Price Setting Behaviour in Jamaica
A Micro and Macro Perspective

James S. J. Robinson[1]
Research Services Department
Research and Economic Programming Division
Bank of Jamaica

ABSTRACT

A number of microeconomic and macroeconomic factors are theoretically perceived to be influential in the price setting behaviour of agents on goods captured within the consumer price index (CPI). This paper seeks to unveil the distinctive behavioural patterns relating to frequency, duration and symmetry in price changes to capture information on price rigidities across varying sectors, types of goods and time, within the Jamaican economy. We found evidence of heterogeneity across industries in the price setting process with signs of fair and attractive pricing strategies being employed among some firms. Various industry classifications display similar results to seminal work conducted on select international markets. Also, there exist asymmetric behavioural patterns among some Jamaican firms when implementing price increases relative to declines. A moderate level of price rigidity is found among industries which may be attributed to some domestic anti-competitive market microstructures and frequent instability in the economic environment.

Keywords: price setting behaviour, rigidity, consumer price

JEL Classificatio**n:**E31, D01

[1] The views expressed in this paper are those of the author and do not necessarily represent those of the Bank of Jamaica.
Email address: james.robinson@boj.org.jm

1. Introduction

Inflation is a measurement of the change in the general level of prices in an economy. It is generally measured as the percentage rate of change between two prices or indexes of prices over a set period of time. Consumers monitor inflation when evaluating their income's spending power over time. Wage earners consider inflation when negotiating current and future contracts; bankers consider inflation when setting the cost of lending (interest rates); businesses consider inflation when setting prices or judging the viability of future investments; governments consider inflation when seeking to enhance the standard of living and reduce the level of poverty. It is therefore imperative to maintain low inflation for any territory. The Bank of Jamaica (BOJ) has been given the charge to "safeguard the value of the domestic currency". It is therefore essential for the BOJ to understand the underlying nuances that motivate price changes in order to forecast and structure policies that will create an environment of low and stable price changes, consistent with its mandate.

The aim of this paper is to assess the general behaviour of price setters in Jamaica across industries, product types and over time. Microeconomic factors based on the relationship amongst firms and between firms as well as consumers play an important role in explaining price setting behaviours. Macroeconomic relationships are crucial in explaining the role that policy action and other exogenous shocks at the aggregate level play in influencing the timing and decision of firms to adjust prices. The literature surrounding the topic of inflation highlights the important characteristic of stickiness of prices over time. In this light, the concerns of price rigidities become an important factor in price setting behaviour. Therefore, this study gives special consideration to the frequency, duration, magnitude and symmetry of price changes.

The Jamaican consumer basket of goods and services significantly reflects food and energy related components. When combined, both food and energy items account for approximately 57.4 per cent of the current CPI basket. Prior to 2006, when the current consumer basket was introduced, the share of food and energy components represented

64.6 per cent of the basket. The remaining components which span a wide range of durable goods, semi-durable goods and services, display orderly behavioural patterns in response to seasonal effects, pass-through of import costs, impact from fiscal policy and persistence in inflation expectations. Changes in the food and energy components of the basket are directly related to the cost of imported oil and grain commodities which serve as raw materials to productive activity in Jamaica. Accordingly, any variation in prices for imported materials invariably results in domestically adjusted prices. International commodities prices are significantly affected by global market conditions and tend to generate various degrees of volatility in domestic consumer prices. Even though imported commodities are generally considered to be essential products for the Jamaican productive sector, the nation cannot rely continually on these items if inflation pressures are to be minimized.

The rest of the study is organized as follows: Section 2 of this paper presents a literature review which outlines the key underlying theories and some empirical findings regarding price setting behaviour. Section 3 outlines the methodology employed in investigating price setting behaviour in Jamaica, while Section 4 discloses the results of various measures and econometric tests used in the analysis. Section 5 provides a summary and makes recommendations for inflation forecasting and general policies for maintaining a low but policy-responsive inflation environment. A summary of the data along with tables and figures are provided in the appendix.

2.0 Literature Review

Much of the theoretical foundations in the literature that pertain to price setting behaviour draws attention to whether inflexibility in price adjustment is attributed to state and/or time dependent factors. A distinction is therefore drawn between state and time dependent models and varying combinations. Time dependent models make definitive assumptions about the duration between two price changes. The models of Taylor (1980) and Calvo (1983) are two time-dependent models which analyse price setting behaviours. The Taylor model is regarded as the basis of most modern macroeconomic analyses on price rigidities (Dhyne et al. 2009). More recent models have improved on the approach of Taylor while incorporating state-dependent components that explain various causes for price rigidities.

Taylor (1979) specified an overlapping contracts model for wage determination in the context of staggered wage adjustments. He demonstrated that the commonly regarded inflation expectations term can be represented as the persistence of inflation emerging from the gradual adjustment of outstanding wage and price contracts that result from new economic information. Taylor (1980) demonstrated that not all wages are contracted at the same time and are staggered. When deciding on wages, firms and unions look not only on current wages, but also on previously arranged contracts as well as contracts that will soon be negotiated to determine the appropriate wage for the intended period of the contract. Due to the characteristic of backward and forward looking wage and price setting behaviours, there are resulting delayed responses from inflation to unemployment. Hence, Taylor (1980) shows that the persistence observed in unemployment shocks (business cycles) are attributed to the staggered nature of wage, prices and other rigid factors such as information. Nonetheless, Taylor type models have been criticized for a number of reasons. Key among these reasons is the assumed exogeneity of price setting intervals or fixed durations, whereas in reality, price setting behaviour is more likely to depend on the state of the economy (Lunnemann and Matha, 2005).

Calvo (1983) also developed another time-dependent model that is often considered an alternative to the Taylor type model. His paper sought to capture stochastic price adjustments across firms as information pertaining to shocks became available. In such a

model, price setters (firms) change prices whenever an appropriate signal occurs, but not necessarily at the time that the signal is first emitted. The model used included an assumption that the probability of a signal occurring in some future period follows a geometric distribution and would be independent of the past period in which the signal was emitted. Additionally, this behaviour, he assumes, would vary randomly across price setters. Calvo (1983) suggested that firms take into consideration the average price and the expected future demand conditions whenever a price adjustment is made. The model captured some key characteristics of the contracts model presented by Taylor (1979) and Taylor (1980) without the complexity of literal contract models. The overarching premise is that prices remain sticky over time due to some embedded information asymmetry.

In contrast to the time-dependent models of Taylor (1980) and Calvo (1983), state-dependent models have been developed with the key feature of endogenizing the price setting mechanism. Caplin and Spulber (1987) demonstrated that firms exposed to a fixed cost when adjusting prices will assess the economic environment before deciding on whether or not to make a price change. Dotsey, King and Wolman (1999) enhanced the time-dependent model presented by Calvo (1983) with state-dependent properties which was achieved by accommodating an increase in the proportion of firms that change prices as the inflation level rose. This was empirically supported by Dhyne et al. (2005). Whereas time-dependent models seek to explain inflation persistence by making assumptions about the duration of price changes among firms, state-dependent models sought to explain inflation persistence on the grounds of various features which are peculiar to the firm. Therefore, time-dependent factors may reflect intra-year frequency of price changes and seasonality effects, while state-dependent models would capture firm-specific features such as menu costs, attractive and fair pricing policies, the degree of competition within the industry as well as the level and cost of accessing information for decision making.

The range of theoretical premises on which staggered or sticky price models rely includes: menu costs, attractive prices, fair pricing and costly information (Dhyne et al. 2009). Menu costs refer to the explicit cost imposed on firms when making nominal

price adjustments. This may include instances where the industry or firm may be regulated, or where the overhead cost of changing the menu of prices becomes a significant deterrent to price adjustment. Attractive prices refer to scenarios where firms set prices with particular characteristics aimed at generating certain behavioural patterns among consumers. Such pricing strategies may include charging a round price which ends with a zero or by signalling competitive type prices by ending prices with a nine. Additionally, firms may seek to set prices with fractional ending points that may aid recollection when consumers actively engage in comparing prices. Wherever attractive pricing behaviour prevails, an automatic price range is established such that prices are altered only when the price change warrants breaching the upper or lower bound. Fair pricing is based on the premise that firms are reluctant to change prices on fears that the action will anger customers. Fair pricing models anticipate that consumers are more accepting of price changes when input costs change rather than in conditions of high demand. Costly information reflects the limitations or high costs associated with obtaining timely and accurate information to guide pricing decisions. All of these premises are likely to lead to staggered pricing behaviour among firms.

A number of empirical studies have been conducted on micro-level consumer price data and other industry specific cases in an effort to unveil rigidities in the price setting behaviour of firms. A summary of empirical investigations for Europe, USA and other territories was provided in the works of Dhyne et al. (2009) and Craigwell, Moore and Morris (2010).

This paper is intended to add to the existing body of work conducted within the Caribbean. In this regard, a few noteworthy research papers for the Caribbean are highlighted. Craigwell, Moore and Worrell (2009) investigated whether consumer price rigidity exist within Barbados. Using retail price data between 1994 and 2008, it was found that price changes were featured on a monthly basis for 50 to 80 per cent of items in all categories of the basket. It was evidenced that price increases were more frequent and pronounced than price declines.

Polius and St. Catherine (2010) presented evidence on price setting behaviour in St Lucia using price quotes from household expenditure surveys used for the monthly CPI calculation. The data ranged from April 2002 to December 2007. Stylized facts using a combination of frequency and duration measures revealed that St. Lucia is characterized by reasonably flexible prices. This, however, was largely attributed to the highly weighted sub-indices of food, fuel, light and transportation. The study provided evidence in support of sticky prices among service sectors relative to food, transport and energy segments. Items that are not frequently purchased, such as clothing, footwear and furniture & fixtures also reflected greater price rigidities. Some asymmetric price changes were also observed with price increases being more frequent and generally larger than price declines.

