Econometrics III

FGV-EESP

Marketing-Mix Strategies Effectiveness: Results from In-Store Consumer Market

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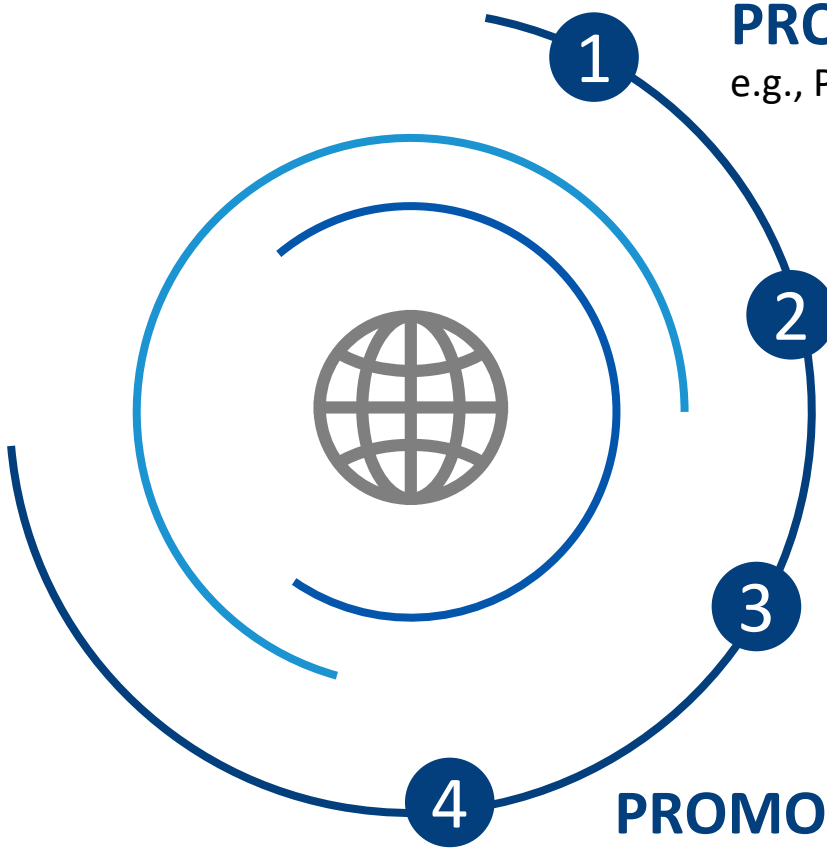
Marketing mix strategies are very important for brands in order to generate greater market share and participation



PRODUCT
e.g., Product Line Length, Product Features

DISTRIBUTION
e.g., Distribution Breadth, Product Commodity Value, Numeric Distribution

PRICE
e.g., Average Price, Relative Price, Discount Depth

PROMOTION
e.g., Display, Advertising Spending, Word of Mouth

Effect on:

- Sales (e.g., brand, category)
- Market share
- Choice
- Elasticity
- Incidence

Vector Autogregression (VAR) has largely been employed in literature to study marketing mix effects on sales, choice and share

