IS BAD NEWS ABOUT INFLATION GOOD NEWS FOR THE EXCHANGE RATE?

And If So, Can That Tell Us Anything About the Conduct of Monetary Policy?

by

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OUTLINE OF TALK

- A model, a headline, and a curious result.
- It’s all in Dornbusch? No.
- Inflation, Taylor rules and exchange rates.
- What can this say about monetary policy?
- Event study set up.
- Empirical results.

Optimal Monetary Policy in the Open Economy – CGG JME Model

- Two countries, each with staggered price setting and facing ‘cost push’ shocks that generate inflation inertia
- Home and foreign countries producing differentiated traded goods – terms of trade a key relative price
- International spillovers via marginal cost/optimal labor supply channel
- Follow Woodford and derive the central bank welfare function from taste, technology, and market clearing subject to the Calvo pricing constraint

IMPLICATIONS

- Optimal monetary policy in each open economy is a Taylor Rule

$$i = rr + E\pi + b(\pi - \pi^*)$$

- Under optimal policy, Taylor Rule is a function of deep parameters

$$b = \sigma + (1 - \sigma)\gamma\xi(1 - \rho) > 0$$

- Optimal policy features a flexible exchange rate, but the exchange rate itself does not enter the reaction function

- Openness has its effects through the neutral real interest rate and the slope of the forward looking Taylor Rule.

- The nominal exchange rate under optimal policy has a unit root as does the domestic price level and they are cointegrated.

A CURIOUS RESULT

- CGG work out the symmetric, two country Nash equilibrium under central bank discretion
- In this equilibrium, bad news about inflation is good news for the exchange rate.
- That is, a Phillips curve shock that **pushes up** actual (and expected) **inflation** triggers an aggressive rise in nominal and real interest rates that actually causes the **nominal exchange** rate to **appreciate**.
- This is so even though in the long run the nominal exchange rate must depreciate in response to an inflation shock.

TENSION

- Using uncovered interest parity and long run purchasing power parity we have

$$e = -\Sigma_{n=0,T}\, i_n + \Sigma_{n=0,T}\, \pi_n + p_{-1}$$

- In the long run, the exchange rate must depreciate in line with PPP. Along the adjustment path it is depreciating.
- But on impact, it can appreciate if policy is sufficiently tight and/or persistent.

Dollar Rises as U.S. Consumer Inflation Accelerates in February

2005-03-23 08:49 (New York)

By Joshua Krongold and Mark Tannenbaum

March 23 (Bloomberg) -- The dollar rose against the euro after a measure of inflation accelerated last month, bolstering expectations the Federal Reserve will raise its benchmark interest rate at a faster pace.

Not ‘Overshooting’ Phenomenon

- In a Dornbusch style model with a money growth target, will get overshooting to a money supply shock that **pushes up inflation**, but the nominal **exchange rate depreciates** in the short run and the long run.
- Easy to show that in a Dornbusch model with a Phillips curve shock, a shock that **pushes up inflation** can cause the **nominal exchange rate** to **depreciate** in the short run and the long run.
- Intuitively, in a Dornbusch model with a money growth target, the long run PPP anchor tends to make the nominal exchange rate and the price level move in the same direction whether or not the shock is to the money supply or to the Phillips curve.

Inflation Shocks, Taylor Rules, and Nominal Exchange Rates

- Does the insight from CGG (2002) apply more broadly to inflation targeting in an open economy, or is it only true for optimal monetary policy in that specific environment?
- Important to allow for endogenous inflation inertia, given the PPP anchor.
- Important to allow for output gap in Taylor rule.
- What can the correlation between inflation surprises and nominal exchange rates tell us anything about the conduct of monetary policy?

Basic Idea

- The exchange rate is an asset price with reflects present value of fundamentals.
- When central bank follows a Taylor rule, the relevant fundamentals are output gap an inflation , since these variables drive time path of interest rates.
- The effect of a shock on exchange rate depends on how it influences expectations of current and future monetary policy.

Basic Idea

- The model, is simple version of Svensson (2000), and has the property that the equilibrium dynamics are a first order Markov process in the state variables.
- However, the parameters of this process are endogenous functions of the monetary policy rule, the Taylor rule coefficients.
- An equilibrium if it exists is a fixed point in the space of expectations over the stochastic process for interest rates.
- Inflation inertia is endogenous and a function of monetary policy.

