

Exploring the Formation of Inflation Expectations in Jamaica: A Pragmatic Approach



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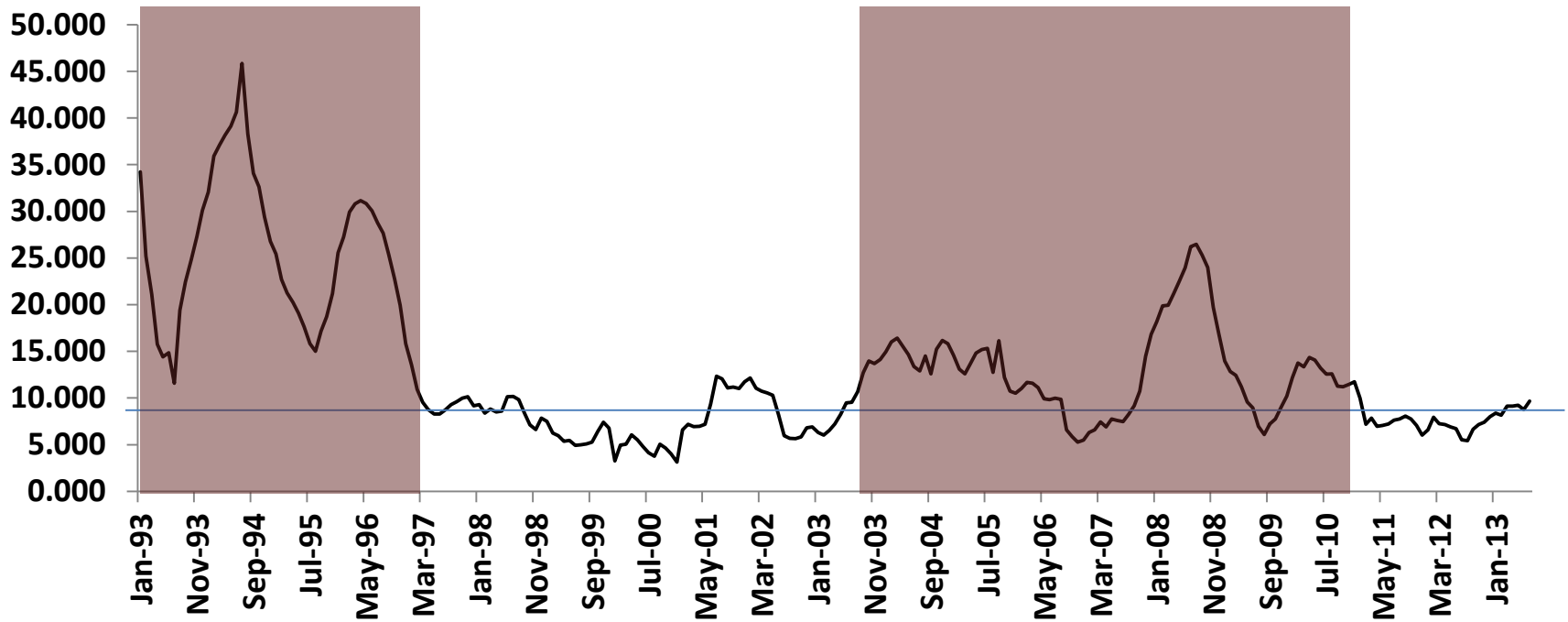
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Motivation

- ❑ Measuring and understanding the dynamics of inflation expectations is a critical component in the operation of all central banks.
- ❖ *It reduces uncertainty in an otherwise volatile environment.*
- ❖ *It can help to guide self-fulfilling expectations.*
- ❖ *It assists central banks to gauge the markets perception of the credibility of monetary policy.*
- ❖ *It can help to determine the effectiveness of issuing various debt instruments (e.g. Fixed Vs. Variable).*