CURRENT LITERATURE ON LONG-TERM EFFECTS OF MARKETING VARIABLES

	Effect of						
	Promotion	*Advertising*	*Distribution*	*Product*	*Effect on*	*Modeling Approach*	*Number of Categories*
Clarke (1976)		✓			Brand sales	VPM	1
Baghestani (1991)		✓			Brand sales	VAR	1
Dekimpe and Hanssens (1995)		✓			Chain sales	VAR	1
Papatla and Krishnamurthi (1996)	✓				Choice	VPM	1
Mela, Gupta, and Lehmann (1997)	✓	✓			Choice	VPM	1
Mela, Jedidi, and Bowman (1998)	✓				Incidence and quantity	VPM	1
Mela, Gupta, and Jedidi (1998)	✓	✓			Market structure	Mixed	1
Kopalle, Mela, and Marsh (1999)	✓				Brand sales	VPM	1
Jedidi, Mela, and Gupta (1999)	✓	✓			Choice and quantity	VPM	1
Foekens, Leeflang, and Wittink (1999)	✓				Brand sales	VPM	1
Dekimpe and Hanssens (1999)	✓	✓			Brand sales	VAR	1
Dekimpe, Hanssens, and Silva-Risso (1999)	✓				Brand and category sales	VAR	4
Srinivasan, Popkowski Leszczyc, and Bass (2000)	✓		✓		Market share	VAR	2
Bronnenberg, Mahajan, and Vanhonacker (2000)	✓	✓	✓		Market share	VAR	1
Nijs et al. (2001)	✓				Category sales	VAR	560
Pauwels, Hanssens, and Siddarth (2002)	✓				Incidence, choice, and quantity	VAR	2
Srinivasan et al. (2004)	✓				Margin and revenue	VAR	21
Pauwels (2004)	✓	✓		✓	Brand sales	VAR	1
Van Heerde, Mela, and Manchanda (2004)				✓	Market structure	VPM (DLM)	1
Pauwels et al. (2004)	✓			✓	Financial measures	VAR	1
Steenkamp et al. (2005)	✓	✓			Brand sales	VAR	442
Sriram, Balachander, and Kalwani (2007)	✓	✓		✓	Brand sales	VPM	2
Ataman, Mela, and Van Heerde (2008)	✓	✓	✓	✓	Brand sales (new brands only)	VPM-SE (DLM)	22
Slotegraaf and Pauwels (2008)	✓			✓	Brand sales	VAR	7
Srinivasan, Vanhuele, and Pauwels (2008)	✓	✓	✓		Brand sales	VAR	4
This article	✓	✓	✓	✓	Brand sales and elasticity	VPM-SE (DLM)	25

Notes: VPM = varying parameter model, VAR = vector autoregressive model, DLM = dynamic linear model, and SE = system of equations.

Source: Ataman, M. B., Van Heerde, H. J., & Mela, C. F. (2010). The Long-Term Effect of Marketing Strategy on Brand Sales. *Journal of Marketing Research*, *47*(5), 866–882. https://doi.org/10.1509/jmkr.47.5.866

The data comes from in-store audit research compiled by a large global research firm

