

Brazilian Inflation Expectations Rationality: Pre-COVID Analysis (2017-2020)

Brazilian REH Analyzer v2.0.0

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1 Executive Summary

Analysis Overview

Rational Expectations Hypothesis: FAIL

Analysis Period: 2017-01-02 to 2019-02-28

Observations: 541

Mean Forecast Bias: -3.795 p.p.

Bias Severity: Extreme (Overestimation)

2 Comprehensive Descriptive Statistics

Table 1: Comprehensive Statistical Summary

Statistic	Forecast (%)	Realized (%)	Error (p.p.)
Mean	4.114	0.319	-3.795
Median	4.050	0.250	-3.730
Std. Deviation	0.355	0.331	0.538
Minimum	3.190	-0.210	-4.800
Maximum	4.820	1.260	-2.040
Skewness	0.096	1.243	0.465
Kurtosis	-0.894	1.629	-0.027
Observations	541	541	541

3 Rationality Test Results

Table 2: REH Test Results Summary

Test	Result	Implication
Unbiasedness	FAIL	Systematic bias
Mincer-Zarnowitz	FAIL	Forecast efficiency
Efficiency	FAIL	Information usage
Overall REH	FAIL	Rational expectations

4 Mincer-Zarnowitz Regression Analysis

The Mincer-Zarnowitz regression tests the null hypothesis of rational expectations:

$$P_t = \alpha + \beta \cdot E_{t-12}[P_t] + \varepsilon_t \quad (1)$$

where $H_0 : (\alpha, \beta) = (0, 1)$ under rational expectations.

Table 3: Mincer-Zarnowitz Regression Results

Parameter	Estimate	Std. Error	t-stat	p-value	95% CI
α (Intercept)	1.208	0.000	7.49	0.0000	[0.891, 1.525]
β (Slope)	-0.216	0.000	-5.53	0.0000	[-0.293, -0.139]

Model Diagnostics: $R^2 = 0.0537$, Joint F-statistic = 38096.68 (p = 0.000000)

4.1 Economic Interpretation

- $\alpha = 1.208 \neq 0$: Systematic forecast bias detected
- $\beta = -0.216 \neq 1$: Forecasters under-respond to their predictions
- Joint test rejection indicates violations of both unbiasedness and efficiency

5 Structural Break Analysis

Table 4: Sub-period Analysis Results

Period	Start	End	Mean Error	REH Status
Period 1	2017-01-02	2017-09-19	-4.107	FAIL
Period 2	2017-09-20	2018-06-12	-3.682	FAIL
Period 3	2018-06-13	2019-02-28	-3.598	FAIL

5.1 Structural Break Interpretation

- Forecast bias ranges from -4.107 to -3.598 p.p. across sub-periods
- Total bias variation: 0.508 p.p.

6 Economic Interpretation

6.1 Quantitative Bias Assessment

Table 5: Enhanced Bias Analysis

Metric	Value	Assessment
Direction	Overestimation	–
Magnitude	3.795 p.p.	Extreme
Grade Category	F	High Impact
Bias Ratio	7.05	High Dominance
Systematic Component	99.0%	of Total Error

6.2 Quantitative Efficiency Assessment

Table 6: Enhanced Efficiency Analysis		
Metric	Value	Assessment
Ljung-Box Statistic	3925.3	Low
LB p-value	1.0000	Not Significant
Efficiency Score	50.0/100	Poor
Predictability Index	39.25	High Predictability
Information Processing	Poor	Quality Assessment

6.3 Enhanced Mincer-Zarnowitz Coefficient Analysis

Alpha Coefficient Interpretation:

$\alpha = 1.208$ (95% CI: [0.000, 0.000])
large systematic over-prediction of 1.208 percentage points

Beta Coefficient Interpretation:

$\beta = -0.216$ (95% CI: [0.000, 0.000])
forecasters systematically move opposite to reality ($\beta = -0.216$), indicating severe misinterpretation

Rationality Plausibility Assessment:

$\alpha = 0$ plausible: Yes
 $\beta = 1$ plausible: No
 Joint rationality plausible: No

6.4 Comprehensive Assessment Dashboard

Table 7: Comprehensive Quality Assessment		
Assessment Dimension	Value	Category
Overall Quality Score	24.6/100	Very Poor
Root Mean Square Error	3.833 p.p.	Accuracy Measure
Mean Absolute Error	3.795 p.p.	Precision Measure
R-Squared	0.054	5.4% Explained
REH Compatibility	REJECTED	Weak Evidence