Additionally, an investigation on price rigidity was conducted by Baudry et al. (2004) on non-fresh food products using CPI micro-data for France. It was found that price changes were generally sticky with duration averaging eight months. In general, price cuts were not significantly different from price increase providing no clear evidence of downward stickiness of prices. There was, however, evidence of heterogeneity across industry groups as price changes for service-related goods were relatively more rigid than manufacturing-related goods.

3.0 Methodology

3.1 Measures of Interest

The measures used to indicate varying aspects of price rigidity includes the frequency (F) and duration (D) calculations. These measures depend on discrete price changes for products within the CPI basket. Prices are considered rigid when the frequency of price adjustments is relatively few and/or when the time duration before another price change is relatively long. Whereas the measure of duration can be approximated from the frequency measure, an initial binary variable (I), capturing signals of price movements, is required for the calculation of frequency. The formulas are presented as follows:

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

Eq. 1: Price change indicator

$$I_{it}^{u} = \begin{Bmatrix} 1 & \forall & p_{it} > p_{it-1} \\ 0 & \forall & p_{it} \leq p_{it-1} \end{Bmatrix}$$

Eq. 2: Positive Price change indicator

$$I_{it}^{d} = \begin{Bmatrix} 1 & \forall & p_{it} < p_{it-1} \\ 0 & \forall & p_{it} \geq p_{it-1} \end{Bmatrix}$$

Eq. 3: Negative Price change indicator

where, I_{it}, I_{it}^{u} and I_{it}^{d} represents binary indicators of price change, price increase and price decrease, respectively. Additionally, p_{it} represents the price of product i at time t.

The frequency measure captures the share of all price quotes that reflect a price change for the product within a month. The following measures capture the frequency of price changes, increases and decreases for the i^{th} product at time t.

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

Eq. 4: Frequency of prices changing

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

Eq. 5: Frequency of prices going up.

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

Eq. 6: Frequency of prices going down.

The variable N_i is the number of the quoted price instances for the product i. F_i is the overall frequency of price changes for the i^{th} product and F_i^{u} and F_i^{d} capture the respective frequency of price increases and decreases, respectively.

The measure of duration (D_i) represents the average number of months before a price change is expected for a particular product i. Duration is approximated as follows:

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

Eq. 7: Duration for the i^{th} product

Synchronization (S_i) is a measure of whether or not prices change at the same time. If products are synchronized then the measure of synchronization should be close to or equal to unity and indicates that firms are likely to move in unison when making price adjustments. A synchronization measure that is closer to zero would reflect non-uniformity in price setting behaviour among firms and varying lags in pass-through of price adjustments. A measure of synchronization is provided by Fisher and Konieczny (2000) and is represented in Eq. 8:

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

Eq. 8: Synchronization of price changes

Hazard functions capture the risk of a price change after a certain period of time has expired. Lunnemann and Matha (2005) note the hazard rate as the function *h(s)*, which captures the conditional probability given that a price spell will end after [s] periods given that [s] periods have expired (see . Eq.9)

$$h(s) = \lim_{ds \to 0} \frac{P(S < s + ds \mid S \geq s)}{ds} = \frac{f(s)}{1 - F(s)}$$

Eq. 9: Hazard rate

3.2 Econometric Methods

The econometric method employed follows the approach taken by Lunnemann and Matha (2005) and Aucremanne and Dhyne (2005). The investigation utilizes a LOGIT model to evaluate the probability of price changes in response to a variety of time and state dependent variables. The dependent variable y_{ijt} is equivalent to the binary variables derived from Eq.1.

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

Eq. 10: Binary dependent variable

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

Eq. 11: Logit representation of a price increase

where:

$$
\begin{aligned}
x_{ijt} &= \alpha_1 \sum_{t=T}^{t} \left| mcpi_{j,t-T} \right| + \alpha_2 \sum_{t=T}^{t} \left| mxate_{j,t-T} \right| + \alpha_3 \sum_{t=T}^{t} \left| mwti_{j,t-T} \right| + \alpha_4 \sum_{t=T}^{t} \left| mtot_{j,t-T} \right| + \alpha_5 \sum_{t=T}^{t} \left| mtbill_{j,t-T} \right| \\
&+ \delta_1 lsizeup_{ij,t-T} + \delta_2 lsizedn_{ij,t-T} \\
&+ \gamma_1 attract + \gamma_2 psycho + \gamma_3 fraction + \gamma_4 round1 + \gamma_5 round2 \\
&+ \phi_1 lendur + \phi_2 dur3 + \phi_3 dur7 + \phi_4 dur8 + \phi_5 dur10 + \phi_5 dur12 \\
&+ \zeta_1 energy + \zeta_2 service + \zeta_3 nprocessf + \zeta_4 processf + \zeta_5 ndurable + \zeta_5 durable \\
&+ \sum_{m=2}^{12} \xi_m month\_m + \sum_{y=2}^{12} \psi_m year\_y
\end{aligned}
$$

where u_i represents the products random effects and ε_{ijt} represents the independently distributed error term. The range of additional independent variables used to capture both state and time dependent factors are represented in x_{ijt} .

Among the range of state dependent variables included in the specification are the absolute accumulated per cent changes for the consumer price index, $\sum mcpi_{j,t-T,t}$, exchange rate, $\sum mxrate_{j,t-T,t}$, West Texas Intermediate (WTI) crude oil price, $\sum mwti_{j,t-T,t}$, Terms of Trade, $\sum mtot_{j,t-T,t}$ and Jamaica's 6-month treasury bill rate, $\sum mtbill_{j,t-T,t}$ since the beginning of each price spell. The impacts of these factors are analysed for price changes in general but also separately for price increases and decreases. Cecchetti (1986) and Lunnemann and Matha (2005) utilized the impact of absolute cumulative inflation and wage following a products' price adjustment to proxy menu costs specific to firms. Among the other variables used to proxy firm specific costs were: the accumulated time in months since last price change, relative size of previous price change and changes in demand conditions.

The variables $lsizeup_{ij,t-T}$ and $lsizedn_{ij,t-T}$ represent the sizes of price changes ushering in the end of a price spell. Consideration is given to the impact of upward and downward

price adjustments in determining whether or not price changes are sticky or flexible. Sticky prices are likely to be characterized by single and large price adjustments while flexible prices will more likely display frequent and marginal price changes.

The binary variables $attract_{ijt}$, $psycho_{ijt}$, $fraction_{ijt}$ and $round_{ijt}$ capture price setting patterns across products and firms. *Attract* represents the overall indicator which tells whether or not firms participate in any attractive price setting strategy. The binary variable attract is a composite of: psychological prices that end with the values of 0.99, 0.95, 0.90 or 0.49; fractional prices ending with 0.25, 0.50, 0.75 and **5.0**; and round numbers ending with 0.00.

The length of time that has expired since the last price change of a product is reflected in the variable $lendur_{ijt}$ representing the length of duration. This variable is expected to capture characteristics of edogeniety in the price setting behaviour of firms over time. This is in contrast to the Taylor and Calvo type models which assume constant durations. The coefficient on this variable will give an indication of the likelihood of a price change as a price spell gets longer.

Figure **4**) features significant risk of a price change at duration periods of 3-months, 7-months, 8-months, 10-months and 12-months. The specific binary variables used in the analysis are to capture these duration effects. They are $dur03$, $dur07$, $dur08$, $dur10$ and $dur12$.

Seasonal variables are included in the model to capture inter-temporal effects on price setting patterns. The month-by-month binary variables will give insight about the month in which price changes would be most likely for a product group. Year-by-year binary variables will indicate the year in which inflation changes would be most likely, considering the economic state during the specific year.

Sectoral effects were also included in the specification as binary variables. The range of classifications includes energy, services, processed foods, unprocessed foods, durables and non-durable goods. According to Aucremanne and Dhyne (2005), including sectoral groups will address any observed heterogeneity across the sample space. The results will highlight if there are any distinctive behavioural patterns among firms that are classified within a specific sector.

Considering the impact of time and state dependent variables on both price increases and decreases, the following LOGIT specifications were also estimated in line with Aucremanne and Dhyne (2005) and Lunnemann and Matha (2005).

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

Eq. 12: Logit representation of a price increase

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

Eq. 13: Logit representation of a price decline

where:

$$\begin{aligned}
x_{ijt} &= \alpha_1\sum_{t=T}^{t}\left|mcpi_{j,t-T}^{+}\right|+\alpha_2\sum_{t=T}^{t}\left|mxate_{j,t-T}^{+}\right|+\alpha_3\sum_{t=T}^{t}\left|mwti_{j,t-T}^{+}\right|+\alpha_4\sum_{t=T}^{t}\left|mtot_{j,t-T}^{+}\right|+\alpha_5\sum_{t=T}^{t}\left|mtbill_{j,t-T}^{+}\right| \\
&+\alpha_6\sum_{t=T}^{t}\left|mcpi_{j,t-T}^{-}\right|+\alpha_7\sum_{t=T}^{t}\left|mxate_{j,t-T}^{-}\right|+\alpha_8\sum_{t=T}^{t}\left|mwti_{j,t-T}^{-}\right|+\alpha_9\sum_{t=T}^{t}\left|mtot_{j,t-T}^{-}\right|+\alpha_{10}\sum_{t=T}^{t}\left|mtbill_{j,t-T}^{-}\right| \\
&+\delta_1 lsizeup_{ij,t-T}+\delta_2 lsizedn_{ij,t-T} \\
&+\beta_1 cpi+\beta_2 xrate+\beta_3 wti+\beta_4 tot+\beta_5 tbill \\
&+\gamma_1 attract+\gamma_2 psycho+\gamma_3 fraction+\gamma_4 round1+\gamma_5 round2 \\
&+\phi_1 lendur+\phi_2 dur3+\phi_3 dur7+\phi_4 dur8+\phi_5 dur10+\phi_6 dur12 \\
&+\zeta_1 energy+\zeta_2 service+\zeta_3 nprocessf+\zeta_4 processf+\zeta_5 ndurable+\zeta_6 durable \\
&+\sum_{m=2}^{12}\xi_m month_m+\sum_{y=2}^{12}\psi_m year_y
\end{aligned}$$

The superscript of (+) and (-) on the accumulated inflation and other cumulative state dependent variables are incorporated to capture potential asymmetric behaviour among firms. Asymmetric effects are displayed when either a positive or negative adjustment in

any of the observed regressors display significant differences in the probability of a price change.