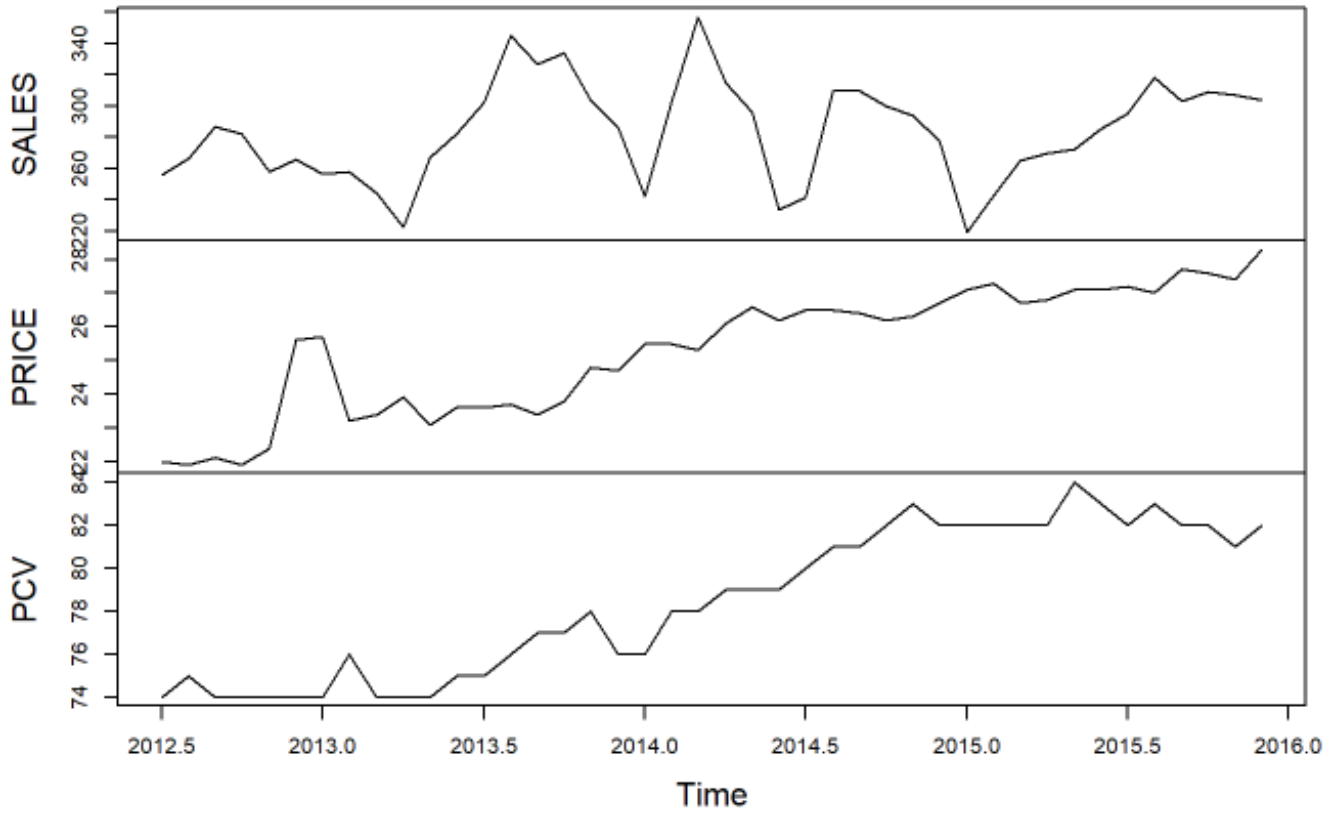
Cookie Category

42

periods were observed from jul-12 to dec-15

3

variables were considered: sales, price, distribution



Variable operationalization and descriptive statistics

Variable	Operationalization	Mean	SD
Sales	Sales of the brand to consumers in volume (kilos)	283,400	32.15516
Product Category Volume (PCV%)	Share of the brand category sold by the stores in which the brand has been sold.	78.48	3.437513
Price	Average brand price to consumers in reais	25.33	1.864101

Specified Model

$$\begin{bmatrix} SALES_t \\ PCV_t \\ PRICE_t \end{bmatrix} = \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \end{bmatrix} + \begin{bmatrix} \beta_{11}^1 & \beta_{12}^1 & \beta_{13}^1 \\ \beta_{21}^1 & \beta_{22}^1 & \beta_{23}^1 \\ \beta_{31}^1 & \beta_{32}^1 & \beta_{33}^1 \end{bmatrix} \times \begin{bmatrix} SALES_{t-1} \\ PCV_{t-1} \\ PRICE_{t-1} \end{bmatrix} + \begin{bmatrix} \beta_{11}^p & \beta_{12}^p & \beta_{13}^p \\ \beta_{21}^p & \beta_{22}^p & \beta_{23}^p \\ \beta_{31}^p & \beta_{32}^p & \beta_{33}^p \end{bmatrix} \times \begin{bmatrix} SALES_{t-p} \\ PCV_{t-p} \\ PRICE_{t-p} \end{bmatrix} + \begin{bmatrix} e_{1,t} \\ e_{2,t} \\ e_{3,t} \end{bmatrix}$$

Where:

- $SALES$ is the volume sale in kilos for the focal brand in month *t*;
- PCV is the product commodity value (retail distribution) for the focal brand in month *t*;
- Price is the unit *PRICE* for the focal brand in month *t*.