The Model

- A small open economy that takes world interest rate and log world price level as given and constant and equal to zero. Four equations.
- Aggregate demand

$$y = - r + (e - p)$$

r equals $i - E\pi_{+1}$ the ex ante real rate

$e - p$ is the log real exchange rate

The Model

- Aggregate supply

$$\pi = \pi_{-1} + y + \varepsilon$$

π is domestic inflation and ε is shock. Inflation inertia.

- Monetary policy (as in CGG (1998))

$$i = E\,\pi_{+1} + b(\pi - \pi^*) + ay$$

when inflation above target or output above potential, central bank seeks to raise the ex ante real interest rate. Allow for goal of stabilizing output gap.

The Model

- Interest Parity

$$e - p = E\,(e_{+1} \;-\; p_{+1}) - r$$

we let $q = e - p$ and note $e = \pi + q + p_{-1}$

- Via interest parity, the log level of the real exchange rate reflects the entire expected time path of monetary policy

$$q = -\,E\,\Sigma_{k=0,\infty}\; r_{+k}$$

Solving the Model

- Could do Blanchard Kahn but more intuition with the 'guess and verify' method: we guess that in the real interest rate process implied by the Taylor rule and the rational expectations equilibrium of the model is Markov

$$\mathrm{E}\, r_{+j} = d^{j} r$$

- If this guess is correct, there is a simple relationship between r and q which for example was exploited by Campbell and Clarida (1987)

$$q = -r / (1 - d)$$

- We note that $\partial q / \partial r = -1 / (1 - d)$ reflecting the fact that the level of the real exchange rate is the present value of the entire future time path of monetary policy via the Taylor rule.

Solving the Model

- Under the guess that E $r_{+j} = d^{j} r$ we can express the process for inflation as

$$\pi = \pi_{-1} - (2 - d)\, b(\pi - \pi^*)/\{(1-d) + a(2-d)\} + \varepsilon$$

- The process for the real interest rate is

$$r = (1 - d)b(\pi - \pi^*)/\{(1-d) + a(2-d)\}$$

- Thus r will be stationary first order Markov if π is stationary first order Markov

Solving the Model

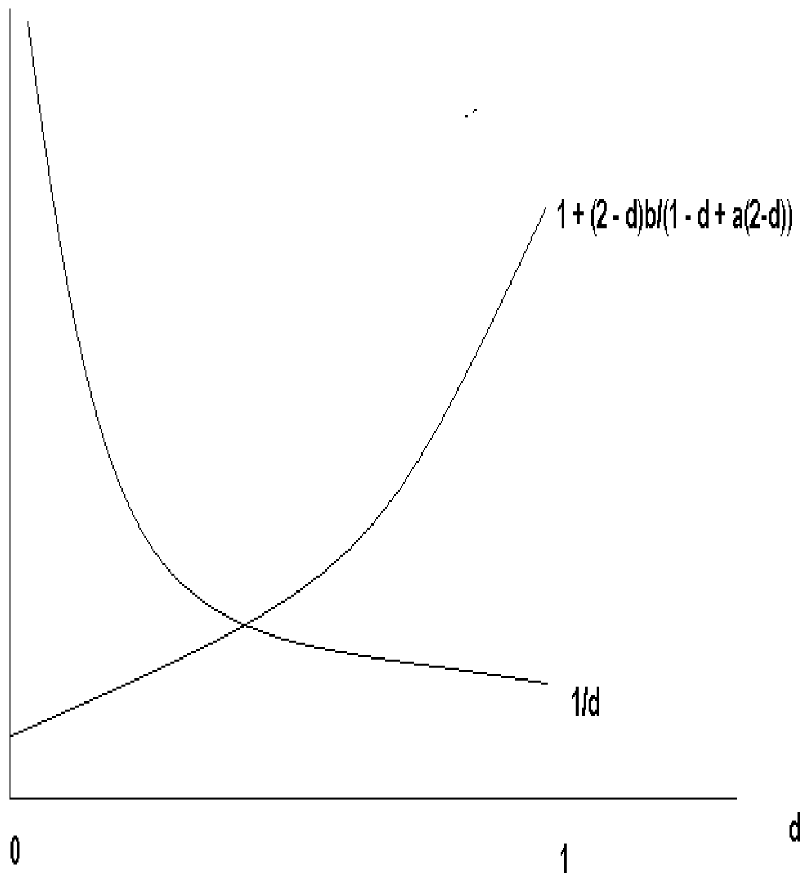
- From inspection, we see that π will be stationary first order Markov if there is a solution $0 < d^*(b, a) < 1$ to the following nonlinear equation

$$(1 + (2 - d^*)\, b/\{(1-d^*) + a(2-d^*)\}) = 1/d^*$$

- A unique rational expectations equilibrium exists.

