



Inflation Expectations Measurement and its Effect on Inflation Dynamics in Colombia

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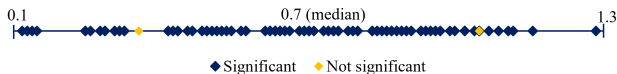
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The Importance of Measuring Expectations

- NKPC estimates for inflation expectations (1949-2016)¹:



- Central banks in EME's rely on an increasing number of measures of inflation expectations for policy analysis (Sousa & Yetman, 2016).
- Excessive policy shocks resulting from assessments based on measures that overestimate the effect of expectations might create unnecessary contractions in economic activity and even generate financial risks.

¹We examined 19 studies reporting a total of 121 estimates for inflation expectations.



About this Study

- **Objective:** determine whether the effect of expectations on inflation dynamics in Colombia depends on the measurement of this variable.
- **Approach:** we estimate NKPC measuring expectations with data from financial markets, economic surveys, and macroeconomic models.
- **Result:** a one percentage point (p.p.) increment in expectations leads to a median increase in inflation of:
 - 0.96 p.p. for financial market expectations
 - 0.78 p.p. for economic survey expectations
 - 0.50 p.p. for macroeconomic model expectations



Measures of Inflation Expectations²

1. Breakeven Inflation Rate (**BEI**)

- Difference between yields of nominal and inflation indexed bonds with equivalent maturities.

2. Quarterly Survey of Economic Expectations (**QSEE**)

- Survey conducted by the CBoC where respondents provide forecasts for macroeconomic variables of interest.

3. Macro Models (**4GM**)

- Semi-structural economic model that reflects key features of the Colombian economy and supports monetary policy analysis at the CBoC.

²The measures of inflation expectations consist of one-year-ahead expectations.



Strengths/Limitations

1. Financial Markets

- Compensation scheme of inflation-protected securities favors forecast precision.
- Separating market expectations from other factors that affect yield curves.

2. Economic Surveys

- Reliable when markets for inflation-protected securities are underdeveloped or exhibit significant liquidity risk.
- Biases from certain sectors hinders effectiveness in reflecting aggregate changes in expectations.

3. Macroeconomic Models

- Based on economic theory and systematic empirical relationships, facilitating the analysis of fundamental drivers of inflation.
- Bounded by model specifications and assumptions, limiting their ability to reflect changes in factors that affect inflation.

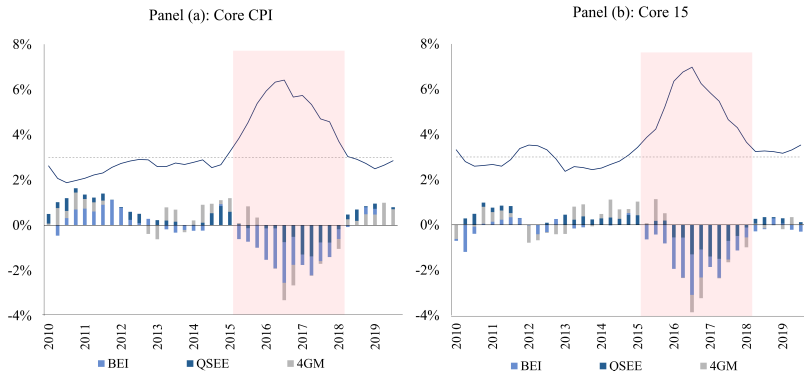


Data

- The data for inflation corresponds to annualized variation in two measures of core inflation.
 - **Core CPI:** excludes food and energy prices from the CPI.
 - **Core 15:** excludes the 15% most volatile prices from the CPI each period using the RMSE as criterion for this procedure.
- These measures include goods and services that collectively represent 68% (Core CPI) and 88% (Core 15), respectively, of the overall CPI in Colombia.



Deviations of Expectations from Core Inflation



Forecast errors averaged one percentage point with major disagreements arising during episodes of elevated inflation.



Empirical Strategy

- We examine inflation dynamics using the hybrid NKPC:

$$\pi_t = \gamma_b \pi_{t-1} + \gamma_f E_t \pi_{t+1} + \lambda x_t + \epsilon_t$$

- Our estimations employ the GMM:
 - Mitigates endogeneity that arises from measurement error or reverse causality.
 - Instruments for expectations: 2-6 lags of inflation, the output gap, and interest rates.
- We checked the robustness of our results using the output gap and real marginal costs as alternative measures of real economic activity.