Test for Unit Roots & Cointegration Test

Sales Series

Augmented Dickey-Fuller Test

data: SALES
Dickey-Fuller = -2.9119, Lag order = 3,
p-value = 0.2142

alternative hypothesis: stationary

I(1) *Differentiated*

p-value = < 0.01

Price Series

Augmented Dickey-Fuller Test

data: PRICE
Dickey-Fuller = -3.7345, Lag order = 3,
p-value = 0.03439

alternative hypothesis: stationary

I(1) *Differentiated*

p-value = < 0.01

Distribution Series

Augmented Dickey-Fuller Test

data: PCV
Dickey-Fuller = -1.4495, Lag order = 3,
p-value = 0.7906

alternative hypothesis: stationary

I(1) *Differentiated*

p-value = < 0.01

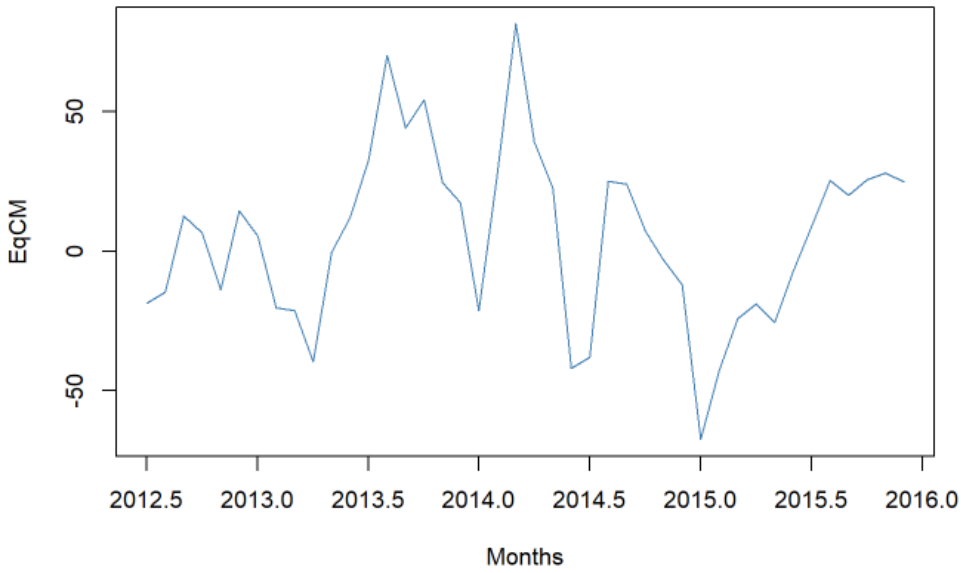
We also conduct the Johansen cointegration trace and eigenvalue test, which helped us to identified zero cointegrating relations (test = 40.23 > 41.07 at 1pct).

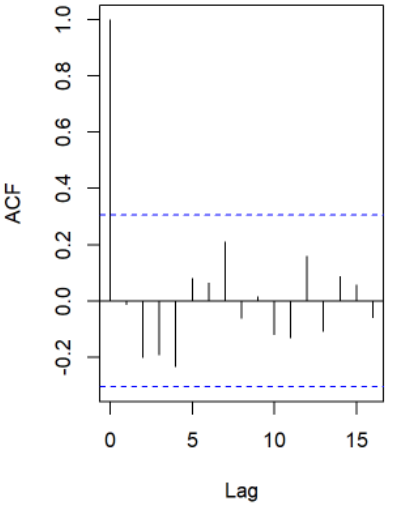
Residuals of the regression; ACF and PACF

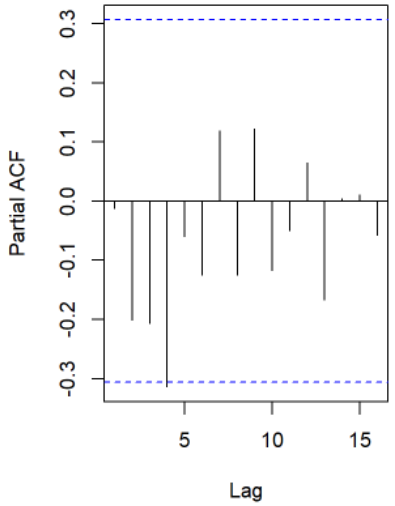
Regression results

	Dependent variable:
	Sales
Price	-6.464
PCV	5.631
Constant	1.060
Observations	42
R^2	0.07224
Adjusted R^2	0.02342
Residual Std. Error	28.44 (df = 38)
F Statistic	1.48 (df = 2; 38)
Note:	*p<0.1; **p<0.05; ***p<0.01

Residual analysis







We applied the ADF test to test for a unit root in the residuals. Based on the augmented dickey fuller test results, we can reject the null hypothesis and confirm that the residuals are stationary for the regression.

