Lack of Credibility, Inflation Persistence and Disinflation in Colombia

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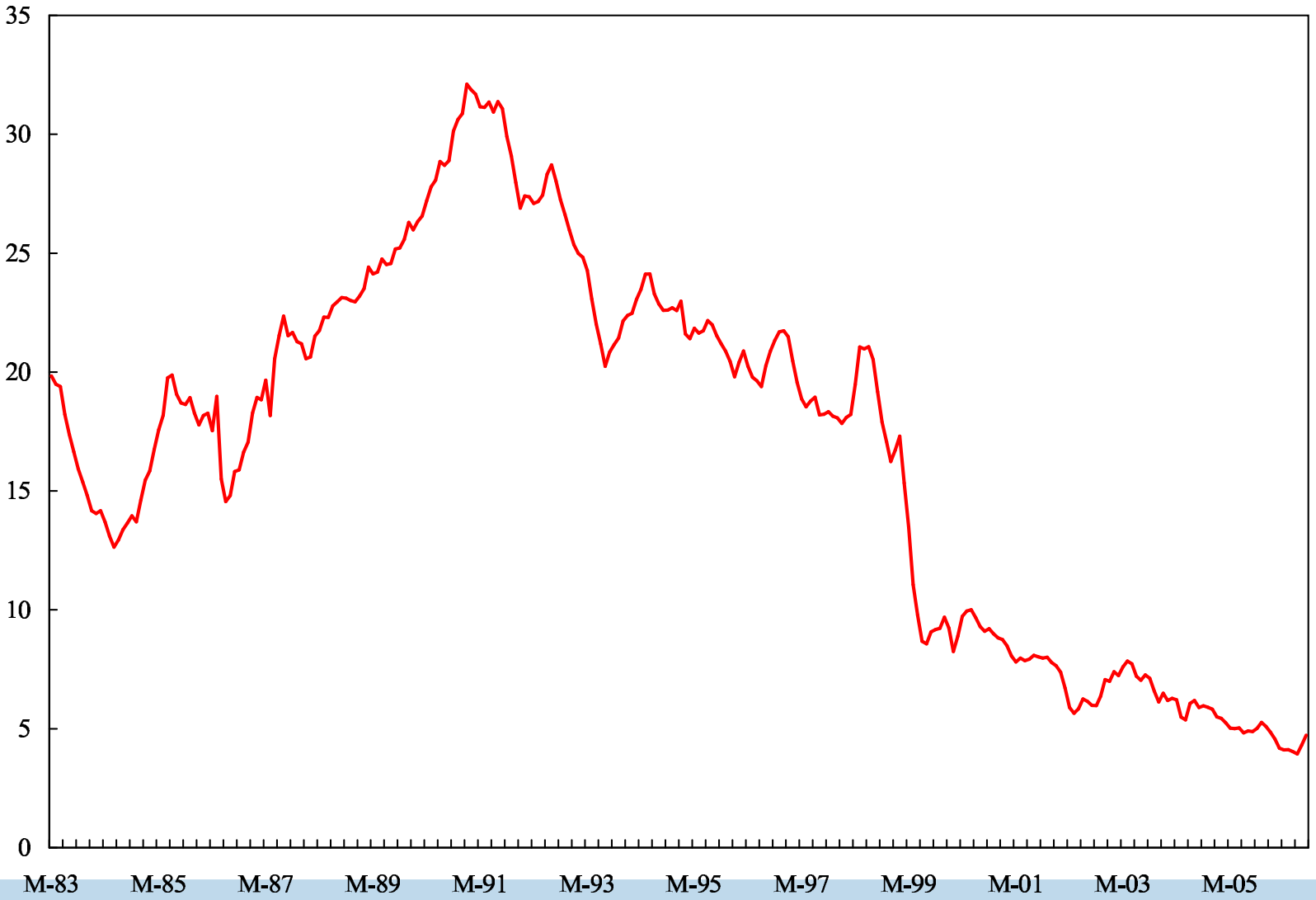
Introduction

Colombia: A low disinflation process.



Gradually the Central Bank has gained credibility.