4.0 Results

4.1 Measuresof Interest

Results pertaining to frequency, duration and synchronization on the micro data gathered from the 8-class dataset are reported in Table 2. On average, the duration of a price spell in Jamaica during the period 1995 to 2006 lasted seven months. This reflected a 10-month spell between two price increases and 23 months between two price declines. The results demonstrate that, on average, 18 per cent of monthly price quotes reflected price changes, where the proportion of price quotes reflecting price increases and decreases was 11 per cent and seven per cent, respectively. On average 42 per cent of firms changed prices at the same time. Synchronization is neither skewed to a price increase or decrease as 38 per cent of firms uniformly adjust prices upward versus 37 per cent of firms reflecting uniformity when lowering prices (see Table 2).

Non-processed foods include agriculture related produce such as vegetables, starchy foods and fruits as well as some unprocessed meats and fish. This classification reflected the highest frequency (31%) of monthly price adjustments when compared to other local industry segments (see Table 2). Average price spells for non-processed foods lasted for approximately four months and were the lowest among domestic industry segments. The frequency of price adjustments for non-processed foods was comparable to European territories which ranged from 19 per cent to 55 per cent (see Table 5). Considering available information, France reflected a comparable duration period of approximately 4.7 months when compared to the 4.1 months duration for non-processed foods in Jamaica. There was, however, a marginal variation in the responsiveness of firms when increasing prices relative to reducing prices for non-processed foods.

Energy-related components reflected a high frequency of price changes. Approximately 18 per cent of price quotes within the energy group reflected a price change on a monthly basis. Also, a price change each month was approximately three times more likely to be

a price increase than a price decrease. Data from the 8-class basket suggest that energy-related prices are typically adjusted every six months where price increases are expected at least once every nine months and price declines once every twenty-seven months. This result is inconsistent with the common perception that energy-related prices change very frequently. Select European countries reflected monthly frequency rates within the range of 74 per cent to 82 per cent within the energy industry (see Table 5). The extended duration of energy related price changes may be due to the less than comprehensive coverage of energy-related components within the 8-class basket as well as anti-competitive type policies during the period of investigation.[2] Transport was also classified among energy components and represented the most frequently adjusted division within the 8-class basket. However, the average price spell of four months for transport related costs is still higher than typical.

Energy prices are reasonably synchronized with 33 per cent and 30 per cent of firm's raising and lowering prices together, respectively. Transportation reflected the highest level of synchronization among service providers. Approximately 72 per cent of transport related prices adjusted in unison with similar patterns reflected for both price increases and decreases (see Table 2).

Both durable and non-durable goods reflect notable frequency in price adjustments. Among durable goods, 27 per cent of price quotes in a month reflected an adjustment. On average, price increases accounted for 15 per cent of price quotes within a month while price declines represented 12 per cent. The duration between two price changes for durable goods was four months. On average, firms selling durable goods waited seven months before passing through a second price increase. Nevertheless, price declines are reflected once every ten months. This may reflect the practice of annual product sales among merchants of durable goods when prices are lowered but reversed when the sale period ends. Price changes among durable goods reflect average synchronization levels of 45 per cent with relatively similar patterns for both price increases and decreases. Durable goods are largely imported and may reflect relatively high levels of synchronization as firms respond in similar fashion to variations in import costs as well

[2] Fuel was comprised of only kerosene, charcoal, and cooking gas in the 8-class basket.

as accustomed periods of sales. These goods include household furniture, large appliances such as refrigerators, television sets and motor vehicles, among others.

The non-durable goods category was the next most frequent in price adjustments (see Table 2). Approximately 21 per cent of non-durable price quotes reflected price changes each month. However, price increases were more likely to occur than price declines as represented by frequencies of 13 per cent and eight per cent, respectively. The duration of price spells among non-durables was approximately six months with an average of eight months between price increases and eighteen months between price declines. Firms selling non-durables are slightly less synchronized than average but relatively more so for price increases than for price declines with values of 30 per cent and seven per cent, respectively.

Services represent the least frequent price changes among selected groups. Approximately 12 per cent of price quotes were likely to represent a price change within a month. Additionally, services were three times more likely to reflect a price increase than a decrease with monthly frequencies of nine per cent and three per cent, respectively. Services typically reflect a price spell of nine months where price increases occur at least once every eleven months. Nevertheless, service providers reflect levels of uniform price movements comparable to behaviour among energy providers. Price increases and decreases reflect respective co-movement of 33 per cent and 31 per cent among service providers.

A comparison of the calculated measures was provided for select regional and international territories (see Table 5). The results show that total frequency of price adjustments in Jamaica fell within the corresponding decile as for Luxembourg, Italy and France within the European market. A similar result was featured for processed foods when Jamaica was compared to Belgium and France. There were also similarities for frequencies of service rate changes between Jamaica and all European territories, however with Jamaica at the highest end. Energy price changes in the observed European states were, on average, four times more frequent than that observed in

Jamaica. This may be due to the strong reliance on a monopoly structure in running the industry. Regional counterparts who underwent similar studies included Barbados, Belize and St. Lucia. All three countries reflected very high frequency in price movements with average duration of price spells between one and two months relative to the seven months, on average, for Jamaica. However, Jamaica's duration between price spells was comparable to the results presented by France (see Table 5).

Econometric Analysis

4.2 Time Dependent Factors:

Length of Duration – Duration is a time dependent factor among the components that explain price setting behaviours. One indicator used to capture this effect was the length of time which elapsed since the start of a products price spell (*len_duration*). This represents the duration length since the last price change at any point in time for a particular product. Table 3 demonstrates that the odds of a price change when the duration period increase by a unit of time is (1:1) and is largely significant.[3] The odds of a price increase after an increase in the duration length is also (1:1) but displays some asymmetry for price declines which reflects lower odds of (1:1.1). This indicates that the odds were 10 per cent less likely to occur. All instances are largely significant. The marginal effects for the duration length on the probability of a price change, increase and decrease, were all negative. The negative sign suggests that when the elapsed time since each price spell increases, the probability of a price change lessened, giving rise to downward sloping hazard functions.

Last size up and down - captures the magnitude of a price change ending a price spell. In

Table **1**, these are featured as (*up_lastsize* and *dn_lastsize*) and are all largely significant. The results demonstrate that the odds of a price change relative to no-price change are the same for varying magnitudes of price adjustments terminating a price spell. A similar result is observed for both the likelihood of price increases and decreases. In all three

[3] In this paper the terms, "largely significant", "significant", and "slightly significant" is used when referring to statistical significance at the 1%, 5% and 10% levels, respectively.

scenarios, the marginal effects are approximately zero. Cecchetti (1986) indicated that the small effects of the price change ending a price spell may suggest that firms face small adjustment costs and thereby reset prices frequently, as opposed to large and infrequent price adjustments. The marginal effects are approximately zero in all these instances, supporting this argument.

Figure 4). These include (*dur_03, dur_07, dur_08, dur_10* and *dur_12*) as identified in Table 3 and Table 4. The results highlight price setting behaviour that relates to the time expired since a former price change. All five time intervals are largely significant for price changes, increases and decreases, excepting for price declines after 12-month intervals (dur_12) which were insignificant at the 10% level (see Table 3). The results demonstrate that the odds of a price increase are all strong when duration periods of seven, eight, ten and twelve months have expired. However, after three months have expired since a price adjustment, the odds that prices would change, increase or decrease, were not good (see Table 3). In such cases, the marginal effects were all negative indicating that, on average, in three months subsequent to a price change, any price change would quite likely be in the opposite direction or no change.

Monthly seasonality effects – Monthly seasonality was incorporated in the baseline model to capture inter-temporal behavioural patterns among price setters. Using January as the base year, the odds of a [price increase : no-price-increase] was notably higher in April, May, June, July, October and November relative to the odds of a [price-decline : no-price-decline]. This was also reflected in monthly frequency plots (see Figure 2) where greater price changes occurred in April to May and October to November, mainly among durables, non-durables, processed foods and services. The June to July effect was primarily among non-processed foods and, to some extent processed foods and non-durables. Adverse weather patterns with heavy rainfall in May-June and October-November as well as drought conditions in the early months of the year tend to disrupt domestic agriculture supplies and distribution chains. Additionally, new fiscal measures

at the beginning of a fiscal period may adversely affect rates within the service sector. In January, there was typically low frequency of price change across all major sectors (see Figure 2). On average, the proportion of firms lowering prices on a monthly basis exceeds the number of firms increasing prices. This is true for all industries except for services which displays longer duration between price adjustments.

When price increases and decreases were addressed independently, the results showed that price increases are weakest in August, September and December reflecting the back-to-school and Christmas periods (see seasonal impacts in Table 3 and Table 4). This result may be attributed to increased competition and a seasonal expansion in supplies in anticipation of greater demand among certain items during those periods. These periods also reflect low frequency of price changes among energy, durables, non-durables, processed foods and to some extent services (see Figure 2). Price declines, however, are strongest in the first half of each year (February to June) and also in November and December, which coincides with some seasonal declines in agriculture prices and falling commodity prices following peaks in the winter period. The marginal effects were all positive and largely significant highlighting a definite seasonal pattern in the price setting behaviour of firms. Price declines and increases were equally likely during the period July to October when frequencies of price increase and decreases moved in tandem (see Table 3, Table 4 and Figure 2). The mixture of price increases and decreases may be characteristic of periodic sales followed by price reversals across the wide cross-section of firms which Lunnemann and Matha (2005) addressed as a key feature of explaining price changes.

4.3 State Dependent Factors:

Macroeconomic factors – The macroeconomic state-dependent factors included in the model are per cent changes in *cpi*, *exrate*, *wti*, *tot* and*tbill*. The baseline model distinguishes between accumulated changes, increases and decreases for each macro component. It is anticipated that the likelihood of price increases would increase along with higher inflation, depreciating exchange rate, higher energy costs, rising interest rates and even more when the terms of trade deteriorate.

