



# Price Setting Behaviour In Jamaica

## A Micro and Macro Perspective

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November 19, 2011



- ▶ Introduction
- ▶ Literature Review
- ▶ Key Definitions
- ▶ Data & Methodology
- ▶ Measured Results
- ▶ Estimated Results
- ▶ Summary & Implications

## ▶ Inflation Impacts:

- ▶ Cost of Capital
- ▶ Standard of Living
- ▶ Competitiveness
- ▶ Real growth
- ▶ Wealth (pensions)

## ▶ Inflation Factors:

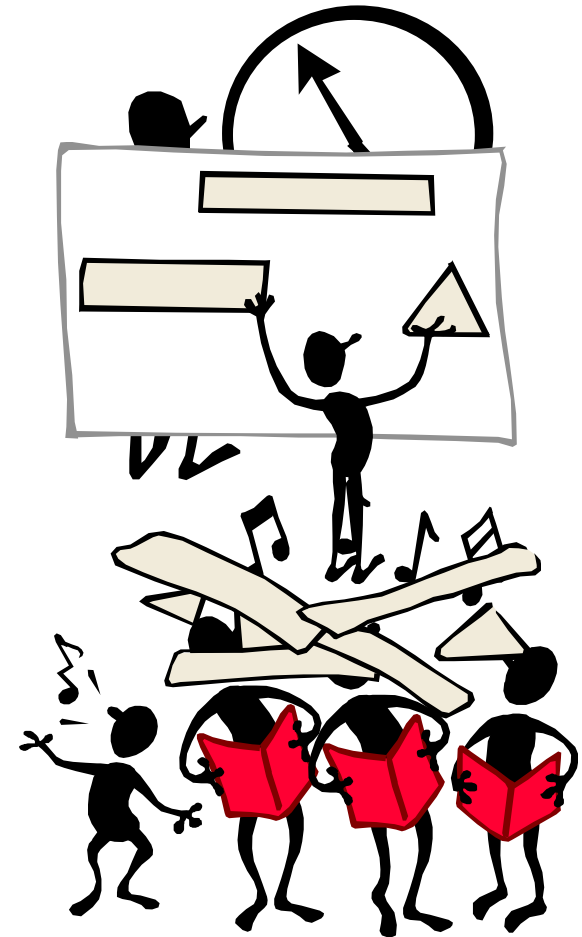
- ▶ Cost of Production
- ▶ Weather
- ▶ Commodity Prices
- ▶ Exchange Rate
- ▶ Fiscal Policy

## ▶ Policy Concerns:

- ▶ Impact of Policy on Price Setters
- ▶ Components of Inflation Expectations
- ▶ Conditions for sustainable low inflation

- ▶ To unveil the price setting behaviour of firms in Jamaica across industries, type of good and time.
  
- ▶ To distinguish between micro and macro factors that contribute to price setting patterns among Jamaican firms.
  
- ▶ Questions of Concern:
  - ▶ Do firms adjust prices down as fast as they adjust them up?
  - ▶ When are prices more likely to increase and or decrease?
  - ▶ Are price changes more likely among some goods than others?
  - ▶ Are patterns of price adjustments similar to other countries?
  - ▶ Is there a difference in behaviour when competition is less?
  - ▶ Are price adjustments mainly shock responsive or automatic?

- ▶ **Time Dependent Models**
  - ▶ Taylor Models (1980)
  - ▶ Calvo Models (1983)
- ▶ **State Dependent Models**
  - ▶ Chaplin & Spulber (1987)
  - ▶ Dotsey, King and Wolman (1999)
- ▶ **Regional Studies**
  - ▶ Craigwell, Moore & Worrell (2009)
  - ▶ Polius & St. Catherine (St. Lucia)
  - ▶ Ford (Belize)
  - ▶ Aucremanne & Dhyne (2005) Belgium
  - ▶ Lunnemann & Matha (2005) Luxembourg



## ▶ Variable Types

- ▶ Time-dependent
- ▶ State-dependent

## ▶ Pricing Strategies

- ▶ Menu Costs
- ▶ Attractive Pricing
  - ▶ Psychological
  - ▶ Fractional
  - ▶ Round
- ▶ Fair Pricing
- ▶ Costly Information

## ▶ Price patterns

- ▶ Stickiness / Staggered
- ▶ Rigidity
  - ▶ Intrinsic
  - ▶ Extrinsic

## ▶ Measures of Interest

- ▶ Frequency
- ▶ Duration or Price Spell
- ▶ Synchronization
- ▶ Symmetry or Asymmetry
- ▶ Hazard or Risk