Year	Inflation (1)	Expectation (2)	Target (3)	Mistake (1)-(3)	Surprise (1)-(2)	Anchoring (2)-(3)	Credibility
1997	17.68	18.45	18.00	-0.32	-0.77	0.45	
1998	16.70	17.95	16.00	0.70	-1.25	1.95	
1999	9.23	15.79	15.00	-5.77	-6.56	0.79	
2000	8.75	9.89	10.00	-1.25	-1.14	-0.11	33.00
2001	7.64	8.85	8.00	-0.36	-1.21	0.85	46.90
2002	6.99	6.95	6.00	0.99	0.04	0.95	35.00
2003	6.49	6.58	5.50	0.99	-0.09	1.08	42.00
2004	5.50	6.13	5.50	0.00	-0.64	0.63	69.10
2005	4.85	5.41	5.00	-0.15	-0.56	0.41	77.80
2006	4.19	4.60	4.50	-0.41	-0.31	0.10	90.10

At the same time inflation persistence has fallen.

In this paper we try to address the following questions:

- What is the nature and the degree of inflation persistence in Colombia?
- How important is lack credibility on monetary policy on explaining it?
- How does this explanation compare to other explanations, for example: *ad hoc* price indexation?
- Given the estimated degree of credibility and the current level of inflation, what is the sacrifice ratio of achieving the long run target?

Measuring inflation persistence

Measures of inflation persistence

- Measuring inflation persistence is controversial.
- We measure inflation persistence based on a time varying mean.
- Usually, inflation persistence is measured as sum of the autoregressive coefficients in a linear model that allows for breaks in mean - Bai and Perron (1998), Altissimo and Corradi (2003).
- We consider a smooth trend rather than an abrupt one.

Empirical model

To characterize the evolving changes in the mean of inflation, we use the following model

$$\pi_t = \mu_t + x_t$$
$$x_t = \rho x_{t-1} + \nu_{3t}$$
$$\mu_t = \beta_{t-1} + \mu_{t-1} + \nu_{1t}$$
$$\beta_t = \beta_{t-1} + \nu_{2t}$$

with $\nu_{it} \sim N(0, \sigma^2_{\nu_i})$, $i = 1, 2, 3$ and $\mathrm{E}[\nu_{it}\nu_{js}] = 0$ for $i \neq j$ and $t \neq s$.

- Parameter $\rho \in (-1, 1)$ is our persistence measure.
- Trend and persistence are modelled simultaneously rather than sequentially.

Estimated persistence for the different inflation rates

	π_{IPC}	π_{IPCSA}	π_{IPCT}	π_{IPCNT}	π_{IPCR}	π_{IPCB}
$\hat{\rho}$	0.40	0.67	0.86	0.09	0.86	0.91

- Inflation Measures: Total CPI, CPI excluding food, Traded and non traded CPI, Regulated CPI and Core CPI.
- All measures of inflation display a significant amount of persistence.
- The exception is non traded inflation.
- How important is lack of credibility in explaining inflation persistence?

The model

Main equations

A standard NKM with imperfect information -as in Erceg and Levin (2003). Agents observe the inflation target, but have to learn about its permanent and transitory components.

Phillips curve

$$\pi_t = \beta E_t \pi_{t+1} + \lambda x_t + u_t \tag{1}$$

IS curve

$$y_t = E_t y_{t+1} + \sigma \left(r_t + E_t \pi_{t+1} + E_t g_{t+1} - g_t \right) \tag{2}$$

Monetary policy rule

$$i_t = \gamma_i i_{t-1} + (1 - \gamma_i) \left[\gamma_\pi \left(\pi_t - \overline{\pi}_t \right) + \gamma_x y_t \right] + z_t \tag{3}$$

Imperfect Information

$$u_t = \beta \left(E_t \pi_{t+1} - \widehat{\pi}_{t+1} \right) \tag{4}$$

Key result

Erceg and Levin (2003) show that u_t can be written as:

$$u_t = (1-\kappa)u_{t-1} + (1-\kappa)\eta\epsilon_t^p$$

where κ is the speed at which agents learn to distinguish between the two components of the target.