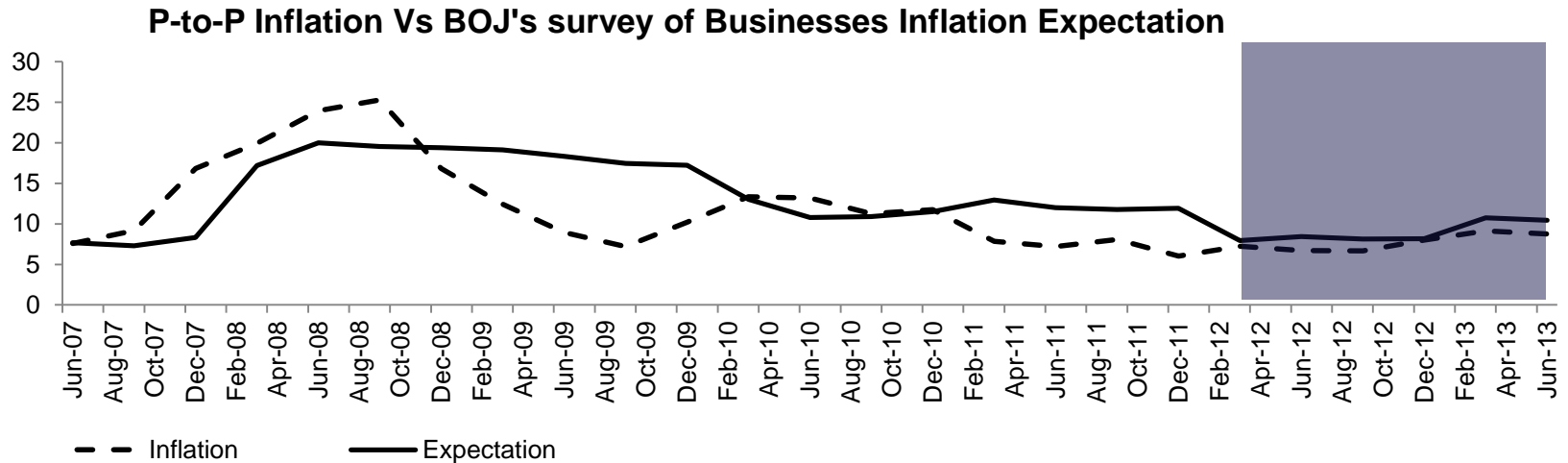
Stylized facts

Annual Point-to-point Inflation



The evolution of inflation in Jamaica over the last two decades can be seen as having gone through 4 distinct time periods as outline above.

Stylized facts



- ❑ During periods of relatively low and stable inflation there has been improvements in business confidence and a convergence between inflation and inflation expectations.
- ❑ This is evident in final period observed of the graph above where the expectations have been converging with actual inflation.
- ❑ This has further served to motivate the papers objective to better understand the formation of businesses' inflation expectations.

Review of Literature

- ❑ Virtually all central banks, including the Bank of Jamaica, conduct some variation of inflation expectations surveys
- ❑ There are currently two surveys on inflation expectations conducted in Jamaica.
 - ❖ *The survey of Business Conditions conducted quarterly by the Jamaica Chamber of Commerce (JCC).*
 - ❖ *Survey of Businesses Inflation Expectation conducted approximately bi-monthly on behalf of the Bank of Jamaica (BOJ).*

Review of Literature

- Deacon and Derry (1994) in critique of survey results have contended that they typically have the following limitations:
 - ❖ *They take time to compile and analyze and therefore may not give current information.*
 - ❖ *Some results have been proven to be irrational.*
 - ❖ *Accuracy is limited by duration and hence they tend to give short term indications.*
 - ❖ *The results of surveys are susceptible to measurement errors.*
 - ❖ *Market participants have little or no incentive to provide accurate information.*

Review of Literature

- ❑ Despite the importance and attention that has been afforded to the topic, the measurement of inflation expectations has proven to be very difficult.
- ❑ Historically there has been generally three empirical approaches taken to measure Expectations.
 - ❖ *The adaptive expectations approach*
 - ❖ *The rational expectations approach and*
 - ❖ *The Market data approach*

Review of Literature

- ❑ These more recent models have sought to utilize market data (particularly financial market data) to estimate inflation expectation.
- ❑ The financial market has the added advantage that it is closely knitted with monetary policy.
- ❑ Deacon and Derry (1994) utilize a financial market analysis to illustrate how United Kingdom gilts can be used to derive estimates of inflation expectations based on the “break even” inflation rate.