6.5 Policy Scenario Analysis

Following 2024 central bank forecasting standards (Bernanke Review), we present scenario-based assessments:

Current Persistence (Probability: 70%):
Bias and inefficiencies persist at current levels
 Expected MAE: 3.99 p.p., Priority: Immediate Intervention Required

Gradual Improvement (Probability: 20%):
Forecasting quality improves over 2-3 years
 Expected MAE: 2.66 p.p., Priority: Supportive Measures

Deterioration (Probability: 10%):
Forecasting quality deteriorates further
 Expected MAE: 4.93 p.p., Priority: Crisis Intervention

6.6 Key Quantitative Insights

- Bias magnitude: 3.80 percentage points
- Efficiency loss: 94.6% of variation unexplained
- Predictable error component: 97.5% of total error

7 Enhanced Policy Implications

Following 2024 forecast evaluation standards with quantitative evidence-based recommendations.

7.1 For Central Bank Policymakers

Quantitative Evidence-Based Recommendations:

- **QUANTIFIED BIAS:** Systematic overestimation of 3.80 percentage points requires immediate attention
- **EFFICIENCY TARGET:** Current autocorrelation statistic of 3925 needs reduction to <20 for acceptable efficiency
- **QUALITY SCORE:** Current forecast quality score of 24.6/100 indicates urgent intervention required
- **CRITICAL:** Negative β coefficient (-0.216) indicates forecasters systematically misinterpret central bank signals
- α coefficient of 1.208 indicates 121 basis points of predictable bias
- Address systematic bias of 3.80 p.p. through enhanced communication
- Target efficiency improvements to reduce autocorrelation from 3925
- Implement forecaster training programs

Specific Performance Targets:

- Reduce systematic bias from 3.80 to <2.66 percentage points within 24 months
- Improve efficiency from current LB statistic of 3925 to <20 within 18 months

7.2 For Market Participants

Quantified Market Opportunities:

- **ARBITRAGE OPPORTUNITY:** Predictable bias of 3.80 p.p. offers systematic profit potential
- **ERROR PREDICTABILITY:** 97.5
- **RISK ASSESSMENT:** Quality score of 24.6/100 suggests high uncertainty in market-based expectations

Risk-Return Assessment:

- Strategy Risk Level: High (Quality Score: 24.6/100)
- Expected Volatility: 3.83 percentage points RMSE
- **WARNING:** Very poor forecast quality increases strategy risk

7.3 For Researchers

Research Priorities with Statistical Evidence:

- **PERSISTENCE:** REH violations documented over 2.2-year period with consistent patterns
- **MODEL SPECIFICATION:** R^2 of 3.833 suggests -283.3
- **ALTERNATIVE MODELS:** Evidence strongly supports adaptive expectations framework

Model Development Priorities:

- **URGENT:** Investigate counter-intuitive negative β coefficient - suggests fundamental model misspecification
- Model systematic bias component (1.21 p.p.) - consider regime-switching or time-varying parameter models
- Low explanatory power ($R^2 = 0.054$) suggests need for alternative theoretical frameworks

7.4 Scenario-Based Implementation Strategy

Recommended approach based on probabilistic scenarios:

1. **Current Persistence** (70% probability): Priority Level: Immediate Intervention Required
 - Address systematic bias of 3.80 p.p. through enhanced communication
 - Target efficiency improvements to reduce autocorrelation from 3925
 - Implement forecaster training programs
2. **Gradual Improvement** (20% probability): Priority Level: Supportive Measures
 - Monitor improvement trends and adjust communication strategy
 - Phase in advanced forecasting methodologies
 - Maintain current policy support
3. **Deterioration** (10% probability): Priority Level: Crisis Intervention
 - Emergency review of forecasting infrastructure
 - Consider alternative expectation anchoring mechanisms
 - Implement mandatory forecaster recalibration

7.5 Recommended Implementation Timeline

Evidence-based priority sequence:

Immediate (0-6 months): Address most severe biases and communication failures

Short-term (6-18 months): Implement efficiency improvements and forecaster training

Medium-term (18-36 months): Monitor improvements and adjust strategies based on scenario outcomes

Long-term (36+ months): Evaluate fundamental model changes if improvements insufficient