## ▶ **Dataset I:**

### ▶ *8 division classification:*

- ▶ Household Expenditure Survey (HES) 1984
- ▶ Covering 280 commodities
- ▶ With base period Jan-1988
- ▶ Monthly data from Jan-1995 to Dec-2006
- ▶ Panel data representing 1,643,052 unique data points
- ▶ Classed by: brand, region, outlet, town, collection point
- ▶ Removed duplicate, seasonal surveys.
- ▶ Right censoring of data

## ▶ **Dataset II:**

### ▶ *12 division classification using 2006 as base year (COICOP)*

- ▶ Household Expenditure Survey (HES) 2004/05
- ▶ Covering 480 commodities
- ▶ Base year Dec-2006
- ▶ Monthly data from Jan-2006 to Dec-2007
- ▶ Panel data representing 646,140 unique data points
- ▶ Classed by: brand, region, outlet, town, collection point

- ▶ Price Changes:

$$I_{it} = \begin{cases} 1 & \forall p_{it} \neq p_{it-1} \\ 0 & \forall p_{it} = p_{it-1} \end{cases}$$

- ▶ Frequency:

$$F_i = \frac{\sum_{i=1}^n I_{it}}{N_i}$$

- ▶ Duration:

$$D_i = \frac{1}{F_i}$$

- ▶ Synchronization:

$$S_i = \frac{\sqrt{N^{-1} \sum_t (F_{it} - F_t)^2}}{\sqrt{F_t (1 - F_i)}}$$



# Measured Results



## Frequency, Duration, Synchronization Calculations for Price change, increase and decrease

	Freq(+/-)	Freq(+)	Freq(-)	Dur(+/-)	Dur(+)	Dur(-)	Sync(+/-)	Sync(+)	Sync(-)
All Jamaica	0.18	0.11	0.07	6.54	9.55	23.12	0.42	0.38	0.37
Food & Drink	0.21	0.13	0.07	5.62	8.21	19.00	0.32	0.30	0.26
Starches	0.37	0.20	0.17	2.75	5.05	6.06	0.25	0.23	0.23
Vegetable & Fruits	0.34	0.18	0.16	3.39	6.03	7.99	0.26	0.27	0.28
Fuels & Other Household Supplies	0.15	0.11	0.04	6.85	9.77	24.28	0.33	0.28	0.28
Fuels	0.16	0.13	0.03	6.44	8.04	34.68	0.33	0.31	0.30
Household Supplies	0.15	0.10	0.05	6.91	10.01	22.80	0.34	0.27	0.28
Housing & Other Housing Expenses	0.17	0.13	0.05	6.24	8.50	23.83	0.37	0.33	0.33
Household Furnishings & Furniture	0.23	0.14	0.10	5.19	8.33	14.81	0.43	0.38	0.38
Healthcare & Other Personal Expenses	0.14	0.10	0.04	7.57	10.25	29.70	0.38	0.35	0.32
Personal Clothing Footwear & Other Accessories	0.12	0.08	0.04	8.38	12.02	28.71	0.42	0.37	0.35
Transportation	0.31	0.14	0.17	4.37	7.99	13.34	0.72	0.71	0.69
Miscellaneous Expenses	0.13	0.09	0.04	8.09	11.37	31.29	0.39	0.36	0.34
Durable	0.27	0.15	0.12	4.15	7.11	10.49	0.45	0.41	0.40
Non Durable	0.21	0.13	0.08	5.55	8.23	18.22	0.32	0.30	0.27
Processed Foods	0.17	0.12	0.05	5.95	8.61	19.73	0.32	0.29	0.25
Non Processed Foods	0.31	0.17	0.14	4.14	6.67	12.58	0.27	0.26	0.27
Services	0.12	0.09	0.03	8.60	11.39	35.54	0.37	0.33	0.31
Energy	0.18	0.14	0.05	6.33	8.51	26.91	0.34	0.33	0.30