Specification checks

- We checked the validity of instruments using Hansen's Over-Identification (OI) Test:
 - Null hypothesis: there is no correlation between regressors and the error term.
- We analyzed the goodness-of-fit of our estimations by comparing the r-squared and RMSE.
- We examined forecast precision through Fisher's Test (FT) and Pesaran-Timmerman's (PT) Test:
 - FT null: expectations and inflation series are not co-integrated.
 - PT null: sign of changes in expectations corresponds to the sign of changes in inflation.



Specification Checks (2)

	(1)	(2)	(3)	(4)	(5)	(6)
BEI	95.8%	0.936	0.334	0.000	0.000	115
QSEE	90.0%	0.952	0.265	0.000	0.000	108
4GM	98.3%	0.961	0.261	0.000	0.000	118
Mean/Total	94.7%	0.952	0.286	0.000	0.000	341

(1) Specifications that fail to reject null hypothesis in Hansen's OI test

(2) Median r-squared

(3) Median RMSE

(4) p-value FT test

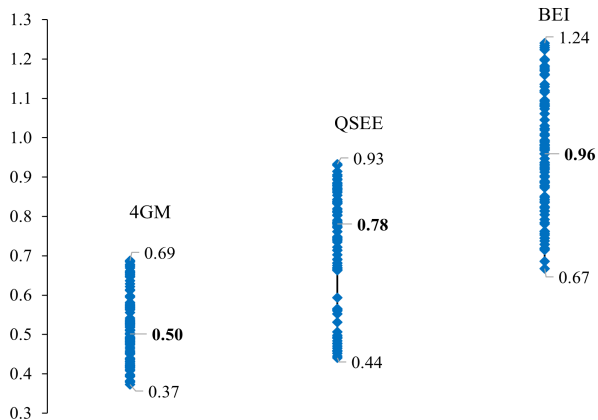
(5) p-value PT test

(6) Specifications with valid instruments

Most empirical specifications used valid instruments, attained high explanatory capacity, and exhibited equivalent forecast precision.



NKPC Estimates of Inflation Expectations in Colombia (2010-2019)



The effect of expectations on inflation dynamics in Colombia depends on their measurement.



Possible Explanations

1. Asymmetric Losses from Forecasting Errors
2. Differences in Forecasting Costs
3. Lags in Information Updates
4. Modelling Limitations



Asymmetric Losses from Forecasting Errors

- Financial market participants have “skin in the game”:

$$\uparrow \pi^e = \uparrow i - r$$

- Given that higher than anticipated inflation can result in negative real returns, these agents bear a higher cost of underpredicting inflation.
- To hedge against inflationary risk, investors overshoot their expectations (Capistran & Timmermann, 2009).



Differences in Forecasting Costs

- When selecting forecasting methods not all agents face the same cost, with specialized predictors demanding more resources (Brock and Hommes, 1997):
- These cost differences prompt agents to select distinct forecasting methods (Branch, 2004).
 - Formation of expectations in Colombia consists of a mix between adaptive and rational expectations (Huertas et al., 2015).



Lags in Information Updates

- Disagreements could be explained by staggered information updates about future economic activity, such that certain agents employ outdated information when forming expectations (Mankiw et al., 2003).
 - Professional forecasters constantly monitor and update their expectations based on macroeconomic developments (Sousa & Yetman, 2016).
 - Less sophisticated agents gradually acquire information from specialized forecasters by reading news reports (Carroll, 2003).



Modelling Limitations

- Model-based expectations are bounded by model specifications and assumptions derived from economic theory and systematic empirical relationships.
- Climate-related shocks do not affect relative prices in the 4GM model, limiting the sensitivity of model expectations to shocks that affect other measures.



Main Takeaways

- The effect of expectations on inflation dynamics in Colombia varies according to the measurement of this variable.
- Financial market measures exhibit greater effects on inflation relative to expectations from economic surveys and macroeconomic models.
- Our findings are consistent with the empirical evidence regarding NKPC estimations and our results are robust to the use of alternative measures of core inflation, real economic activity, and instrumental variables.



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