- *CPI changes (cpi)* - Table 3 demonstrates that the odds of a price change following strong changes in inflation were weak with odds of [1:1.2]. This result suggests that the odds of a price change as inflation increases would be lessened by 20 per cent for every percentage point increase in inflation. However, this outcome conflicts with expectations that rising inflation would indicate a greater likelihood of price increases and may be indicative of underlying asymmetric patterns for price increases separate from price decreases. When the odds of a price increase and decrease were observed separately, the odds of a price increase in the CPI was approximately [1:1] but worsens considerably in the case of a decline in the CPI. This result suggests that prices are equally likely to rise or fall when the CPI increases but becomes very unlikely to either increase or decrease when the CPI declines. The strong and significant odds that prices will not decline when the CPI declines are indicative of downwardly sticky prices. It may also be deduced that prices are generally rigid downward since the marginal effects (coefficient) for declines in the CPI are both strong and largely significant.

- *Exchange rate changes (xrate)* - The results in Table 3 demonstrate that the odds of a price change when depreciation of the exchange rate is large is significant and consistent with a ratio of [2.9:1]. The marginal effect is positive suggesting that faster depreciation in the exchange rate is likely to be met with increased prices while appreciation in the exchange rate will reflect a high likelihood of firms lowering prices. This result, however, was not justified when distinction was made between rising and declining exchange rates. The results suggest that price increases and decreases are equally likely when the exchange rate either depreciates or appreciates. Both odds were [1:1] (see Table 3).

- *Other macroeconomic factors* - The odds of accumulated changes in the Terms of Trade (*tot*) and Treasury Bills (*tbill*) reflected similar characteristics to accumulated deviations in the exchange rate when explaining the likelihood of a change, increase or decrease, in a firm's price. The accumulated deviation in the WTI crude oil price (*wti*) since the initiation of a price spell did not reflect any

higher odds of a price increase or decrease. This was the same for higher and lower *wti* prices.

Commercial pricing strategies – The literature suggests that firms generally employ attractive pricing strategies when making decisions about price adjustments. The group of attractive pricing strategies captured in the dataset includes psychological, fractional and round prices. The literature suggests that firms which set prices with desired properties may adjust prices less frequently because some price changes may be too small to adjust to the next desired price level e.g. from one round price to another round price. When all attractive prices are grouped, the result in Table 3 shows that pricing strategies neither increase nor lower the odds of a price change. This result was insignificant, however, and may suggest asymmetric behaviour among firms when reacting to a price increase relative to a price decrease. This inference was confirmed by the estimates which discriminate between a price increase and decrease. The results demonstrated that the odds of a price increase were lowered to [1:1.1] when a price setting strategy was used. However, the odds of a price decline increases to [1.2:1] when a price decline was experienced. The marginal effects of a price increase in response to attractive price setting patterns were negative but were positive when explaining price declines. This result supports the notion that the greater the number of firms practicing attractive pricing strategies, the less likely there will be price increases. However, price declines are more likely when firms practice attractive pricing strategies.

This type of behaviour among firms may be due to the nature of setting optimal prices. When a price increase is warranted, firms will set prices at optimal levels so as to maximize margins and minimize the need for readjusting prices within the interim. Hence, when reasons for a price increase surface, the firm is able to absorb some costs without charging customers more or they will be able to wait until conditions normalize. However, when conditions warrant price declines, given that firms are at or close to optimal prices with reasonable margins, they may find it in their best interest to pass on some of the savings to customers and increase competitiveness. Being at the top of the threshold, lowering prices to an attractive price may be well within grasp. Firms that display such characteristics may practice fair pricing strategies in conjunction with

attractive pricing, where the former reflects a strong commitment to customer loyalty and stability in prices.

In Table 4, the LOGIT model was re-estimated with different indicators for the three classes of attractive prices. The results demonstrate that the indicator for psychological pricing is insignificant for price changes, increases and decreases. Hence, firms in Jamaica are not accustomed to setting prices that end with a nine. This may be due to the culture of Jamaican consumers who tend to pay more attention to round numbers (i.e. numbers ending with a zero). This reflects significance for fractional pricing strategies and round pricing strategies across models explaining a price change, increase and decrease. The most common attractive pricing strategy is fractional pricing where prices end with a 0.75, 0.50 or 0.25. Fractional prices reflected odds of [1.4:1] for price changes and odds of [1.3:1] for both price increases and decreases. Whereas fractional pricing displays symmetric behaviour for price increases and decreases, round prices did explain the asymmetric behaviour observed in the grouped indicator for attractive prices in the baseline model. Among firms that practice round pricing strategies, the odds that prices would increase as opposed to not increasing is [1:1.3]. On the contrary, the odds that prices would decline as opposed to not declining, was [1.1:1]. Hence, firms practicing round pricing strategies are more likely to lower prices and less likely to increase prices. The band between two round prices would be greater than the band between two fractional prices. Hence, the principle of optimizing prices for reasonable margins, lowering the frequency of price increases and passing on savings within a fair pricing framework, would be a reasonable policy for firms setting round prices. This is consistent with previous discussion.

Competition amongst firm's– The indicator of competitiveness captures the number of outlets selling a specific product. The theory suggests that prices would be less sticky among competitive industries than among industries with significant market power (dominance). This was incorporated in our model as (*compete*). The results showed that the level of competition did not affect the likelihood of a price change, increase or decrease. In all cases, the odds of a price adjustment was [1:1] and largely significant.

This might be due to sample selection criteria where the number of outlets may be censored at a maximum level and ignored at a minimum level. Additionally, the range of goods and services captured within the CPI may be classified as goods which are generally competitive or display competitive price setting patterns.

Industry classification – Industry classification is essential as it plays two significant roles in the analysis. Firstly, it highlights industry specific characteristics in the likelihood of price changes. Secondly, it accounts for observed heterogeneity across groups within the data, thereby enhancing the reasonability of estimates from the LOGIT specification. Aucremanne and Dhyne (2005) noted that omitting industry specific dummies may lead to declining hazard functions which conflicts with theoretical perspectives. Among the industries that reflect significant adjustments to the likelihood of a price change a price increase or a price decrease, are non-processed foods, durable goods, and energy goods, while services reflect generally lower odds. This result reflects heterogeneity of price-setting behaviour across industries, a feature that is strongly supported by the literature. Energy products, for instance, typically reflect higher frequency of price adjustments relative to services which may change prices only once a year.

Table 3 displays the odds of price adjustments for non-processed foods as $[1.8:1]^{cg}$, $[1.5:1]^{up}$ and $[2.1:1]^{dn}$; durable goods as $[1.5:1]^{cg}$ and $[2.6:1]^{dn}$ where impacts on price increases was insignificant.[4] The odds of energy goods were $[1.4:1]^{cg}$, $[1.3:1]^{up}$ and $[1.3:1]^{dn}$. However, services reflected lower odds of $[1:1.4]^{cg}$, $[1:1.3]^{up}$ and $[1.1.5]^{dn}$ which is consistent with expectations that service-oriented firms will adjust prices less frequently than non-service oriented firms. This reduced tendency to lower prices reflects asymmetric behaviour among service providers when adjusting prices up or down. Figure 1 demonstrates the distribution of price increases relative to declines and shows a bias towards price increases among service industries. In general, the greater the number of service oriented firms in Jamaica, the less likely will there be price changes, increases or decreases. Instead, prices will remain generally stable among this group. The results

[4] The symbols cg, up, and dn represent change, upward and downward price adjustments, respectively.

also demonstrated that non-durable goods (*ndurable*) displayed greater odds of lowering prices and reduced odds of increasing prices (see Table 4 and Figure 1)

Annual economic impacts – Annual dummies are used to capture the economic conditions prevailing in a specific year. Therefore, the model seeks to identify to what extent a given year may affect the likelihood of price adjustments. The baseline model demonstrates that the odds of price changes, increases and decreases, were highest in the early years, particularly 1995, and gradually lessened to an odd-ratio of [1:1] in 2001. In 2002 the odds ratio indicated the unlikelihood of a price change especially for a price increase while the possibility of price decline was inconsequential [1:1]. In 2003 however, the likelihood of price changes and especially a price decline, increased. This contradicted a priori expectations in the context of significant instability in the foreign exchange market during that year, following a ratings downgrade by Standard and Poor's on Jamaican sovereign bonds. Prices were significantly higher in 2003 due to the significant exchange rate depreciation as well as the impact of rising international commodity prices and the implementation of various tax measures. However, the strong likelihood of price declines may be attributed to the significant and extended reduction in agriculture prices in the first half of 2003 due to a recovery of agriculture supplies following the damaging effects of flood rains in the latter half of 2002. In the year that followed 2003, however, the likelihood of price changes, increases and decreases, was very weak in favour of low inflation conditions.

5.0 Summary& Recommendations

The results from the 8-class CPI basket demonstrate that during the period 1995 to 2006, a price spell typically lasted seven months. Approximately 16 per cent of prices were expected to adjust on a monthly basis with some bias toward price increases relative to price declines. On average, 39 per cent of firms adjust prices at the same time with no real difference in this pattern when increasing or lowering prices. Among the main results stemming from the study are the following:

1. There was significant heterogeneity in price-setting behaviour across industries. This was revealed in higher frequencies of price adjustments among energy, durable and no-durable goods relative to low frequencies among processed foods and service-based industries.

2. Unlike major international markets for consumer goods such as the USA and Europe which practice psychological pricing strategies, Jamaican firms display no such tendency. Instead, firms which engage in attractive pricing tend to utilize either fractional or round pricing strategies where prices end with 0.25, 0.50 & 0.75; or zero, respectively.

3. Price setting behaviour among Jamaican firms is largely consistent with international patterns where frequencies and duration measures nest within typical bands while maintaining heterogeneity across local industry types. These patterns were not explicitly reflected in results from our regional counterparts.