- The persistence of inflation and thus the interest rate $d^*(b, a)$ is endogenous and is decreasing in b, the Taylor rule coefficient on inflation, and increasing in a, the Taylor coefficient on the output gap.

Existence of Rational Expectations Equilibrium



Some Limiting Cases

- As $b \to 0$, $d(b, a) \to 1$
- As $a \to \infty$, $d(b, a) \to 1$
- As $b \to \infty$, $d(b, a) \to 0$

A Shock to Inflation

- A temporary Phillips curve shock $\varepsilon > 0$ pushes up inflation but by less than the shock. This is because the central bank reacts by pushing up the nominal and the ex ante real interest rate. The real exchange rate appreciates on impact, reflecting expectation of a prolonged period of tight money.

$$q = - E \, \Sigma_{k=0,\infty} \, r_{+k}$$

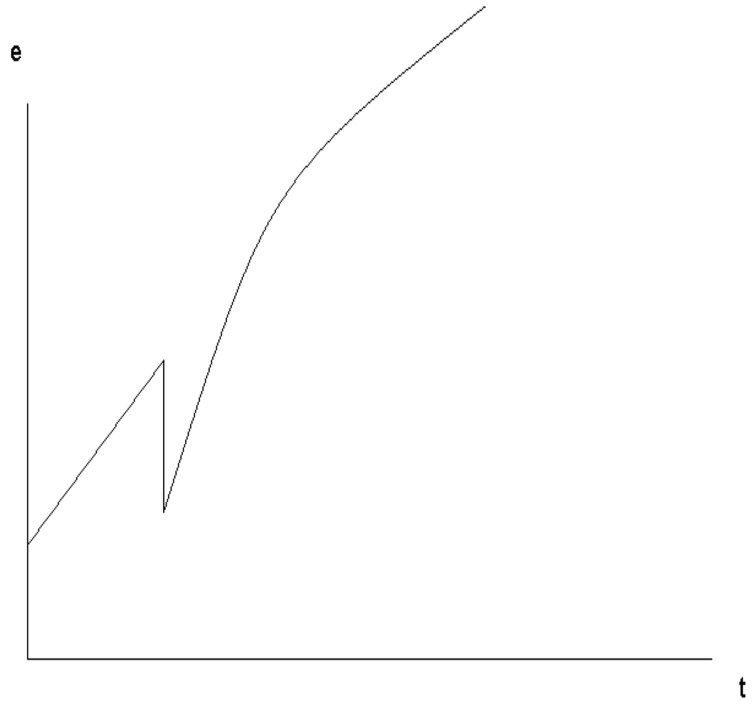
What about the nominal exchange rate?

Exchange Rate Dynamics to Inflation Shock

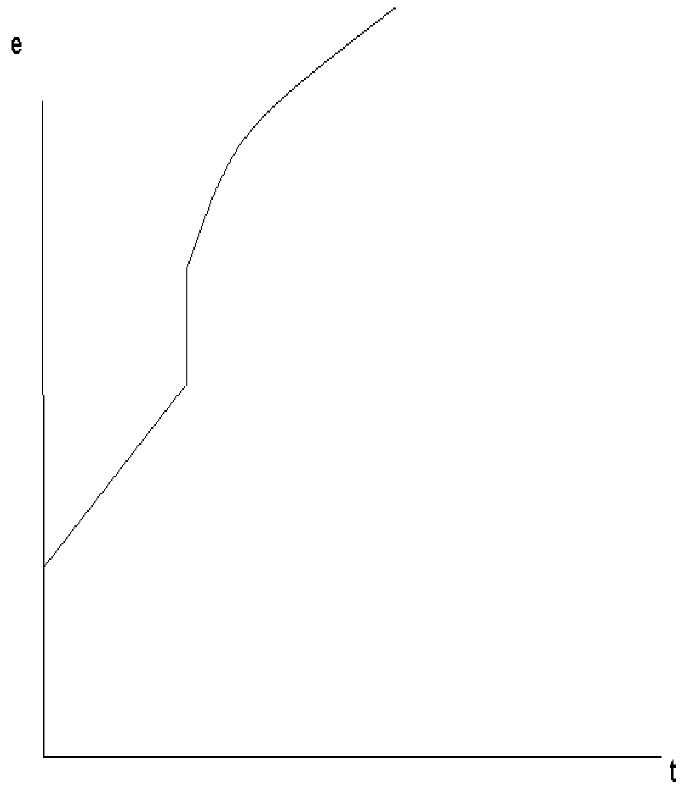
Result: For any given $a \geq 0$, there exists a $b(a)$ such that, for all $b > b(a)$, $\partial e_t / \partial \varepsilon_t < 0$. That is, if the central bank responds sufficiently aggressively to a rise in inflation, the nominal exchange rate *appreciates* on impact in response to an adverse inflation shock. Also $b(0) > 0$.