VAR Estimation results

	Dependent variable:		
	y		
	SALES	PRICE	PCV
SALES.l2	**-0.651****	0.011**	-0.003
	(0.278)	(0.004)	(0.011)
PCV.l2	**-12.590***	0.077	-0.235
	(6.754)	(0.109)	(0.278)
SALES.l3	**-0.525***	0.003	-0.008
	(0.259)	(0.004)	(0.011)
SALES.l4	**-0.617***	0.007	-0.022*
	(0.289)	(0.005)	(0.012)
PRICE.l6	**-16.000***	0.048	-0.430
	(8.806)	(0.141)	(0.362)
SALES.l7	**-0.068**	-0.002	-0.017*
	(0.206)	(0.003)	(0.008)
PCV.l7	**-21.978****	0.142	-0.337
	(9.580)	(0.154)	(0.394)
const	**30.915****	-0.091	0.502
	(11.461)	(0.184)	(0.471)
Observations	**34**	34	34
R^2	**0.745**	0.638	0.557
Adjusted R^2	**0.300**	0.004	-0.218
Residual Std. Error (df = 12)	**26.002**	0.418	1.069
F Statistic (df = 21; 12)	**1.673**	1.007	0.718
Note:			***p<0.1; ****p<0.05; *****p<0.01**

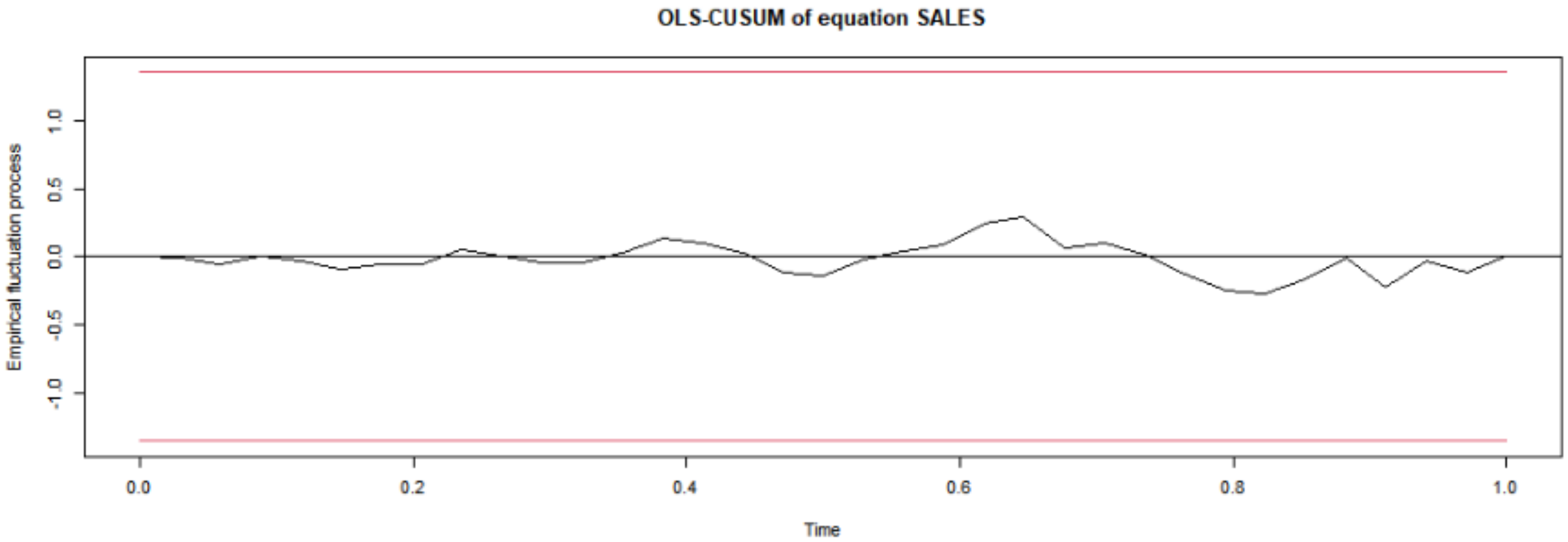
Effects:

- **Distribution has a significative negative effect** on sales for the focal brand (β_{12}^{2} = -12.590, p-value < 0.05 and β_{12}^{7} = -21.978, p-value < 0.05)
- **Price has also a significative negative effect** on sales for the focal brand (β_{13}^{6} = -16.000, p-value < 0.05)
- **Lagged sales also had a small negative effect** on sales (β_{11}^{2} = -0.651, p-value < 0.05.