4. Firms display asymmetric behavioural patterns when dealing with price increases relative to declines. This was displayed in a strong resistance to lowering prices when the general price level falls but displaying equal tendencies to raise or lower prices when the general price level rises. Firms that practice round pricing strategy also display asymmetric behaviour patterns by resisting frequent price increases but quite ready to pass savings on to loyal customers by lowering prices.

Firms display some consistency in price setting behaviour but this is much lower than expected in competitive industries. This result reflects the prevalence of asymmetric information in the domestic pricing mechanism which is an indication of some degree of rigidity in price setting behaviour. However, the results point to a well-established system of adjusting prices which have adapted to generally low economic growth, frequent instability and numerous anti-competitive type policies. The energy sector, for instance, reflects very low frequency of price changes, relative to international counterparts, which may be attributed to anti-competitive type policies. Also, service-

based industries reflected much shorter price spells than observed internationally and may be attributed to the unstable conditions within foreign currency, capital and both foreign and domestic goods markets.

Government policies should therefore be directed towards enhancing economic stability, eliminating counter-productive and anti-competitive type policies which promote rigid prices and, instead, seek to facilitate and advance the delivery of crucial information that will enable competitive-type decision making among businesses and consumers.

BIBLIOGRAPHY

Aucremanne, L, and E Dhyne. 2005. “Time-Dependent versus State-Dependent Pricing: A Panel Data Approach to the Determinants of Belgian Consumer Price Changes.” National Bank of Belgium. Working Papers-Research Series, No. 66, 71p.

Baudry, Laurent, Herve Le Bihan, Patrick Sevestre, and Sylvie Tarrieu. 2004. Price Rigidity: Evidence from the French CPI Micro-Data. EBC Working Paper, No. 384. Frankfurt: European Central Bank.

Calvo, Guillermo A. 1983. “Staggered Prices in a Utility-Maximizing Framework.” *Journal of Monetary Economics*, Vol. 12, 383-398.

Caplin, A, and D Spulber. 1987. “Menu Costs and Optimization with State-Dependent Pricing.” *Quarterly Journal of Economics*, Vol. 31, 703-725.

Cecchetti, S. 1986. “The Frequency of Price Adjustment: A Study of the Newsstand Prices of Magazines.” *Journal of Econometrics*, Vol. 31, No. 3, 255-274.

Craigwell, Ronald, Winston Moore and DeLisle Worrell. 2009. "Does Consumer Price Rigidity Exist in Barbados?" Paper presented at Tenth Annual SALISES Conference: Navigating Risks and Building Resilience in Small States, Cave Hill, March 25-27.

Craigwell, Roland, Winston Moore, and Diego Morris. 2010. *Price Rigidity: An Introduction.* Bridgetown: Central Bank of Barbados.

Dhyne, Emmanuel et al. 2005. “Price Setting in The Euro Area: Some Stylized Facts from Individual Consumer Price Data.” ECB Working Paper Series No. 524. Frankfurt: European Central Bank.

Dhyne, Emmanuel, Jerzy Konieczny, Fabio Rumler and Patrick Sevestre. 2009. Price Rigidity in the Euro Area: an Assessment. Final Report. European Economy: Economic Papers. 380. 227pp.

Dotsey, Michael, Robert King, and Alexander Wolman. 1999. “State-Dependent Pricing and the General Equilibrium Dynamics of Money and Output.” *Quarterly Journal of Economics*, Vol. 114, No. 2, 655-690.

Fisher, Timothy, and Jerzy Konieczny. 2000. “Synchronization of Price Changes by Multiproduct Firms: Evidence from Canadian Newspaper Prices.” *Economics Letters*, Vol. 68, No. 3, 271-277.

Lunnemann, Patrick and Thomas Y Matha. 2005. “Consumer Price Behaviour in Luxembourg: Evidence from Micro CPI Data.” ECB Working Paper Series No. 541. Frankfurt: European Central Bank.

Polius, Tracy, and Edwin St. Catherine. 2011. "Price Setting Behaviour in Saint Lucia: Evidence from CPI Data." *in: Price Formation and Inflation Dynamics in The Caribbean*, edited by Roland Craigwell, Winston Moore and DeLisle Worrell. UWI, St. Augustine, Trinidad and Tobago: Caribbean Centre for Money and Finance. pp 90-117.

Taylor, John B. 1980. "Aggregate Dynamics and Staggered Contracts." *Journal of Political Economy*, Vol. 88, No. 1, 1-23.

Taylor, John B. 1979. "Staggered Wage Setting in a Macro Model." *American Economic Review* Vol. 69, No. 2, 108-113.

APPENDIX 1.0 - *Data & Characteristics*

A longitudinal dataset was used consisting of monthly price data collected by the Statistical Institute of Jamaica (STATIN) for computing the Jamaica Consumer Price Index. The dataset is comprised of 8-classes according to divisions of consumer spending which was used prior to the more recently implemented 12 division basket according to Classification of Individual Consumption According to Purpose (COICOP) methodology which was implemented in December 2006. The 8-class dataset includes 1,643,052 unique price quotes across the range of CPI classifications for the period January 1995 to December 2006. Each price quote was distinctively identified by a numeric code for the specific product brand, regional area, outlet, town, and collection point. Alongside each product id value is a uniquely associated month, year and price, where all prices are quoted in Jamaican dollars. The 8-class panel dimension consists of 18,570 cross sections with the longest subset of observations being 132 months over the 12 year period.

The dataset had some missing data points. Missing data may occur in instances where prices are surveyed on a seasonal basis. Such instances of missing data may also include cases where the data is surveyed only on a quarterly basis. Another case of missing data may occur if the product is absent from an outlet at the point of survey. All cases of missing information results in censored data.[5] *To rectify instances of missing information, the "carry forward" methodology was employed to price quotes within each year. As a result, cases where a missing data point occurred after a price quote; the former quote was carried forward. In cases where there was no price quote before a missing data point, the earliest price record in the year for the specific product was left unchanged. This adjustment follows a right-hand censoring of the dataset, however, consistent with similar studies, left-hand censoring was avoided due to the complexity, potential hazards, and minimal benefit of imposing such transformation on the data.*

5 - (Lunnemann and Matha 2005) identifies uncensored data as being characterized by a distinctive start and end of price spell. Left censored displays no definite start of a spell, while right censored has no definite end of spell. A double censored data has neither a start nor an end of price spell.

APPENDIX 2.0 – *Tables & Figures*

Table 1: Old and New CPI Basket of Goods & Services

Count	Weights	Eight (8) Division Classification (Previous Basket)
1	55.6	FOOD & DRINK
		Starches
		Vegetable & Fruits
2	7.4	FUELS & OTHER HOUSEHOLD SUPPLIES
		Fuels
		Household Supplies
3	7.9	HOUSING & OTHER HOUSING EXPENSES
4	2.8	HOUSEHOLD FURNISHINGS & FURNITURE
5	7.0	HEALTHCARE & OTHER PERSONAL EXPENSES
6	5.1	PERSONAL CLOTHING FOOTWARE & OTHER ACCESSORIES
7	6.4	TRANSPORTATION
8	7.9	MISCELLANEOUS EXPENSES
8	100.0	All Jamaica

Count	Weights	Twelve (12) Division by COICOP (Current Basket)
1	37.5	FOOD & NON-ALCOHOLIC BEVERAGES
	35.1	Food
	6.9	Vegetables and Starchy Foods
	2.4	Non-Alcoholic Beverages
2	1.4	ALCOHOLIC BEVERAGES & TOBACCO
3	3.3	CLOTHING & FOOTWEAR
4	12.8	HOUSING, WATER, ELECTRICITY, GAS & OTHER FUELS
	3.5	Rentals for Housing
	7.1	Electricity, Gas and Other Fuels
5	4.9	FURNISHINGS, HOUSEHOLD EQUIPMENT & ROUTINE HOUSEHOLD MAINTENANCE
6	3.3	HEALTH
7	12.8	TRANSPORT
8	4.0	COMMUNICATION
9	3.4	RECREATION & CULTURE
10	2.1	EDUCATION
11	6.2	RESTAURANTS & ACCOMMODATION SERVICES
12	8.4	MISCELLANEOUS GOODS & SERVICES
8	100.0	All Jamaica