Along the adjustment path, the nominal exchange rate is depreciating and the nominal interest rate is falling (but remains above the world interest rate).

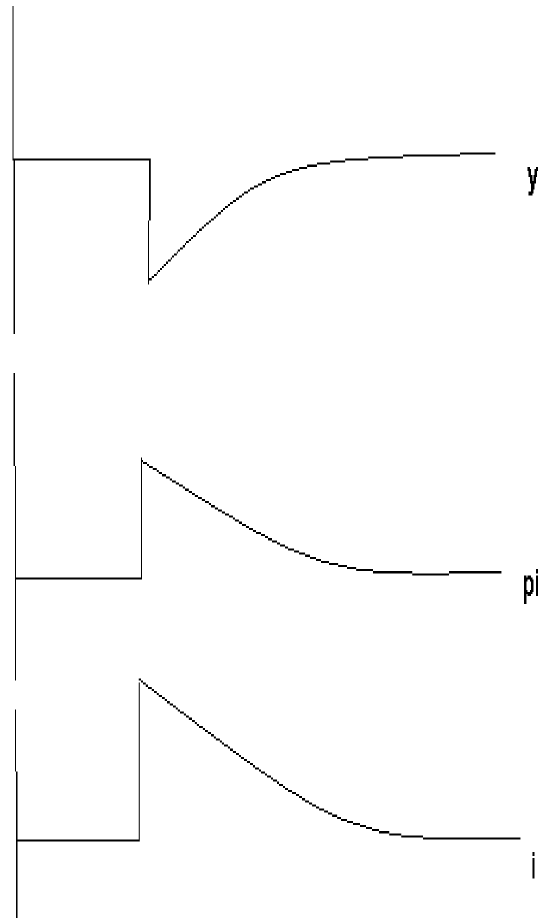
A Shock to Inflation
b > b(a)



Shock to Inflation
b < b(a)



Impulse Response to Inflation Shock



Event Study

- In the data, what is the sign of the correlation between inflation surprises and exchange rate changes?
- Is it significant?
- Is it different for inflation targeters and non-inflation targeters?
- Is it different for headline inflation and core inflation?
- Do regime changes change the sign of the correlation?

Set Up

- Expected inflation from Bloomberg.
- Exchange rate changes around time of inflation announcement from Merrill Lynch and Olsen.
- Sample is monthly from July 2001 to December 2005. Up to 394 total observations for 10 countries and two different measures of inflation, headline and core.
- For UK before independence and Norway before adoption of inflation targeting, expected inflation from MMS.

Table 1: 10-Minute Exchange Rate Returns

	AUD-USD	NZD-USD	EUR-USD
Mean	0.00%	0.00%	0.00%
Standard Deviation	0.07%	0.09%	0.05%
	GBP-USD	**USD-JPY**	**USD-CAD**
Mean	0.00%	0.00%	0.00%
Standard Deviation	0.05%	0.05%	0.05%
	USD-NOK	**USD-SEK**	**USD-CHF**
Mean	0.00%	0.00%	0.00%
Standard Deviation	0.07%	0.07%	0.06%

