

Brazilian Inflation Expectations Rationality: Post-COVID Recovery Analysis (2023-2025)

Brazilian REH Analyzer v2.0.0

July 23, 2025

1 Executive Summary

| |
|---|
| Analysis Overview |
| Rational Expectations Hypothesis: FAIL |
| Analysis Period: 2023-01-02 to 2024-06-28 |
| Observations: 373 |
| Mean Forecast Bias: -3.875 p.p. |
| Bias Severity: Extreme (Overestimation) |

2 Comprehensive Descriptive Statistics

Table 1: Comprehensive Statistical Summary

| Statistic | Forecast (%) | Realized (%) | Error (p.p.) |
|----------------|--------------|--------------|--------------|
| Mean | 4.290 | 0.415 | -3.875 |
| Median | 3.963 | 0.390 | -3.655 |
| Std. Deviation | 0.760 | 0.278 | 0.812 |
| Minimum | 3.358 | -0.020 | -5.700 |
| Maximum | 5.860 | 1.310 | -2.363 |
| Skewness | 0.917 | 1.504 | -0.482 |
| Kurtosis | -0.704 | 3.214 | -0.637 |
| Observations | 373 | 373 | 373 |

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) | 0.433 | 0.000 | 5.23 | 0.0000 | [0.270, 0.596] |
| β (Slope) | -0.004 | 0.000 | -0.22 | 0.8248 | [-0.042, 0.033] |

Model Diagnostics: $R^2 = 0.0001$, Joint F-statistic = 37464.85 (p = 0.000000)

4.1 Economic Interpretation

- $\alpha = 0.433 \neq 0$: Systematic forecast bias detected
- $\beta = -0.004 \neq 1$: 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 | 2023-01-02 | 2023-06-30 | -4.827 | FAIL |
| Period 2 | 2023-07-03 | 2023-12-28 | -3.623 | FAIL |
| Period 3 | 2023-12-29 | 2024-06-28 | -3.180 | FAIL |

5.1 Structural Break Interpretation

- Forecast bias ranges from -4.827 to -3.180 p.p. across sub-periods
- Total bias variation: 1.647 p.p.
- **Substantial** time-variation in forecast bias detected

6 Economic Interpretation

6.1 Quantitative Bias Assessment

Table 5: Enhanced Bias Analysis

| Metric | Value | Assessment |
|----------------------|----------------|----------------|
| Direction | Overestimation | – |
| Magnitude | 3.875 p.p. | Extreme |
| Grade Category | F | High Impact |
| Bias Ratio | 4.77 | High Dominance |
| Systematic Component | 97.9% | of Total Error |

6.2 Quantitative Efficiency Assessment

| Table 6: Enhanced Efficiency Analysis | | |
|---------------------------------------|----------|---------------------|
| Metric | Value | Assessment |
| Ljung-Box Statistic | 3327.5 | Low |
| LB p-value | 1.0000 | Not Significant |
| Efficiency Score | 50.0/100 | Poor |
| Predictability Index | 33.28 | High Predictability |
| Information Processing | Poor | Quality Assessment |

6.3 Enhanced Mincer-Zarnowitz Coefficient Analysis

Alpha Coefficient Interpretation:

$\alpha = 0.433$ (95% CI: [0.000, 0.000])
small systematic over-prediction of 0.433 percentage points

Beta Coefficient Interpretation:

$\beta = -0.004$ (95% CI: [0.000, 0.000])
forecasters systematically move opposite to reality ($\beta = -0.004$), 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 | 21.9/100 | Very Poor |
| Root Mean Square Error | 3.959 p.p. | Accuracy Measure |
| Mean Absolute Error | 3.875 p.p. | Precision Measure |
| R-Squared | 0.000 | 0.0% 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: 4.07 p.p., Priority: Immediate Intervention Required

Gradual Improvement (Probability: 20%):

Forecasting quality improves over 2-3 years
Expected MAE: 2.71 p.p., Priority: Supportive Measures

Deterioration (Probability: 10%):

Forecasting quality deteriorates further
Expected MAE: 5.04 p.p., Priority: Crisis Intervention

6.6 Key Quantitative Insights

- Bias magnitude: 3.87 percentage points
- Efficiency loss: 100.0% of variation unexplained
- Predictable error component: 97.1% 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 3.87 percentage points requires immediate attention
- **EFFICIENCY TARGET:** Current autocorrelation statistic of 3328 needs reduction to <20 for acceptable efficiency
- **QUALITY SCORE:** Current forecast quality score of 21.9/100 indicates urgent intervention required
- **CRITICAL:** Negative β coefficient (-0.004) indicates forecasters systematically misinterpret central bank signals
- Address systematic bias of 3.87 p.p. through enhanced communication
- Target efficiency improvements to reduce autocorrelation from 3328
- Implement forecaster training programs

Specific Performance Targets:

- Reduce systematic bias from 3.87 to <2.71 percentage points within 24 months
- Improve efficiency from current LB statistic of 3328 to <20 within 18 months

7.2 For Market Participants

Quantified Market Opportunities:

- **ARBITRAGE OPPORTUNITY:** Predictable bias of 3.87 p.p. offers systematic profit potential
- **ERROR PREDICTABILITY:** 97.1
- **RISK ASSESSMENT:** Quality score of 21.9/100 suggests high uncertainty in market-based expectations

Risk-Return Assessment:

- Strategy Risk Level: High (Quality Score: 21.9/100)
- Expected Volatility: 3.96 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 1.5-year period with consistent patterns
- **MODEL SPECIFICATION:** R^2 of 3.959 suggests -295.9
- **ALTERNATIVE MODELS:** Evidence strongly supports adaptive expectations framework

Model Development Priorities:

- **URGENT:** Investigate counter-intuitive negative β coefficient - suggests fundamental model misspecification
- Low explanatory power ($R^2 = 0.000$) 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 3.87 p.p. through enhanced communication
 - Target efficiency improvements to reduce autocorrelation from 3328
 - 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