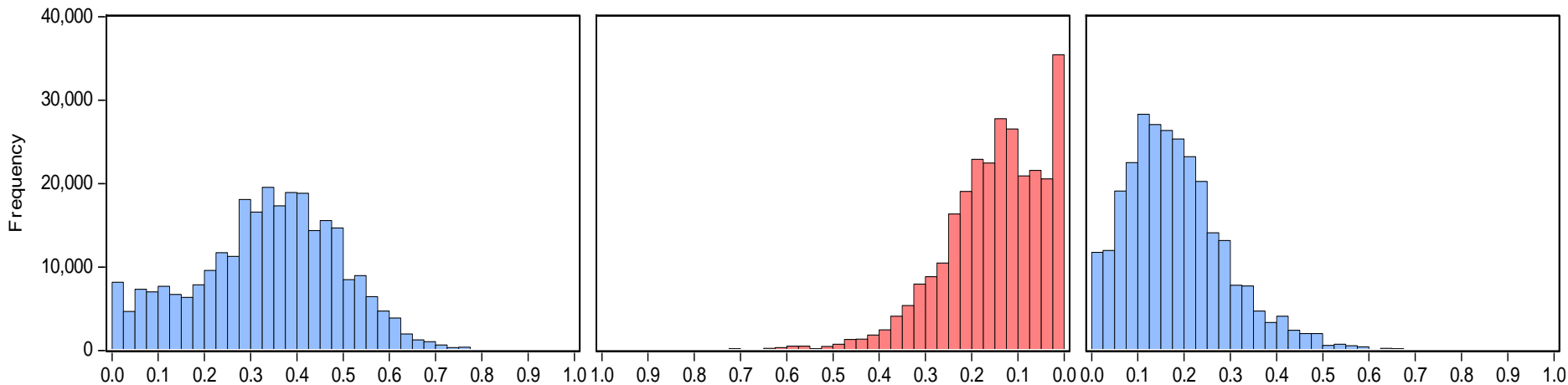
## Non-processed:

**F**requency (highest); **D**uration (shortest); **S**ymmetric; **S**ynchronized (27%).

non-processed food price (change)

(decline)

(increase)



	Freq(+/-)	Freq(+)	Freq(-)	Dur(+/-)	Dur(+)	Dur(-)	Sync(+/-)	Sync(+)	Sync(-)
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<b>Non Processed Foods</b>	<b>0.31</b>	<b>0.17</b>	<b>0.14</b>	<b>4.14</b>	<b>6.67</b>	<b>12.58</b>	<b>0.27</b>	<b>0.26</b>	<b>0.27</b>
Services	0.12	0.09	0.03	8.60	11.39	35.54	0.37	0.33	0.31
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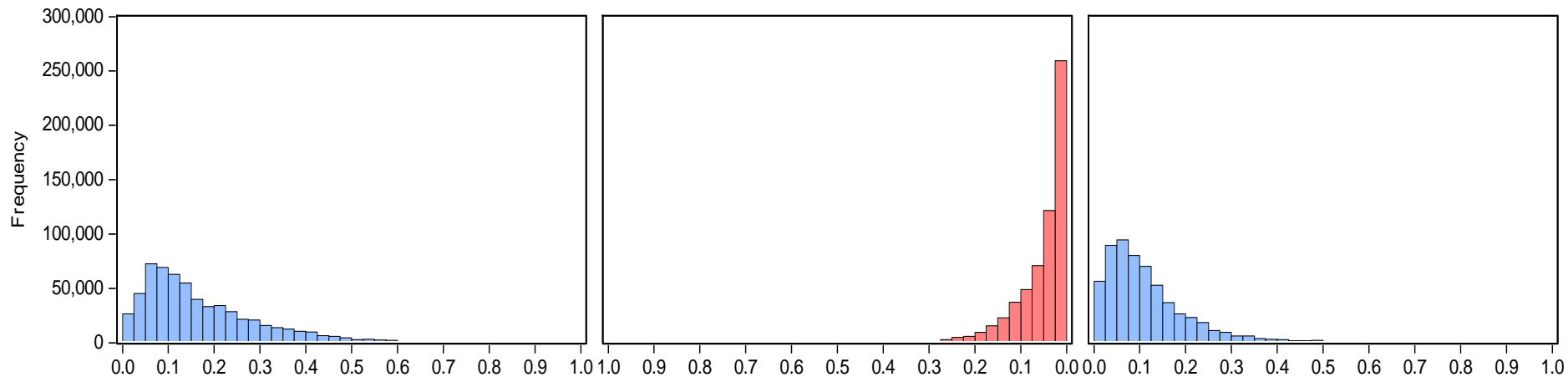
## Processed:

**Frequency (average); Duration (average); Asymmetric {2:1}; Synchronized (32%)**

processed foods price (change)

(decline)

(increase)