Table 2: Inflation Surprises

	Canada				UK			
	Headline		Core		Headline		Core	
	MoM	YoY	MoM	YoY	MoM	YoY	MoM	YoY
Mean	-0.04	-0.04	-0.03	-0.01	0.00	-0.01	-0.02	-0.02
Standard Deviation	0.21	0.23	0.15	0.17	0.13	0.15	0.15	0.14

	Norway				Sweden			
	Headline		Core		Headline		Core	
	MoM	YoY	MoM	YoY	MoM	YoY	MoM	YoY
Mean	-0.07	-0.09	-0.09	-0.10	-0.03	-0.05	-0.03	-0.03
Standard Deviation	0.27	0.30	0.22	0.21	0.17	0.17	0.17	0.19

	Japan				US			
	Headline		Core		Headline		Core	
	MoM	YoY	MoM	YoY	MoM	YoY	MoM	YoY
Mean	0.03	0.02	0.02	0.02	-0.01	0.04	0.00	0.00
Standard Deviation	0.13	0.12	0.10	0.08	0.14	0.18	0.10	0.12

	Australia		Euro Area		New Zealand	Switzerland	
	Headline		Headline		Headline	Headline	
	QoQ	YoY	MoM	YoY	QoQ	MoM	YoY
Mean	-0.01	0.00	0.00	0.00	-0.04	-0.03	-0.07
Standard Deviation	0.18	0.19	0.09	0.07	0.16	0.20	0.23

Table 3: All Countries

	Headline		Core	
	MoM	**YoY**	**MoM**	**YoY**
Coefficient	0.2	0.2	0.5	0.5
T- Statistic	5.9	6.2	9.7	9.2
R-Squared	0.08	0.09	0.27	0.25
# Observations	394	387	257	259

Regression method: stacked OLS.
Percentage change in exchange rate resulting from a one percentage point upward surprise in inflation.
Positive coefficient indicates appreciation of domestic currency.
Countries: Australia, Canada, Euro area, Japan, New Zealand, Norway, Sweden, Switzerland, UK, and US.
Data: July 2001- December 2005. Some countries missing observations.

Table 4a: Individual Country Results

	Canada				UK			
	Headline		Core		Headline		Core	
	MoM	YoY	MoM	YoY	MoM	YoY	MoM	YoY
Coefficient	0.07	0.04	0.5	0.2	0.3	0.2	0.3	0.3
T- Statistic								
OLS	1.2	0.8	5.0	3.3	2.9	3.1	3.3	4.0
White	1.4	1.0	6.3	2.8	2.2	2.6	2.8	3.3
Newey-West	1.2	0.9	6.7	2.7	1.9	2.1	2.3	2.7
R-Squared	0.02	0.01	0.47	0.19	0.14	0.16	0.18	0.23
# Observations	54	54	30	50	53	54	50	54

Percentage change in exchange rate resulting from a one percentage point upward surprise in inflation.

Positive coefficient indicates appreciation of domestic currency.

Data: July 2001- December 2005. Number of observations may be less than total months due to missing observations.

White and Newey-West used to correct for potential heteroscedasticity.

Table 4b: Individual Country Results

	Norway				Sweden			
	Headline		Core		Headline		Core	
	MoM	YoY	MoM	YoY	MoM	YoY	MoM	YoY
Coefficient	0.5	0.6	1.3	1.3	0.3	0.2	0.2	0.2
T- Statistic								
OLS	2.8	3.5	7.5	7.7	3.4	3.3	3.1	3.1
White	2.3	2.4	5.7	5.4	3.6	3.0	3.3	3.2
Newey-West	2.0	2.1	6.6	5.7	3.4	3.1	2.9	2.9
R-Squared	0.19	0.27	0.65	0.64	0.23	0.21	0.21	0.20
# Observations	35	35	32	35	41	42	40	42

Percentage change in exchange rate resulting from a one percentage point upward surprise in inflation.

Positive coefficient indicates appreciation of domestic currency.

Data: July 2001- December 2005. Number of observations may be less than total months due to missing observations.

White and Newey-West used to correct for potential heteroscedasticity.

