

# Brazilian Inflation Expectations Rationality: Comprehensive Analysis (2017-2025)

Brazilian REH Analyzer v2.0.0

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## 1 Executive Summary

<b>Analysis Overview</b>
<b>Rational Expectations Hypothesis: FAIL</b>
<b>Analysis Period:</b> 2017-01-02 to 2024-06-28
<b>Observations:</b> 1,878
<b>Mean Forecast Bias:</b> -3.805 p.p.
<b>Bias Severity:</b> Extreme (Overestimation)

## 2 Comprehensive Descriptive Statistics

Table 1: Comprehensive Statistical Summary

Statistic	Forecast (%)	Realized (%)	Error (p.p.)
Mean	4.243	0.438	-3.805
Median	4.060	0.400	-3.700
Std. Deviation	0.799	0.417	0.971
Minimum	2.290	-0.680	-6.500
Maximum	6.457	1.620	-1.460
Skewness	0.584	0.264	-0.179
Kurtosis	-0.115	0.386	-0.564
Observations	1,878	1,878	1,878

## 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
$\alpha$ (Intercept)	0.874	0.000	17.15	0.0000	[0.774, 0.974]
$\beta$ (Slope)	-0.103	0.000	-8.70	0.0000	[-0.126, -0.080]

**Model Diagnostics:**  $R^2 = 0.0388$ , Joint F-statistic = 85672.94 (p = 0.000000)

### 4.1 Economic Interpretation

- $\alpha = 0.874 \neq 0$ : Systematic forecast bias detected
- $\beta = -0.103 \neq 1$ : 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	2019-07-04	-3.799	FAIL
Period 2	2019-07-05	2021-12-29	-3.265	FAIL
Period 3	2021-12-30	2024-06-28	-4.349	FAIL

### 5.1 Structural Break Interpretation

- Forecast bias ranges from -4.349 to -3.265 p.p. across sub-periods
- Total bias variation: 1.084 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	3.805 p.p.	Extreme
Grade Category	F	High Impact
Bias Ratio	3.92	High Dominance
Systematic Component	96.9%	of Total Error

### 6.2 Quantitative Efficiency Assessment

Table 6: Enhanced Efficiency Analysis

Metric	Value	Assessment
Ljung-Box Statistic	17000.5	Low
LB p-value	1.0000	Not Significant
Efficiency Score	50.0/100	Poor
Predictability Index	170.00	High Predictability
Information Processing	Poor	Quality Assessment

### 6.3 Enhanced Mincer-Zarnowitz Coefficient Analysis

**Alpha Coefficient Interpretation:**

$\alpha = 0.874$  (95% CI: [0.000, 0.000])  
*moderate systematic over-prediction of 0.874 percentage points*

**Beta Coefficient Interpretation:**

$\beta = -0.103$  (95% CI: [0.000, 0.000])  
*forecasters systematically move opposite to reality ( $\beta = -0.103$ ), 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	20.3/100	Very Poor
Root Mean Square Error	3.927 p.p.	Accuracy Measure
Mean Absolute Error	3.805 p.p.	Precision Measure
R-Squared	0.039	3.9% 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: 4.95 p.p., Priority: Crisis Intervention

## 6.6 Key Quantitative Insights

- Bias magnitude: 3.80 percentage points
- Efficiency loss: 96.1% of variation unexplained
- Predictable error component: 99.4% 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 17000 needs reduction to  $<20$  for acceptable efficiency
- **QUALITY SCORE:** Current forecast quality score of 20.3/100 indicates urgent intervention required
- **CRITICAL:** Negative  $\beta$  coefficient (-0.103) indicates forecasters systematically misinterpret central bank signals
- Address systematic bias of 3.80 p.p. through enhanced communication
- Target efficiency improvements to reduce autocorrelation from 17000
- 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 17000 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:** 99.4
- **RISK ASSESSMENT:** Quality score of 20.3/100 suggests high uncertainty in market-based expectations

#### Risk-Return Assessment:

- Strategy Risk Level: High (Quality Score: 20.3/100)
- Expected Volatility: 3.93 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 7.5-year period with consistent patterns
- **MODEL SPECIFICATION:**  $R^2$  of 3.927 suggests -292.7
- **ALTERNATIVE MODELS:** Evidence strongly supports adaptive expectations framework

#### Model Development Priorities:

- **URGENT:** Investigate counter-intuitive negative  $\beta$  coefficient - suggests fundamental model misspecification
- Low explanatory power ( $R^2 = 0.039$ ) 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 17000
  - 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