	Freq(+/-)	Freq(+)	Freq(-)	Dur(+/-)	Dur(+)	Dur(-)	Sync(+/-)	Sync(+)	Sync(-)
<b>All Jamaica</b>	<b>0.18</b>	<b>0.11</b>	<b>0.07</b>	<b>6.54</b>	<b>9.55</b>	<b>23.12</b>	<b>0.42</b>	<b>0.38</b>	<b>0.37</b>
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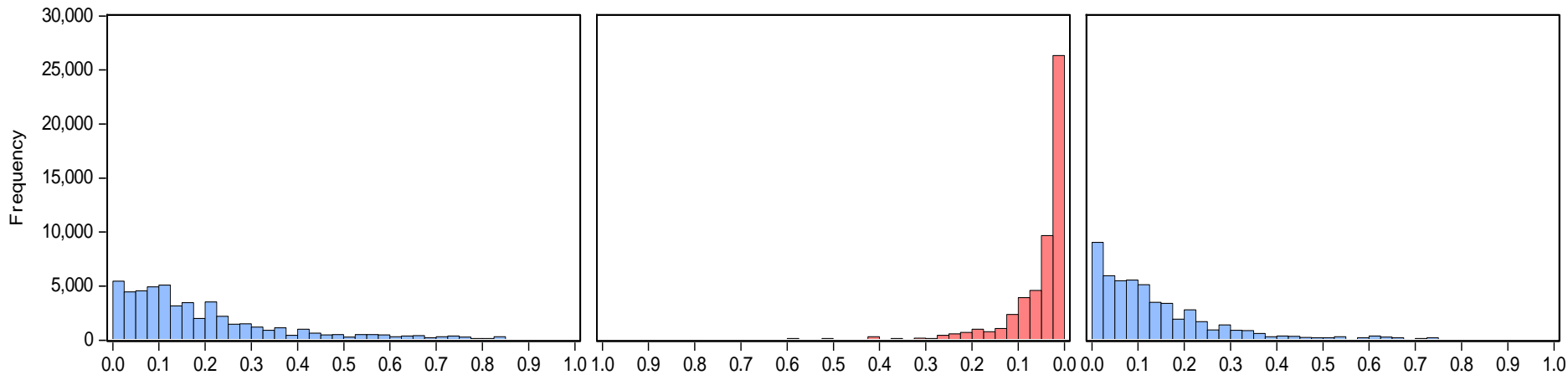
## Energy:

**Frequency (average); Duration (average;) Asymmetric {3:1}; Synchronized (34%).**

energy price (change)

(decline)

(increase)

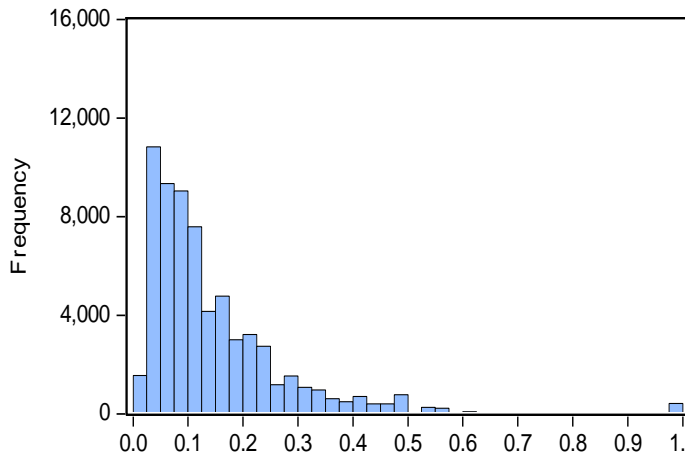


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<b>Energy</b>	<b>0.18</b>	<b>0.14</b>	<b>0.05</b>	<b>6.33</b>	<b>8.51</b>	<b>26.91</b>	<b>0.34</b>	<b>0.33</b>	<b>0.30</b>

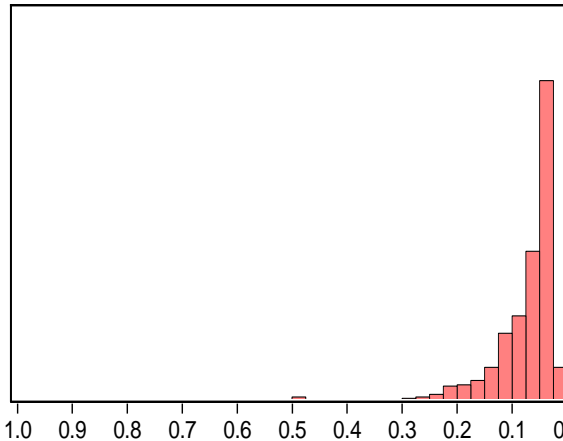
## Services:

**Frequency (least); Duration (longest); Asymmetric {3:1}; Synchronized (37%).**

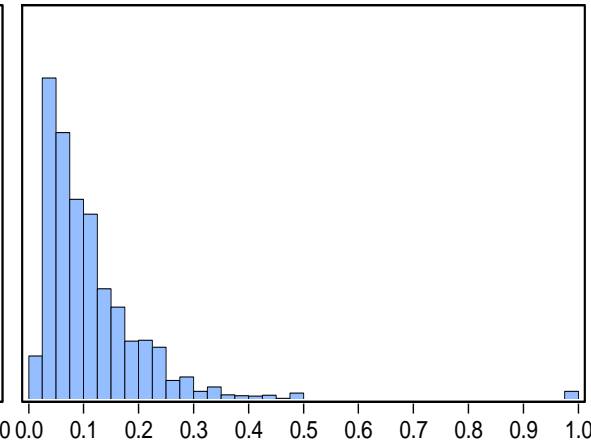
service price (change)



