	-0.769**	0.443**
Vegetables and vegetable products	-1.014**	0.867**
Starchy roots, tubers, legumes, nuts, and oilseeds	-0.680**	1.026**
Fruit and fruit products	-1.265**	0.867**
Beef, veal, and lamb	0.054	1.240**
Pork	-1.482**	1.277*
Poultry, other fresh meats	-1.215**	1.250**
Processed meats products	-1.017**	1.093**
Fish and seafood	-1.128**	1.286**
Milk and dairy products	-1.394**	0.939**
Cheese	-0.780**	1.021**
Sugar and confectionary and prepared desserts	-0.876**	0.762**
Plant based fats	0.180	1.297**
Composite dishes	-0.995**	0.975**
Snacks and other foods	-0.947**	0.823**
Drinks	-0.937**	0.960**
Residual category	-0.991**	0.962**

Notes: *p < .05, **p < .01.

④ Conclusions





- The promotion users of **Supermarket A** and **Supermarket B** are distinct.
- Promotion induces an increase in household expenditures .
- The effects are heterogenous between categories and supermarkets.
- The effects of promotions are stronger in **Supermarket B** than **Supermarket A**.
- Promotion can cause the reallocation of budget between categories.
- The own-promotion effect is higher than cross-promotion effect.
- The cross-promotion effects are mostly negative and asymmetric between related categories.
- Customers of **Supermarket A** are more price sensitive (Price-elastic).



Thanks!

**Do you have any questions?
Any suggestions?**

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