We use this model to think about inflation persistence:

- κ determines the degree of expectations-driven persistence
- β determines degree of intrinsic persistence
- λ, the elasticity of the NKPC, determines the degree of extrinsic persistence

Model estimation

The Bayesian method

We follow the estimation method proposed by Schorfheide (2000) that consist on the following steps

1. For a given set of parameters we solve the model using Klein (2000) method to find the state transition equation.
2. The state-space representation is completed by adding a measurment equation to the model dynamics.
3. The next step consists on computing the likelihood through Kalman filtering and to combine it with the prior distribution of the parameters to get the posterior density.
4. Posterior draws are obtained using the random walk Metropolis-Hastings algorithm as described in Schorfheide (2000).
5. This procedure is implemented in Dynare.

Data

We use quarterly HP-detrended data from 1987:1 to 2005:4. We could also use our filtered measure.

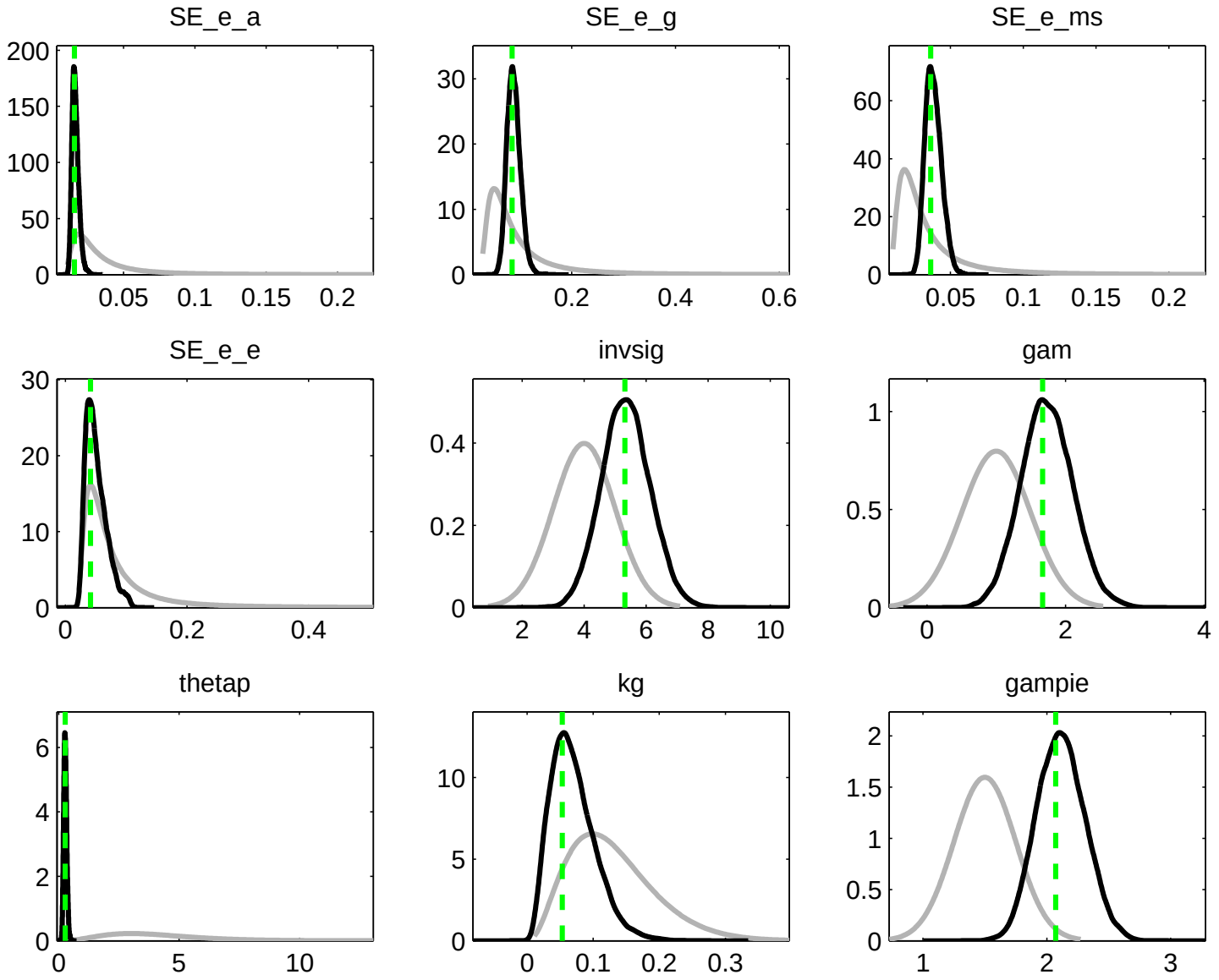
1. As a proxy of the nominal interest rate we use the interest rate on 90-day certificates of deposits.
2. Our inflation measure is the quarterly (annualized) growth rate of the CPI.
3. Output is measured as the real GDP
4. Real wages are the median of the real wage per hour of wage earners who work 40 hours or more per week