(decline)

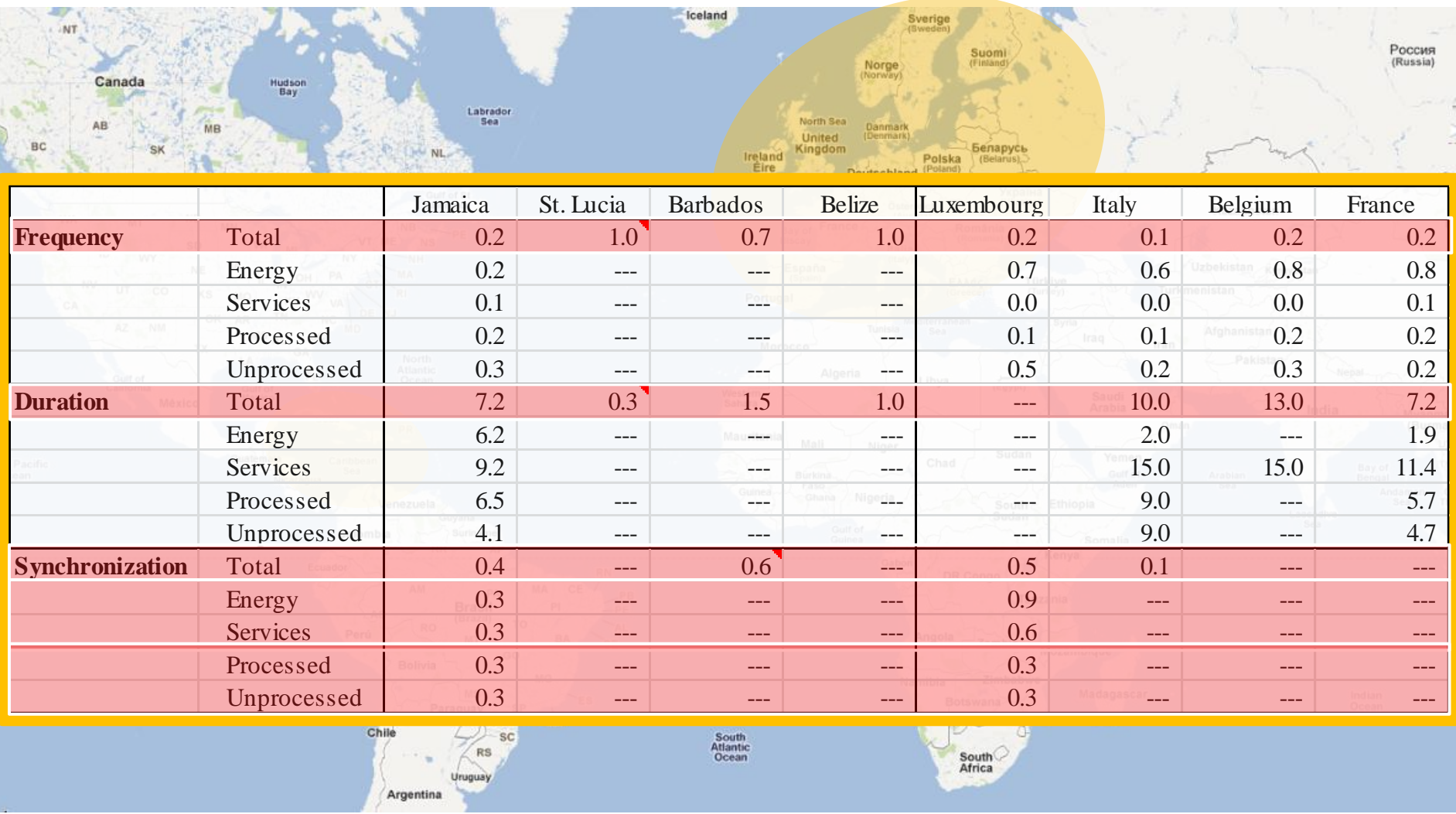


(increase)



	Freq(+/-)	Freq(+)	Freq(-)	Dur(+/-)	Dur(+)	Dur(-)	Sync(+/-)	Sync(+)	Sync(-)
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# Country Comparisons