Robustness:

- **Serial Correlation Test (Portmanteau Test):** model with serial correlation (p-value < 0.01)
- **Heteroscedasticity (Arch Test):** No heteroscedasticity (p-value = 0.612)
- **Normality (JB-Test, Skewness, and Kurtosis):** Residuals are normally distributed
  - JB-Test: p-value = 0.9521
  - Skewness: p-value = 0.7348
  - Kurtosis: p-value = 0.9542

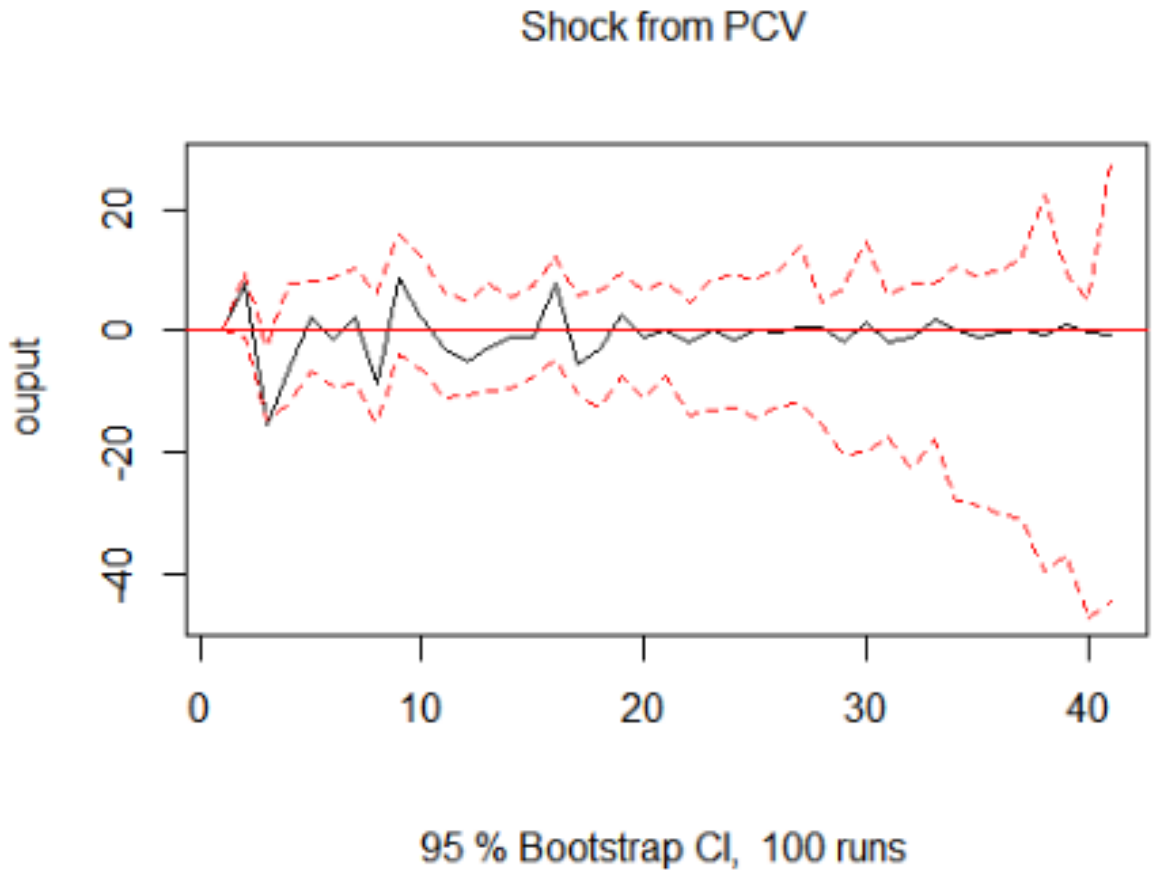
OLS-CUSUM of Sales



Granger-Causality Test and Impulse Response Function

Sales are granger-caused by the lags of distribution

(p-value = 0.004359)



Conclusions & Limitations

1

AVAILABLE DATA

Available data is from a short time period (42 months of data); therefore, the statistical results may be limited.

2

LIMITED BRANDS & CATEGORIES

Access to only a certain brand and product line. Effects on the available period may not be significant to reflect the expected results.

3

MODEL SPECIFICATION

Model lacks control variables and other important variables of the marketing-mix model (e.g., investments in advertising, word-of-mouth, promotions, display).

4

OPERATIONALIZATION OF VARIABLES

Operationalization of our variables may not be ideal for the proposed model. There are other options to operationalize (e.g., relative price, ACV)

Thank you