Table 4c: Individual Country Results

	Australia Headline		Euro Area Headline		New Zealand Headline	Switzerland Headline	
	QoQ	YoY	MoM	YoY	QoQ	MoM	YoY
Coefficient	0.1	0.1	0.1	0.1	0.7	0.1	0.1
T- Statistic							
OLS	1.0	1.1	1.1	0.9	3.0	2.9	3.1
White	1.0	1.1	1.2	1.0	3.3	2.7	3.0
Newey-West	1.1	1.2	1.1	1.2	3.2	2.7	3.4
R-Squared	0.06	0.08	0.02	0.02	0.38	0.16	0.16
# Observations	18	17	54	54	17	48	53

Percentage change in exchange rate resulting from a one percentage point upward surprise in inflation.

Positive coefficient indicates appreciation of domestic currency.

Data: July 2001- December 2005. Number of observations may be less than total months due to missing observations.

White and Newey-West used to correct for potential heteroscedasticity.

Table 4d: Individual Country Results

	Japan				US			
	Headline		Core		Headline		Core	
	MoM	YoY	MoM	YoY	MoM	YoY	MoM	YoY
Coefficient	0.07	0.1	0.07	0.07	-0.1	-0.2	0.1	0.2
T- Statistic								
OLS	1.4	1.8	1.0	0.7	-0.4	-1.1	0.9	0.7
White	1.2	1.9	0.8	0.7	-0.4	-1.1	0.9	0.7
Newey-West	1.3	1.6	0.7	0.7	-0.4	-1.2	0.9	0.8
R-Squared	0.04	0.06	0.02	0.01	0.00	0.05	0.01	0.02
# Observations	54	54	51	52	54	25	54	25

Percentage change in exchange rate resulting from a one percentage point upward surprise in inflation.

Positive coefficient indicates appreciation of domestic currency.

Data: July 2001- December 2005. Number of observations may be less than total months due to missing observations.

White and Newey-West used to correct for potential heteroscedasticity.

Table 5: Inflation Targeters versus Non-Inflation Targeters

	Inflation Targeters				Non-Inflation Targeters			
	Headline		Core		Headline		Core	
	MoM	YoY	MoM	YoY	MoM	YoY	MoM	YoY
Coefficient	0.3	0.2	0.6	0.5	0.01	-0.08	0.1	0.1
T- Statistic	6.1	6.7	9.4	8.9	0.2	-0.8	1.3	1.1
R-Squared	0.11	0.13	0.37	0.31	0.00	0.01	0.02	0.02
# Observations	286	310	152	182	108	77	105	77

Regression method: stacked OLS.

Percentage change in exchange rate resulting from a one percentage point upward surprise in inflation.

Positive coefficient indicates appreciation of domestic currency.

Inflation targeters includes: Australia, Canada, Euro area, New Zealand, Norway, Sweden, Switzerland, and UK.

Non-inflation targeters includes: Japan and US.

Data: July 2001- December 2005. Number of observations may be less than total months due to missing observations.

Table 6: Norway and UK Pre-Inflation Targeting/Independence

	UK			Norway
	Headline		Core	Headline
	MoM	YoY	YoY	YoY
Coefficient	0.00006	-0.0005	-0.0006	-0.0008
T- Statistic				
OLS	0.1	-0.5	-0.7	-1.0
White	0.1	-0.7	-0.8	-1.6
Newey-West	0.1	-1.1	-1.4	-1.6
R-Squared	0.00	0.01	0.01	0.02
# Observations	46	46	46	40

Percentage change in exchange rate resulting from a one percentage point upward surprise in inflation.

Positive coefficient indicates appreciation of domestic currency.

Dates: Norway: August 1997- December 2000. UK: March 1993- December 1996.

Number of observations may be less than total months due to missing observations.

Table 7: Good News versus Bad News

	Headline				Core			
	MoM		YoY		MoM		YoY	
	Positive	Negative	Positive	Negative	Positive	Negative	Positive	Negative
Coefficient	0.1	0.3	0.1	0.3	0.4	0.6	0.3	0.6
T- Statistic	2.4	5.1	2.5	5.4	4.9	7.1	4.1	7.2
# Observations	126	164	113	169	80	98	83	102

Regression method: stacked OLS.

Percentage change in exchange rate resulting from a one percentage point upward surprise in inflation.

Positive coefficient indicates appreciation of domestic currency.

Countries: Australia, Canada, Euro area, Japan, New Zealand, Norway, Sweden, Switzerland, UK, and US.

Data: July 2001- December 2005. Number of observations may be less than total months due to missing observations.

Positive indicates inflation higher than expected - bad news.

Negative indicates inflation lower than expected - good news.