		Jamaica	St. Lucia	Barbados	Belize	Luxembourg	Italy	Belgium	France
<b>Frequency</b>	Total	0.2	1.0	0.7	1.0	0.2	0.1	0.2	0.2
	Energy	0.2	---	---	---	0.7	0.6	0.8	0.8
	Services	0.1	---	---	---	0.0	0.0	0.0	0.1
	Processed	0.2	---	---	---	0.1	0.1	0.2	0.2
	Unprocessed	0.3	---	---	---	0.5	0.2	0.3	0.2
<b>Duration</b>	Total	7.2	0.3	1.5	1.0	---	10.0	13.0	7.2
	Energy	6.2	---	---	---	---	2.0	---	1.9
	Services	9.2	---	---	---	---	15.0	15.0	11.4
	Processed	6.5	---	---	---	---	9.0	---	5.7
	Unprocessed	4.1	---	---	---	---	9.0	---	4.7
<b>Synchronization</b>	Total	0.4	---	0.6	---	0.5	0.1	---	---
	Energy	0.3	---	---	---	0.9	---	---	---
	Services	0.3	---	---	---	0.6	---	---	---
	Processed	0.3	---	---	---	0.3	---	---	---
	Unprocessed	0.3	---	---	---	0.3	---	---	---

$$y_{ijt} = \begin{cases} 1 & \forall p_{ijt} \neq p_{ijt-1} \\ 0 & \forall p_{ijt} = p_{ijt-1} \end{cases}$$

## ▶ Logit Model (RE)

$$P[y_{ijt}] = \frac{\exp(x_{ijt}\beta + u_i + \varepsilon_{ijt})}{1 + \exp(x_{ijt}\beta + u_i + \varepsilon_{ijt})}$$

where:

$$x_{ijt} = \alpha_1 \sum_{t=T}^t |mcpi_{j,t-T}| + \alpha_2 \sum_{t=T}^t |mxate_{j,t-T}| + \alpha_3 \sum_{t=T}^t |mwti_{j,t-T}| + \alpha_4 \sum_{t=T}^t |mtot_{j,t-T}| + \alpha_5 \sum_{t=T}^t |mtbill_{j,t-T}|$$

$$+ \delta_1 lsizeup_{ij,t-T} + \delta_2 lsize dn_{ij,t-T}$$

$$+ \gamma_1 attract + \gamma_2 psycho + \gamma_3 fraction + \gamma_4 round1 + \gamma_5 round2$$

$$+ \phi_1 lendur + \phi_2 dur3 + \phi_3 dur7 + \phi_4 dur8 + \phi_5 dur10 + \phi_5 dur12$$

$$+ \zeta_1 energy + \zeta_2 service + \zeta_3 nprocessf + \zeta_4 processf + \zeta_5 ndurable + \zeta_5 durable$$

$$+ \sum_{m=2}^{12} \xi_m month\_m + \sum_{y=2}^{12} \psi_m year\_y$$

# Results – State Dependence



	Specification	Baseline (macro [+/-])		Base (macro [+])		Base (macro [-])	
	Est. Technique	RE LOGIT		RE LOGIT		RE LOGIT	
	No. of obs.	1643052		1643052		1643052	
	No. of groups	18570		18570		18570	
	Max Obs per group						
	Min   Avg   Max	12   8.5   132		12   8.5   132		12   8.5   132	
	Dep. Variable	pricecg		priceup		pricedn	
	Odds Ratio	Odds Ratio	p-val	Odds Ratio	p-val	Odds Ratio	p-val
<b>(state)</b>	cg_cpi	1 : 1.2	0.000	---	---	---	---
macro	cg_xrate	2.9 : 1	0.0				
changes	cg_wti	1.1 : 1	0.0				
	cg_tot	1.9 : 1	0.0				
	cg_tbill	1.4 : 1	0.0				
<b>(state)</b>	up_cpi	---					
macro	up_xrate	---					
increase	up_wti	---					
	up_tot	---					
	up_tbill	---					
<b>(state)</b>	dn_cpi	---					
macro	dn_xrate	---					
down	dn_wti	---					
	dn_tot	---	---	1 : 1	0.000	1 : 1.0	0.672
	dn_tbill	---	---	1 : 1	0.000	1 : 1.0	0.000

**Odds Ratio:**

1 : 1    ➔ Equal Odds

2 : 1    ➔ Good Odds

1 : 1.5   ➔ Poor Odds

- ▶ The odds of both a price increase and decrease worsens when the inflation falls. Therefore, prices are generally rigid downwards