Table 2: Measures of Price Setting Behaviour

	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

Table 3: Baseline with Macro Changes vs. Increases & Decreases

	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 / Marginal Effect	OR	ME	p-val	OR	ME	p-val	OR	ME	p-val
(state)	cg_cpi	1 : 1.2	-0.200	0.000	---	---	---	---	---	---
macro	cg_xrate	2.9 : 1	1.079	0.000	---	---	---	---	---	---
changes	cg_wti	1.1 : 1	0.056	0.012	---	---	---	---	---	---
	cg_tot	1.9 : 1	0.652	0.000	---	---	---	---	---	---
	cg_tbill	1.4 : 1	0.300	0.000	---	---	---	---	---	---
(state)	up_cpi	---	---	---	1 : 1	-0.007	0.000	1 : 1.0	0.001	0.040
macro	up_xrate	---	---	---	1 : 1	0.022	0.000	1.0 : 1	-0.005	0.000
increase	up_wti	---	---	---	1 : 1	-0.001	0.000	1 : 1.0	0.001	0.000
	up_tot	---	---	---	1 : 1	0.012	0.000	1 : 1.0	0.036	0.000
	up_tbill	---	---	---	1 : 1	0.010	0.000	1.0 : 1	-0.002	0.003
(state)	dn_cpi	---	---	---	1 : 34.9	-3.553	0.000	1.0 : 21.2	-3.053	0.000
macro	dn_xrate	---	---	---	1 : 1	-0.045	0.000	1.0 : 1	-0.038	0.000
down	dn_wti	---	---	---	1 : 1	-0.005	0.000	*1.0 : 1*	*-0.001*	*0.156*
	dn_tot	---	---	---	1 : 1	0.011	0.000	*1 : 1.0*	*0.001*	*0.672*
	dn_tbill	---	---	---	1 : 1	0.007	0.000	1 : 1.0	0.008	0.000
(state)	*attract*	*1 : 1*	*0.003*	*0.555*	*1 : 1.1*	*-0.124*	*0.000*	*1.2 : 1.0*	*0.200*	*0.000*
price	compete	1 : 1	0.009	0.000	1 : 1	0.007	0.000	1 : 1.0	0.008	0.000
setting	psycho	---	---	---	---	---	---	---	---	---
patterns	fraction	---	---	---	---	---	---	---	---	---
	round01	---	---	---	---	---	---	---	---	---
(state)	energy	1.3 : 1	0.288	0.000	1.3 : 1	0.240	0.000	1.3 : 1.0	0.256	0.000
group	service	1 : 1.4	-0.326	0.000	1 : 1.3	-0.277	0.000	1.0 : 1.5	-0.415	0.000
impacts	nprocessf	1.8 : 1	0.565	0.000	1.4 : 1	0.358	0.000	2.1 : 1.0	0.759	0.000
	processf	*1 : 1*	*0.016*	*0.267*	1 : 1	0.038	0.002	*1.0 : 1*	*-0.012*	*0.514*
	ndurable	*1.1 : 1*	*0.053*	*0.275*	1 : 1.1	-0.084	0.038	1.3 : 1.0	0.254	0.000
	sdurable	*1 : 1.1*	*-0.060*	*0.224*	1 : 1.2	-0.209	0.000	1.2 : 1.0	0.211	0.001
	durable	1.6 : 1	0.458	0.000	1.1 : 1	0.105	0.017	2.6 : 1.0	0.958	0.000
(state)	year_95	4.7 : 1	1.549	0.000	3.3 : 1	1.204	0.000	3.3 : 1.0	1.198	0.000
annual	year_96	3.5 : 1	1.261	0.000	2.8 : 1	1.025	0.000	3.2 : 1.0	1.169	0.000
impacts	year_97	2.6 : 1	0.956	0.000	2.3 : 1	0.851	0.000	2 : 1.0	0.671	0.000
	year_98	2.1 : 1	0.752	0.000	2.3 : 1	0.848	0.000	1.9 : 1.0	0.632	0.000
	year_99	1.7 : 1	0.541	0.000	1.6 : 1	0.492	0.000	1.5 : 1.0	0.388	0.000
	year_00	1.1 : 1	0.136	0.000	*1 : 1*	*0.035*	*0.204*	1.2 : 1.0	0.141	0.001
	year_01	*1 : 1*	*0.012*	*0.589*	1 : 1.1	-0.099	0.000	*1 : 1.0*	*0.046*	*0.280*
	year_02	1 : 1.1	-0.057	0.008	1 : 1.2	-0.197	0.000	*1 : 1.0*	*0.044*	*0.283*
	year_03	1.3 : 1	0.273	0.000	1 : 1	0.040	0.076	1.4 : 1.0	0.360	0.000
	year_04	1 : 1.2	-0.171	0.000	1 : 1.4	-0.345	0.000	1.0 : 1.2	-0.148	0.000
	year_05	---	---	---	---	---	---	---	---	---
(time)	up_lastsize	1 : 1	0.000	0.001	1 : 1	0.000	0.000	1 : 1.0	0.000	0.000
duration	dn_lastsize	1 : 1	0.000	0.000	1 : 1	0.000	0.000	1.0 : 1	0.000	0.000
effects	len_duration	1 : 1	-0.018	0.000	1 : 1	-0.012	0.000	1.0 : 1.1	-0.050	0.000
(time)	dur_03	1 : 1.2	-0.222	0.000	1 : 1.1	-0.121	0.000	1.0 : 1.3	-0.234	0.000
hazzard	dur_07	1.3 : 1	0.227	0.000	1.2 : 1	0.197	0.000	1.3 : 1.0	0.240	0.000
durations	dur_08	1.3 : 1	0.294	0.000	1.3 : 1	0.259	0.000	1.4 : 1.0	0.319	0.000
	dur_10	1.5 : 1	0.399	0.000	1.4 : 1	0.361	0.000	1.5 : 1.0	0.395	0.000
	dur_12	1.4 : 1	0.345	0.005	1.5 : 1	0.419	0.000	*1.2 : 1.0*	*0.211*	*0.230*
(time)	month_02	1.3 : 1	0.284	0.000	1.3 : 1	0.238	0.000	1.2 : 1.0	0.220	0.000
seasonal	month_03	1.3 : 1	0.247	0.000	1.2 : 1	0.193	0.000	1.2 : 1.0	0.202	0.000
impacts	month_04	1.4 : 1	0.346	0.000	1.4 : 1	0.311	0.000	1.2 : 1.0	0.211	0.000
	month_05	1.5 : 1	0.423	0.000	1.5 : 1	0.376	0.000	1.3 : 1.0	0.283	0.000
	month_06	1.5 : 1	0.425	0.000	1.5 : 1	0.406	0.000	1.3 : 1.0	0.282	0.000
	month_07	1.3 : 1	0.293	0.000	1.4 : 1	0.315	0.000	1.1 : 1.0	0.136	0.000
	month_08	1.2 : 1	0.193	0.000	1.2 : 1	0.210	0.000	1.1 : 1.0	0.092	0.000
	month_09	1.2 : 1	0.152	0.000	1.1 : 1	0.136	0.000	1.1 : 1.0	0.126	0.000
	month_10	1.3 : 1	0.276	0.000	1.4 : 1	0.316	0.000	1.1 : 1.0	0.129	0.000
	month_11	1.3 : 1	0.282	0.000	1.4 : 1	0.338	0.000	1.2 : 1.0	0.151	0.000
	month_12	1.3 : 1	0.231	0.000	1.2 : 1	0.212	0.000	1.3 : 1.0	0.234	0.000
	constant		-4.855	0.000		-4.918	0.000		-5.824	0.000
	/lnsig2u		-1.685	0.000		-2.596	0.000		-1.851	0.000
	sigma_u		0.431	0.000		0.273	0.000		0.396	0.000
	rho		0.053	0.000		0.022	0.000		0.046	0.000
	Wald-Chi2		---	---		---	---		---	---

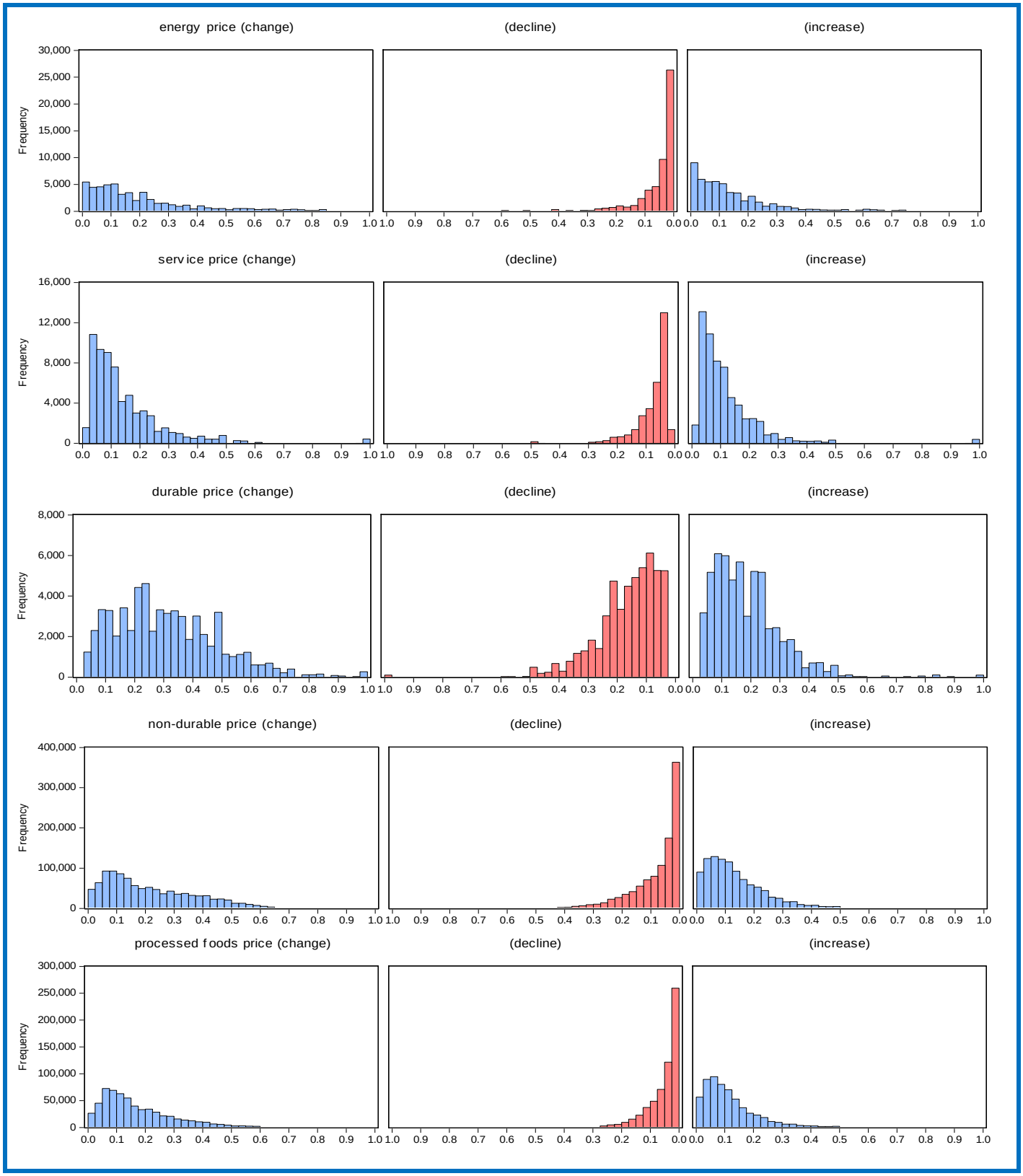
shaded = insignificant at 5% critical level, shaded & italics = insignificant at 10% critical level