Review of Literature

- ❑ This paper utilizes an approach proposed by Patra and Ray (2010).
- ❑ Their paper estimated unbiased and parsimonious model of the actual inflation process and then employed an expanding window approach to generate a time series of expectations for next period inflation.
- ❑ The estimated inflation expectations series was then modelled using a new Keynesian type Phillips curve model which adopts a reduced form equation to determine the major economic variables that assists in explaining movements in inflation expectations.

Methodology

- ❑ The paper firstly sets out to estimate an unbiased and parsimonious measure of inflation expectations.
- ❑ This is done by estimating a model of actual inflation which then utilizes an expanding window to approximate the next period's inflation expectation.
- ❑ In this regard, a Seasonal Autoregressive Moving Average model (SARIMA) was used. The lag structure for the SARIMA model was determined based on AIC and SBC information criterion coupled with an analysis of the auto-correlation function.

Methodology

- Step 1: Estimated inflation over the period January 1985 to December 1999. This estimation resulted in the following model:
 - $\pi_t = \beta_0 AR(1) + \beta_1 MA(1) + \beta_2 MA(2) + \beta_4 SMA(12) + \varepsilon_t$
- Step 2: A recursive expanding window was then utilized to estimate the inflation expectations series over the period January 2000 to June 2013. The series is therefore generated as
 - $\pi_{t+1}^e = \hat{\pi}_{t+1}$

Methodology

- ❑ The estimated inflation expectations series is then modelled using the reduced form equation proposed by Patra and Ray (2010) to determine the major economic variables that assists in explaining movements in inflation expectations.
- ❑ Kiley (2009) added that these models provide a plausible explanation for the dynamics of inflation expectations and have been widely used in the analysis of monetary policy.

Methodology

- The estimated equation takes the following form:

$$\pi_t^e = f$$

$$\left[\begin{array}{c} \sum \pi_{t-i}, \sum g_{t-i}, \sum f_{t-i}, \sum xr_{t-i}, \sum O_{t-i}, \\ \sum C_{t-i}, \sum r_{t-i}, \sum M_{t-i} \end{array} \right] \quad (2)$$

- π_{t-1} = lags of annual inflation
- $(g)_{t-1}$ = lags of GDP gap defined as actual GDP minus trend GDP
- f_{t-i} = lags of annual changes in real fiscal expenditure
- xr_{t-i} = lags of annualized changes in the exchange rate
- O_{t-i} = lags of annual changes in the average crude oil prices
- C_{t-i} = lags of annual changes in the BOJ's grain index
- R_{t-i} = lags of real interest rate (proxied by the 6-month T-bill rate)
- M_{t-i} = lags of annual changes in the real money supply (M1).

Methodology

- ❑ To augment the results of the estimation above the inflation expectations series from the Jamaica Chamber of Commerce (JCC) business confidence survey was also estimated using the same reduced form equation to assess consistency in the results.
- ❑ It should be noted, however, that the survey data have inherent biases, similar to those highlighted in literature.

Results and Analysis

Variable	ADF	PP
Inflation annualized change	-2.6449	-3.5529*
JCC annualized change	-3.8107*	-3.0808*
Estimated inflation expectation	-2.1410	-2.7266**
GDP Gap	-4.6256*	-5.2779*
Real fiscal expenditure annualized change	-2.8519**	-3.7401*
Exchange rate annualized change	-2.1231**	-2.8329**
Average Brent annualized change	-4.1476*	-3.7750*
Grains index annualized change	-3.1718*	-3.5946*
Real interest rate	-2.8426**	-2.9385*
Real M1 annualized change	-4.0737*	-4.6184*

Where * and ** represents significance at the 1% and 5% levels, respectively.

All the variables were found to be $I(0)$ with the exception of annual inflation.

Results and Analysis

- ❑ All the standard tests were conducted on the SARIMA model to ensure proper specification.
- ❑ The auto correlation function suggests that the series exhibit a cyclical pattern hence the seasonal MA term was included in the model.
- ❑ White standard errors were used to control for heteroskedasticity while both the Breusch-Godfrey serial correlation test and an evaluation of the auto-correlation function suggest that there is no serial correlation.
- ❑ The roots of the AR and MA terms were also within the unit circle indicating that the process is stable

Results and Analysis

- ❑ The optimal solution to the reduced form models was selected using a step-wise regression.
- ❑ The models which were also tested to ensure proper specification revealed a number of significant policy sensitive results which are outlined below.