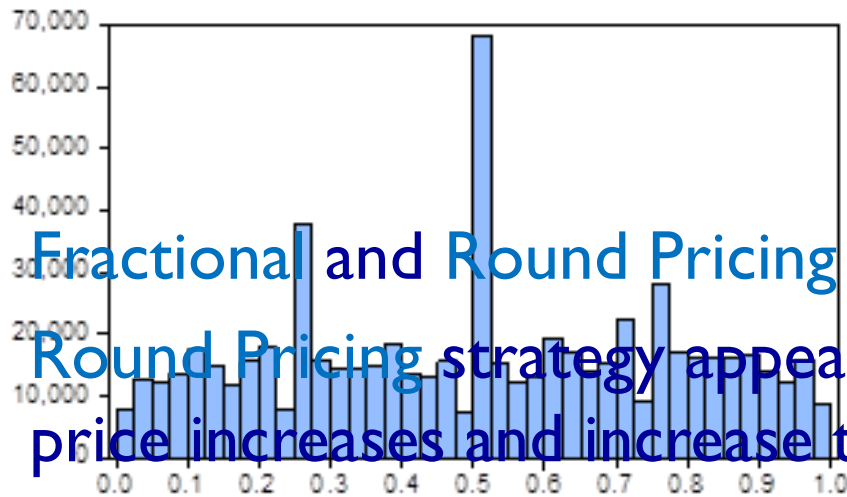


# Results – State Dependence

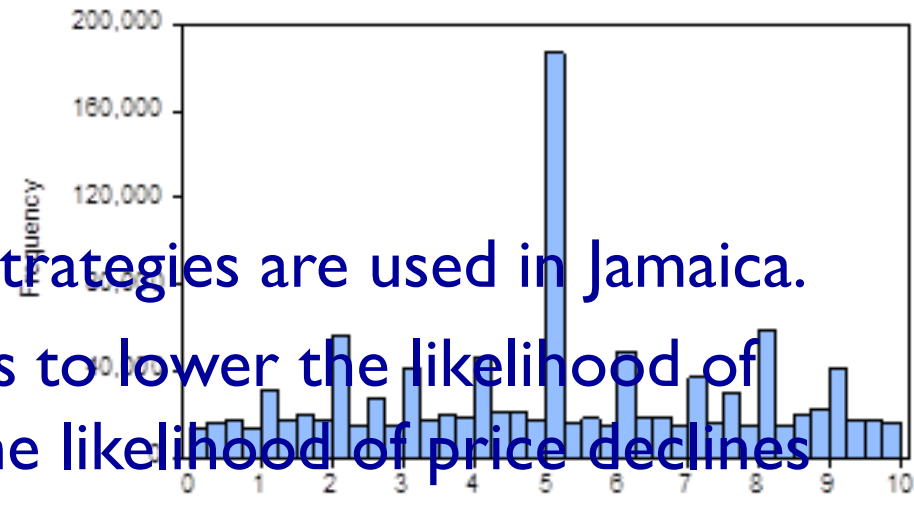


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Est. Technique		RE LOGIT		RE LOGIT		RE LOGIT	
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Max Obs per group							
Min   Avg   Max		12   8.5   132		12   8.5   132		12   8.5   132	
Dep. Variable		<b>pricecg</b>		<b>priceup</b>		<b>pricedn</b>	
Odds Ratio		Odds Ratio	p-val	Odds Ratio	p-val	Odds Ratio	p-val
<b>(state)</b>	<i>attract</i>	---	---	---	---	---	---
price	compete	1 : 1	0.000	1 : 1	0.000	1 : 1.0	0.000
setting	psycho	1.4 : 1	0.810	2.2 : 1	0.537	1.0 : 8695652.2	0.997
patterns	fraction	1.4 : 1	0.000	1.3 : 1	0.000	1.3 : 1.0	0.000
	round01	1 : 1.1	0.000	1 : 1.3	0.000	1.1 : 1.0	0.000

Frequency of Price Ends After \$1.00



Frequency of Price Ends After \$10.00



Fractional and Round Pricing strategies are used in Jamaica.  
 Round Pricing strategy appears to lower the likelihood of price increases and increase the likelihood of price declines