Some Key Priors

- A strong prior: $\beta = 0{,}98$. There is no capital accumulation in the model.
- $\frac{1}{1-\theta}$ set to be between 1 and 8 quarters with 95 percent probability (using a Gamma distribution). Prior mean set at 4 quaters (a strong prior in the literature).
- κ set to be between 0.03 and 0.3 with 95 percent probability. Prior mean set at 0.13 corresponding to US estimate (using a Beta distribution).
- Policy rule priors set according to Taylor's original values for the US.

Results

Prior and Posterior Distributions of Imperfect Credibility Model



Some prior and posterior parameters of Imperfect Credibility Model

		Prior		Posterior		
Parameter	Distribution	mean	Std Dev	Mean	Conf. Interval	
$\frac{1}{1-\theta}$	Gamma	4	2	0.27	0.17	0.37
κ	Beta	0.13	0.0650	0.07	0.02	0.12
γ	Normal	1	0.5	1.74	1.11	2.34
$\frac{1}{\sigma}$	Normal	4	1	5.34	4.07	6.63
γ_s	Uniform [0,1)	0.5	0.2887	0.24	0.06	0.40
γ_π	Normal	1.5	0.25	2.12	1.80	2.43
γ_y	Normal	0.125	0.125	0.06	-0.13	0.25

Some prior and posterior parameters of NKM with indexation

		Prior		Posterior		
Parameter	Distribution	Mean	Std Dev	Mean	Conf. Interval	
$\frac{1}{1-\theta}$	Gamma	4	2	0.85	0.57	1.10
β	Beta	0.98	0.01	0.98	0.97	0.99
γ	Normal	1	0.5	1.75	1.05	2.40
$\frac{1}{\sigma}$	Normal	4	1	5.92	4.66	7.17
γ_s	Uniform [0,1)	0.5	0.2887	0.51	0.42	0.61
γ_π	Normal	1.5	0.25	1.66	1.32	2.00
γ_y	Normal	0.125	0.125	0.20	0.00	0.38

Model Comparison

- We compare the imperfect information model against the NKM with *ad hoc* indexation using the posterior odds ratio test.
- The posterior odds ratio is the ratio of the marginal likelihoods:

$$F_{p,i} = \frac{p\left(Y_T \left| \mathcal{M}_p \right.\right)}{p\left(Y_T \left| \mathcal{M}_i \right.\right)}$$

- We get $p\left(Y_T \left| \mathcal{M}_p \right.\right) = 522{,}06$ and $p\left(Y_T \left| \mathcal{M}_i \right.\right) = 646{,}77$ implying a Bayes factor of $F_{p,i} = 0{,}81$.
- The odds are in favor of the imperfect credibility model.
- Imperfect information induces expectations-driven inflation persistence and reduces the degree of price stickiness (extrinsic persistence).

Disinflation Cost

We compute the cost of disinflating from 4 percent to 3 percent, the long run inflation target set by the Banco de la República.

Cuadro 1: Disinflation Costs and Monetary Policy Effort (bps).

β	0.96	0.97	0.98	0.99
Sacrifice Ratio	191	200	209	219
Policy Effort	135	141	148	155

In the benchmark model this means the present value of a 10 year disinflation of 100 basis points translates in an output loss of 200 basis points and is associated with a policy effort of 150 basis points on interest rates.

Final remarks

Conclusions

In this paper we provide the following answers to the initial questions:

- The high degree of inflation persistence in Colombia can be characterized by a model in which agents learn to decouple permanent from transitory shocks. Our findings suggest that this process is slow.
- We provide evidence that this model outperforms a conventional NKM with *ad hoc* price indexation.
- Lack of credibility on monetary policy plays an important role on explaining part of the expectations-driven persistence, and reduces the importance of extrinsic persistence.
- We estimate that the sacrifice ratio of reducing inflation from 4 percent to 3 percent is about 200 basis points of output.