Table 4: Baseline with Attractive Pricing Patterns

	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 / Marginal Effect	OR	ME	p-val	OR	ME	p-val	OR	ME	p-val
(state)	cg_cpi	1 : 1.2	-0.190	0.000	---	---	---	---	---	---
macro	cg_xrate	3 : 1	1.094	0.000	---	---	---	---	---	---
changes	cg_wti	1.1 : 1	0.055	0.014	---	---	---	---	---	---
	cg_tot	1.9 : 1	0.648	0.000	---	---	---	---	---	---
	cg_tbill	1.4 : 1	0.309	0.000	---	---	---	---	---	---
(state)	up_cpi	---	---	---	1 : 1	-0.007	0.000	---	---	---
macro	up_xrate	---	---	---	1 : 1	0.022	0.000	1.0 : 1	-0.003	0.000
increase	up_wti	---	---	---	1 : 1	-0.001	0.000	1 : 1.0	0.001	0.000
	up_tot	---	---	---	1 : 1	0.013	0.000	1 : 1.0	0.036	0.000
	up_tbill	---	---	---	1 : 1	0.010	0.000	1.0 : 1	-0.003	0.001
(state)	dn_cpi	---	---	---	1 : 34.2	-3.532	0.000	1.0 : 20.5	-3.018	0.000
macro	dn_xrate	---	---	---	1 : 1	-0.045	0.000	1.0 : 1	-0.039	0.000
down	dn_wti	---	---	---	1 : 1	-0.005	0.000	*1.0 : 1*	*-0.001*	*0.134*
	dn_tot	---	---	---	1 : 1	0.011	0.000	*1 : 1.0*	*0.001*	*0.472*
	dn_tbill	---	---	---	1 : 1	0.007	0.000	1 : 1.0	0.009	0.000
(state)	*attract*	---	---	---	---	---	---	---	---	---
price	compete	1 : 1	0.009	0.000	1 : 1	0.007	0.000	1 : 1.0	0.008	0.000
setting	psycho	1.4 : 1	0.301	0.810	2.2 : 1	0.769	0.537	.0 : 8695652.	-15.977	0.997
patterns	fraction	1.4 : 1	0.353	0.000	1.3 : 1	0.268	0.000	1.3 : 1.0	0.299	0.000
	round01	1 : 1.1	-0.122	0.000	1 : 1.3	-0.241	0.000	1.1 : 1.0	0.115	0.000
(state)	energy	1.4 : 1	0.301	0.000	1.3 : 1	0.252	0.000	1.3 : 1.0	0.268	0.000
group	service	1 : 1.4	-0.306	0.000	1 : 1.3	-0.259	0.000	1.0 : 1.5	-0.401	0.000
impacts	nprocessf	1.8 : 1	0.611	0.000	1.5 : 1	0.409	0.000	2.2 : 1.0	0.779	0.000
	processf	*1 : 1*	*0.034*	*0.021*	1.1 : 1	0.057	0.000	*1.0 : 1*	*-0.003*	*0.876*
	ndurable	*1 : 1*	*0.023*	*0.635*	1 : 1.1	-0.116	0.004	1.3 : 1.0	0.240	0.000
	sdurable	*1 : 1.1*	*-0.094*	*0.056*	1 : 1.3	-0.245	0.000	1.2 : 1.0	0.195	0.002
	durable	1.5 : 1	0.427	0.000	1.1 : 1	0.066	0.130	2.6 : 1.0	0.946	0.000
(state)	year_95	4.6 : 1	1.535	0.000	3.3 : 1	1.196	0.000	3.2 : 1.0	1.165	0.000
annual	year_96	3.5 : 1	1.252	0.000	2.8 : 1	1.023	0.000	3.2 : 1.0	1.162	0.000
impacts	year_97	2.6 : 1	0.940	0.000	2.3 : 1	0.842	0.000	1.9 : 1.0	0.656	0.000
	year_98	2.1 : 1	0.740	0.000	2.3 : 1	0.845	0.000	1.9 : 1.0	0.635	0.000
	year_99	1.7 : 1	0.535	0.000	1.6 : 1	0.490	0.000	1.5 : 1.0	0.384	0.000
	year_00	1.1 : 1	0.138	0.000	*1 : 1*	*0.043*	*0.121*	1.1 : 1.0	0.133	0.002
	year_01	*1 : 1*	*0.018*	*0.436*	1 : 1.1	-0.088	0.001	*1 : 1.0*	*0.035*	*0.400*
	year_02	1 : 1.1	-0.056	0.010	1 : 1.2	-0.191	0.000	*1 : 1.0*	*0.031*	*0.447*
	year_03	1.3 : 1	0.277	0.000	1 : 1	0.045	0.044	1.4 : 1.0	0.340	0.000
	year_04	1 : 1.2	-0.175	0.000	1 : 1.4	-0.348	0.000	1.0 : 1.2	-0.171	0.000
	year_05	---	---	---	---	---	---	1 : 1.0	0.000	0.000
(time)	up_lastsize	1 : 1	0.000	0.003	1 : 1	0.000	0.000	1 : 1.0	0.000	0.000
duration	dn_lastsize	1 : 1	0.000	0.000	1 : 1	0.000	0.000	1.0 : 1	0.000	0.000
effects	len_duration	1 : 1	-0.018	0.000	1 : 1	-0.011	0.000	1.0 : 1.1	-0.049	0.000
(time)	dur_03	1 : 1.3	-0.228	0.000	1 : 1.1	-0.130	0.000	1.0 : 1.3	-0.233	0.000
hazzard	dur_07	1.3 : 1	0.225	0.000	1.2 : 1	0.194	0.000	1.3 : 1.0	0.239	0.000
durations	dur_08	1.3 : 1	0.282	0.000	1.3 : 1	0.248	0.000	1.4 : 1.0	0.311	0.000
	dur_10	1.5 : 1	0.386	0.000	1.4 : 1	0.347	0.000	1.5 : 1.0	0.388	0.000
	dur_12	1.3 : 1	0.292	0.016	1.4 : 1	0.368	0.000	*1.2 : 1.0*	*0.171*	*0.329*
(time)	month_02	1.3 : 1	0.283	0.000	1.3 : 1	0.236	0.000	1.2 : 1.0	0.217	0.000
seasonal	month_03	1.3 : 1	0.244	0.000	1.2 : 1	0.190	0.000	1.2 : 1.0	0.197	0.000
impacts	month_04	1.4 : 1	0.340	0.000	1.4 : 1	0.306	0.000	1.2 : 1.0	0.203	0.000
	month_05	1.5 : 1	0.416	0.000	1.4 : 1	0.371	0.000	1.3 : 1.0	0.274	0.000
	month_06	1.5 : 1	0.416	0.000	1.5 : 1	0.399	0.000	1.3 : 1.0	0.274	0.000
	month_07	1.3 : 1	0.294	0.000	1.4 : 1	0.318	0.000	1.1 : 1.0	0.135	0.000
	month_08	1.2 : 1	0.192	0.000	1.2 : 1	0.211	0.000	1.1 : 1.0	0.089	0.000
	month_09	1.2 : 1	0.150	0.000	1.1 : 1	0.135	0.000	1.1 : 1.0	0.123	0.000
	month_10	1.3 : 1	0.274	0.000	1.4 : 1	0.315	0.000	1.1 : 1.0	0.125	0.000
	month_11	1.3 : 1	0.279	0.000	1.4 : 1	0.336	0.000	1.2 : 1.0	0.149	0.000
	month_12	1.3 : 1	0.227	0.000	1.2 : 1	0.210	0.000	1.3 : 1.0	0.232	0.000
	constant	1 : 112.7	-4.724	0.000	1 : 120.8	-4.794	0.000	1.0 : 310.5	-5.738	0.000
	/lnsig2u	1 : -0.6	-1.702	0.000	1 : -0.4	-2.617	0.000	1.0 : -0.5	-1.870	0.000
	sigma_u	1 : 2.3	0.427	0.000	1 : 3.7	0.270	0.000	1.0 : 2.5	0.393	0.000
	rho	1 : 19	0.053	0.000	1 : 46	0.022	0.000	1.0 : 22.3	0.045	0.000
	Wald-Chi2	---	---	---	---	---	---	---	---	---

shaded = insignificant at 5% critical level, shaded & italics = insignificant at 10% critical level

Figure 1: Frequency distributions for price changes, increases and decreases by group