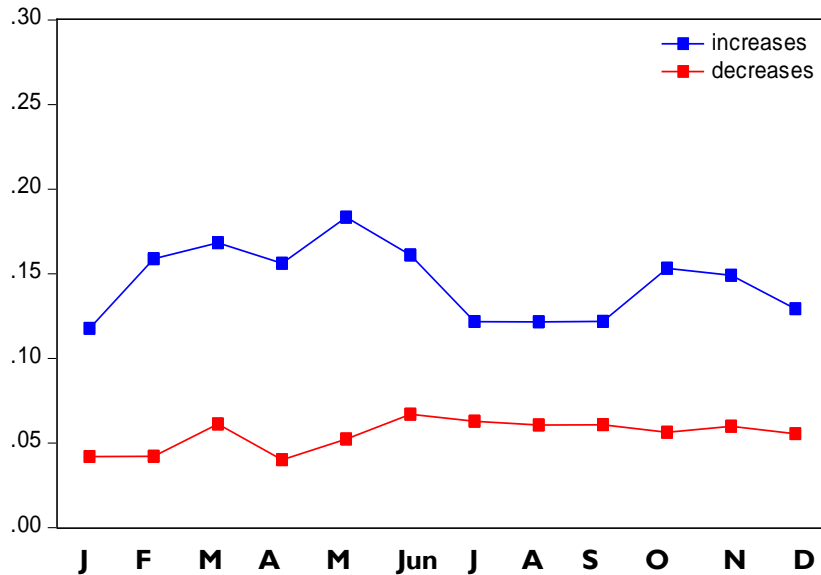
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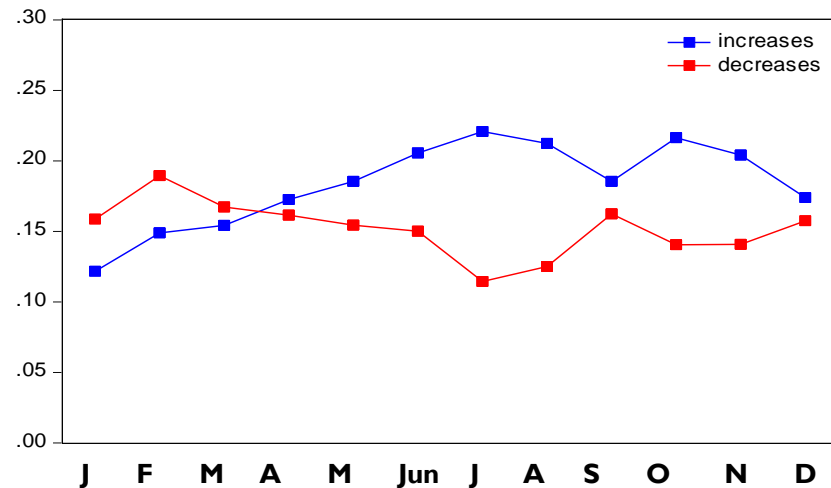
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	Dep. Variable	pricecg		priceup		pricedn	
	Odds Ratio	Odds Ratio	p-val	Odds Ratio	p-val	Odds Ratio	p-val
<b>(state)</b>	energy	1.3 : 1	0.000	1.3 : 1	0.000	1.3 : 1.0	0.000
group	service	1 : 1.4	0.000	1 : 1.3	0.000	1.0 : 1.5	0.000
impacts	nprocessf	1.8 : 1	0.000	1.4 : 1	0.000	2.1 : 1.0	0.000
	processf	1 : 1	0.267	1 : 1	0.002	1.0 : 1	0.514
	ndurable	1.1 : 1	0.275	1 : 1.1	0.038	1.3 : 1.0	0.000
	sdurable	1 : 1.1	0.224	1 : 1.2	0.000	1.2 : 1.0	0.001
	durable	1.6 : 1	0.000	1.1 : 1	0.017	2.6 : 1.0	0.000

- ▶ Price changes are more likely among energy, non-processed foods and durable goods.
- ▶ A price decline is much more likely among non-processed and durable goods.
- ▶ Price changes are highly unlikely for services, and much more in cases of price declines.

Energy



Non-Processed Foods



- ▶ **Energy Price increases:**
  - ▶ Low probability of price increasing in Jan, Jul, Aug, Sep & Dec.
  - ▶ High probability in Feb-Mar & Oct –Nov
- ▶ **Non-Processed foods show:**
  - ▶ When price increases are more likely, Price decreases are unlikely.
  - ▶ This supports the high level of synchronization among firms in setting prices.

- ▶ There was significant heterogeneity in price setting behaviours across industries.
- ▶ Jamaican firms appear to utilize fractional and round pricing strategies.
- ▶ Some firms are more likely to lower than increase prices based on the pricing strategy used.
- ▶ Price setting behaviour in Jamaica resembles patterns observed in other international territories.
- ▶ Firms display asymmetric behavioural patterns when dealing with price increases relative to declines.

- ▶ Non-processed food and Durable goods reflects the most efficient market segments due to the high frequency of price change and symmetry in price changes.
- ▶ These segments, may be more responsive to proper economic policy geared at lowering inflation; especially since non-processed foods represent a significant share (12%) of the CPI Basket.
- ▶ While services display generally sticky prices, prices are much more frequent than international territories. It may require more extended periods of stable economic conditions to lower inflation expectations and the frequency of price changes among Service providers.
- ▶ Energy, Processed, and Non-durable goods which, contains a high level of import content, displays a greater tendency for price increases.
- ▶ Structural policies geared at lowering or substituting imported raw materials for domestic alternatives, may significantly assist in lowering the persistence of imported inflation.



**THE END**



Thank you.  
I look forward to your comments