Results and Analysis

Variables	Estimated expectation (Model 1)	JCC expectations (Model 2)
$INFA_{t-i}$	0.9296	0.2343
GAP_{t-i}	(0.0000)	0 .0001
$Fuel_{t-i}$	0.0030	0.0067
$Grain_{t-i}$	0.0090	(0.0553)
R_{t-i}	(0.0003)	(0.0016)
XR_{t-i}	0.0531	0.2320
M_{t-i}	0.0077	0.1050
$Fiscal_{t-i}$	-----	0.1302
$JCCA_{t-i}$	-----	0.7769

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Conclusion and Recommendations

- ❖ The results of the analysis showed that lags of inflation is the largest contributor to inflation expectations.
- ❖ This suggests that proper communication could be the best policy tool to influence expectations .
- ❖ The relationship between international commodity prices creates and avenue for communication.
- ❖ The analysis suggests that BOJ is constrained somewhat in its ability to influence inflation expectation via monetary policy without making large changes to its policy instruments.
- ❖ The results from the model also indicated that expectations respond moderately to movements in the domestic exchange rate.
- ❖ The small and ambiguous coefficient on the output gap suggest that further work could be done in this regard.

Summary

- ❑ The results from this analysis present a solid framework on which to develop an empirical proxy for inflation expectations.
- ❑ In particular, the study creates a reasonably proxy and a platform on which to assess the BOJ's inflation expectations once a sufficient sample size is achieved.

Time Remaining

0

0

:

0

0

:

0

0

Hours

Minutes

Seconds

Suggestions?