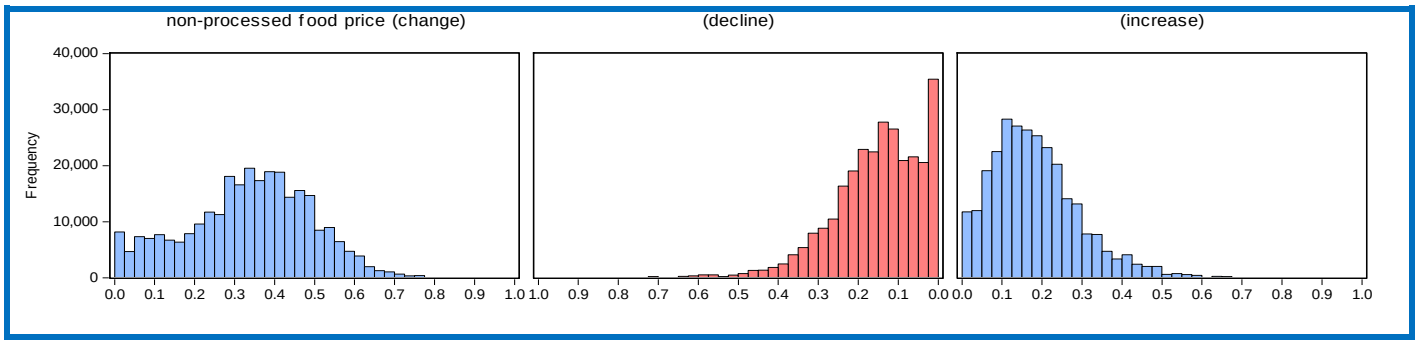


Figure 2: Frequency of Price Changes by Calendar Month

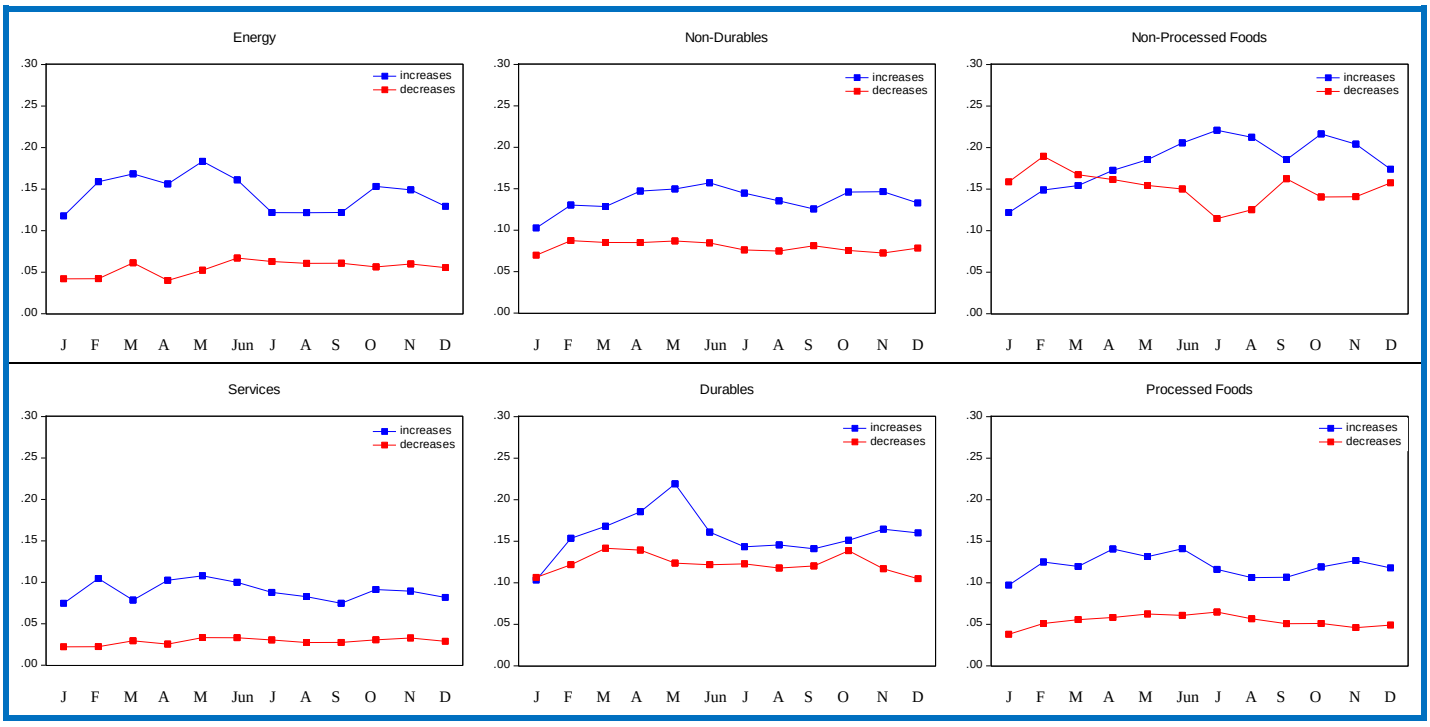
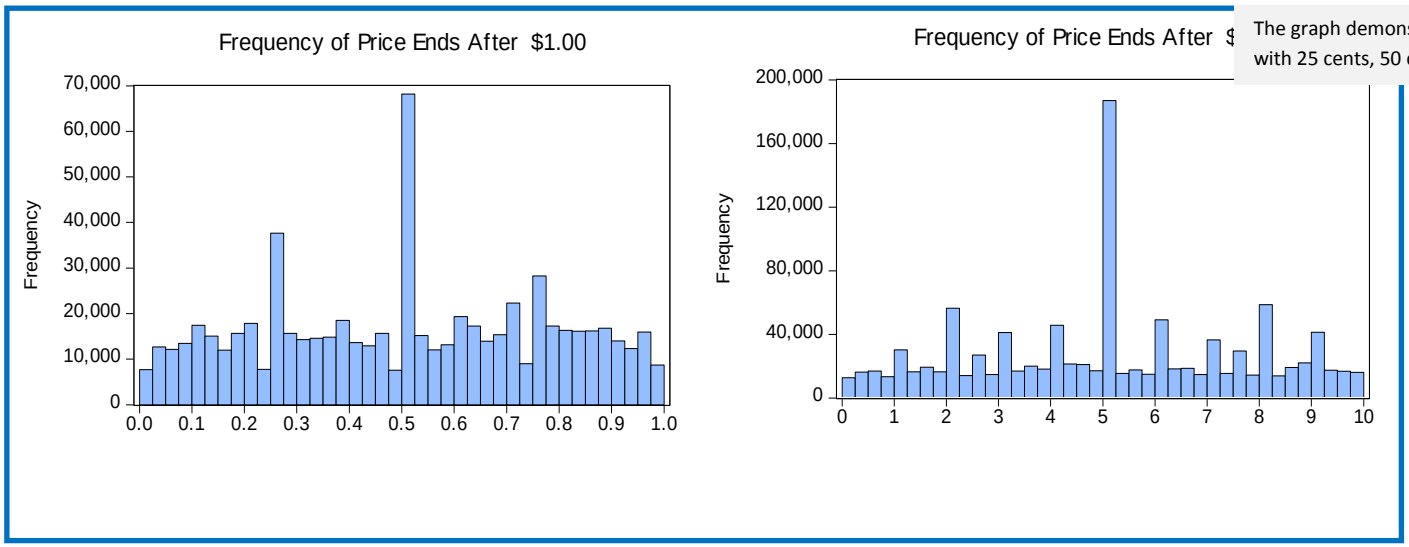


Figure 3: Frequency of Price End Points



The graph demonstrates that attract
with 25 cents, 50 cents and 75 cents

Figure 4: Hazard Functions for first 12 months (draft)

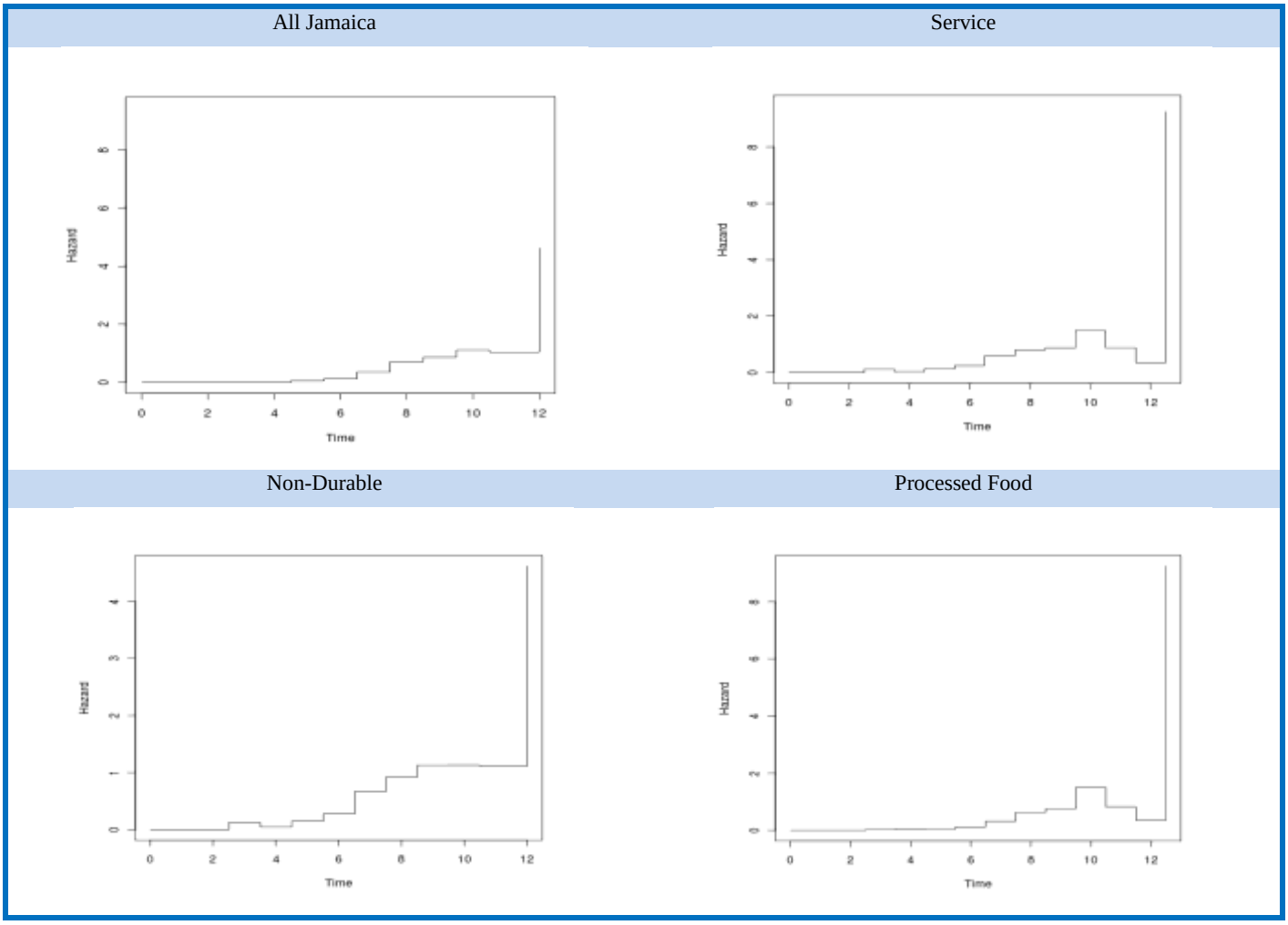


Table 5: Country Comparison Statistics

		Jamaica	St. Lucia	Barbados	Belize	Luxembourg	Italy	Belgium	France
Frequency	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
Duration	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
Synchronization	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	---	---	---