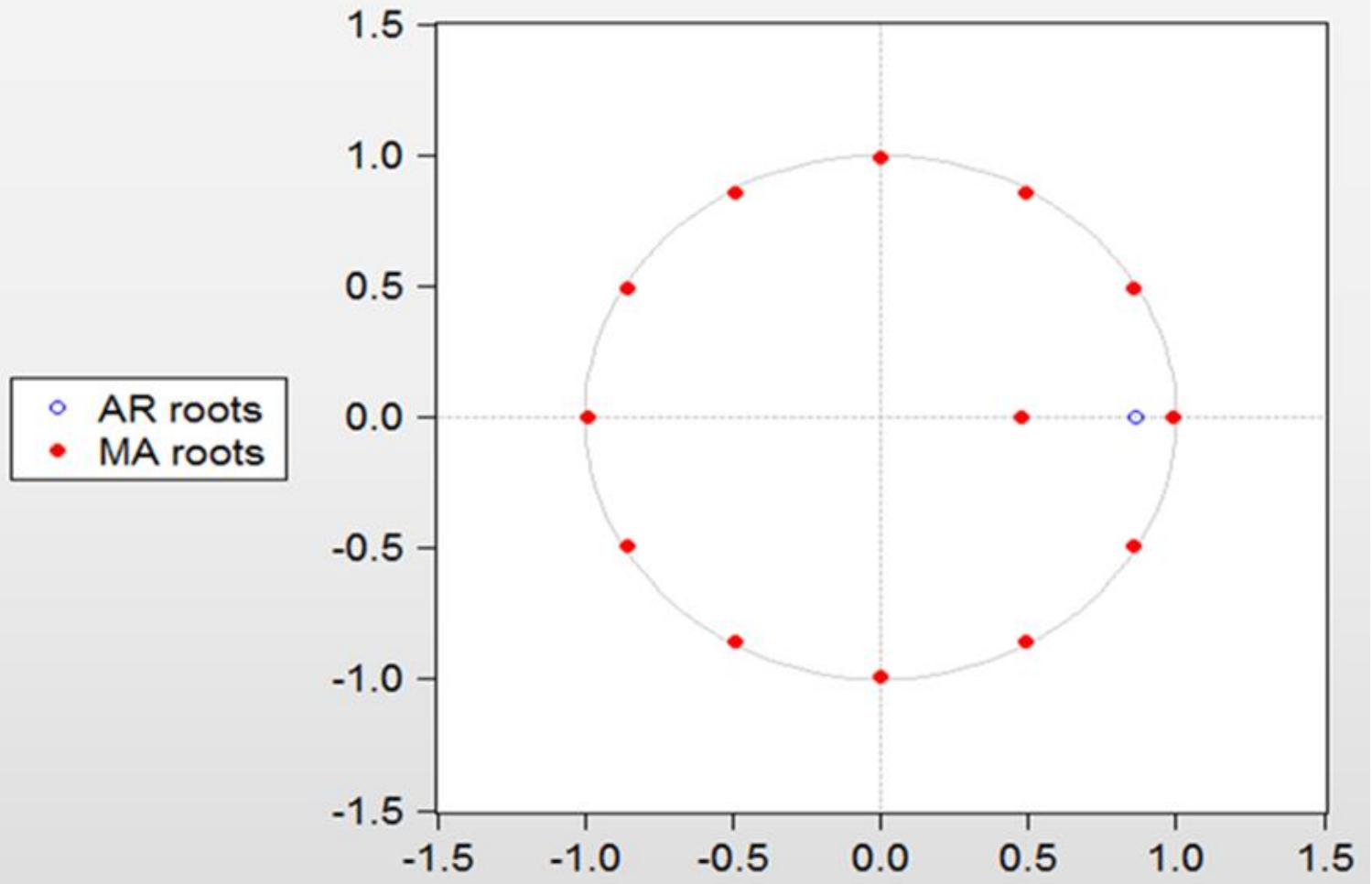
Appendix

Estimated Inflation Expectations Equation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.151059	0.023965	6.303406	0.0000
AR(1)	1.854973	0.048728	38.06775	0.0000
AR(2)	-0.856416	0.048526	-17.64876	0.0000
MA(1)	-0.476833	0.091538	-5.209122	0.0000
SMA(12)	-0.886224	0.025043	-35.38865	0.0000
R-squared	0.988839	Mean dependent var		0.152879
Adjusted R-squared	0.988752	S.D. dependent var		0.111869
S.E. of regression	0.011864	Akaike info criterion		-6.021032
Sum squared resid	0.072774	Schwarz criterion		-5.980249
Log likelihood	1576.489	Hannan-Quinn criter.		-6.005058
F-statistic	11450.95	Durbin-Watson stat		1.895830
Prob(F-statistic)	0.000000			

Appendix

Inverse Roots of AR/MA Polynomial(s)



Appendix

Estimated expectations	
<i>Variables</i>	<i>Coefficients</i>
BRENTA(-6)	-0.004577
BRENTA(-9)	0.007607
C	0.008623
G_IDXA(-5)	0.008999
GDPGAP(-1)	-0.000006
GDPGAP(-2)	0.000005
GDPGAP(-3)	-0.000003
GDPGAP(-7)	-0.000005
GDPGAP(-8)	0.000004
GDPGAP(-9)	-0.000003
INFA(-1)	1.094261
INFA(-4)	-0.084921
INFA(-8)	-0.079700
INT_180(-1)	-0.000265
RM1A(-1)	0.023387
RM1A(-7)	-0.015700
XRA(-3)	0.089601
XRA(-6)	-0.086348
XRA(-9)	0.049864

JCC expectations	
<i>Variables</i>	<i>Coefficients</i>
BRENTA(-1)	0.0457390
BRENTA(-10)	0.0586820
BRENTA(-5)	-0.0976960
G_IDXA(-2)	-0.0552950
GDPGAP(-1)	0.0000312
GDPGAP(-10)	0.0000285
GDPGAP(-4)	0.0000258
GDPGAP(-7)	0.0000325
INFA(-11)	0.6414800
INFA(-3)	0.8260820
INFA(-6)	-1.2332650
INT_180(-10)	-0.0060380
INT_180(-5)	0.0044160
JCCBA(-1)	0.7769380
RFISCA(-1)	0.0867620
RFISCA(-10)	-0.0818980
RFISCA(-7)	-0.1350150
RM1A(-8)	0.1049610
XRA(-10)	0.5427540
XRA(-4)	0.4143380
XRA(-7)	-0.7251060