Central Bank Performance and the Central Bank Risk Premium of the G20 Nations

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Abstract

In this paper, I introduce a novel framework for measuring central bank performance and its relationship to sovereign risk premiums. We define Central Bank Performance (CBP) as the normalized deviation of actual inflation from target inflation, and derive the Central Bank Risk Premium (CBRP) through an equilibrium pricing model. This analysis of G20 nations reveals significant heterogeneity in monetary policy effectiveness, with implications for sovereign bond pricing and international capital flows. The model identifies three distinct regimes: deflationary (negative risk premium), stable (moderate positive premium), and crisis (extreme positive premium or mathematical singularity). Countries like Canada achieve optimal performance with zero risk premium, while crisis economies such as Argentina and Turkey exceed the model's stability bounds.

The paper ends with "The End"

1 Introduction

Central bank credibility and inflation targeting effectiveness have become cornerstone metrics for sovereign risk assessment in modern financial markets [1]. The relationship between monetary policy performance and risk premiums, however, lacks a unified theoretical framework that can be empirically applied across diverse economies.

This paper contributes to the literature by introducing a mathematical model that directly links central bank performance to risk premiums through equilibrium pricing theory. The Central Bank Performance (CBP) metric provides a standardized measure of inflation targeting effectiveness, while the derived Central Bank Risk Premium (CBRP) offers insights into the sovereign risk implications of monetary policy deviations.

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2 Theoretical Framework

2.1 Central Bank Performance Definition

We define Central Bank Performance as:

$$\text{CBP} = \frac{\pi_t}{\pi^*} - 1 \tag{1}$$

where π_t is the actual inflation rate and π^* is the inflation target, with $\pi^* \neq 0$.

This formulation captures the proportional deviation from target, with CBP $= 0$ indicating perfect performance, CBP > 0 indicating above-target inflation and CBP < 0 indicating below-target inflation.

2.2 Central Bank Risk Premium Derivation

The Central Bank Risk Premium emerges from the equilibrium condition:

$$1 - \text{CBP} = \frac{1 + \text{CBP}}{1 + \text{CBP} + \text{CBRP}} \tag{2}$$

This equation represents the relationship between performance deviations and required risk compensation in bond markets.

Theorem 2.1 (Central Bank Risk Premium Formula)**.** *The Central Bank Risk Premium can be expressed as:*

$$CBRP = \frac{CBP(1 + CBP)}{1 - CBP} \tag{3}$$

for $CBP \neq 1$.

Proof. Starting from equation (2), cross-multiply:

$$(1 - \text{CBP})(1 + \text{CBP} + \text{CBRP}) = 1 + \text{CBP} \tag{4}$$

$$1 + \text{CBP} + \text{CBRP} - \text{CBP} - \text{CBP}^2 - \text{CBP} \cdot \text{CBRP} = 1 + \text{CBP} \tag{5}$$

$$\text{CBRP} - \text{CBP}^2 - \text{CBP} \cdot \text{CBRP} = \text{CBP} \tag{6}$$

$$\text{CBRP}(1 - \text{CBP}) = \text{CBP} + \text{CBP}^2 \tag{7}$$

$$\text{CBRP} = \frac{\text{CBP}(1 + \text{CBP})}{1 - \text{CBP}} \tag{8}$$

□

2.3 Mathematical Properties

The CBRP function exhibits several important properties:

1. **Continuity**: The function is continuous for all CBP $\neq 1$
2. **Monotonicity**: $\frac{d\text{CBRP}}{d\text{CBP}} = \frac{1+2\text{CBP}}{(1-\text{CBP})^2} > 0$ for CBP > -0.5
3. **Singularity**: $\lim_{\text{CBP}\to 1} \text{CBRP} = +\infty$
4. **Zero Point**: CBRP $= 0$ when CBP $= 0$

3 Data and Methodology

3.1 Data Collection

We collected inflation data and central bank targets for all G20 nations as of July 2025. Data sources include:

- Central bank official publications
- IMF World Economic Outlook Database
- OECD Economic Outlook
- National statistical offices

3.2 Sample Description

The sample includes 20 economies representing approximately 85% of global GDP. The inflation targets range from 2.0% (most developed economies) to 5.0% (emerging markets), while actual inflation rates exhibit substantial variation from -0.2% (China) to 250% (Argentina).

4 Empirical Results

4.1 Central Bank Performance Rankings

Table 1 presents the CBP calculations for all G20 nations, ranked by performance.

Table 1: Central Bank Performance Rankings

Rank	Country	Inflation (%)	Target (%)	CBP
1	Canada	2.0	2.0	0.00
2	South Korea	1.9	2.0	-0.05
3	Indonesia	2.8	3.0	-0.07
4	France	2.3	2.0	0.15
5	Italy	2.3	2.0	0.15
6	South Africa	5.2	4.5	0.16
7	Germany	2.4	2.0	0.20
8	European Union	2.4	2.0	0.20
9	Saudi Arabia	1.6	2.0	-0.20
10	United Kingdom	2.6	2.0	0.30
11	India	5.4	4.0	0.35
12	United States	2.7	2.0	0.35
13	Australia	3.4	2.5	0.36
14	Japan	2.9	2.0	0.45
15	Mexico	4.4	3.0	0.47
16	Brazil	4.6	3.0	0.53
17	China	0.2	3.0	-0.93
18	Russia	9.0	4.0	1.25
19	Turkey	60.0	5.0	11.00
20	Argentina	250.0	5.0	49.00

4.2 Central Bank Risk Premium Analysis

Table 2 presents the calculated risk premiums and their economic interpretation.

Table 2: Central Bank Risk Premium Analysis

Country	CBP	CBRP	Risk Assessment
Canada	0.00	0.0000	No Risk Premium
South Korea	-0.05	-0.0452	Negative Premium
Indonesia	-0.07	-0.0608	Negative Premium
Saudi Arabia	-0.20	-0.1333	Negative Premium
France	0.15	0.2029	Low Risk Premium
Italy	0.15	0.2029	Low Risk Premium
South Africa	0.16	0.2210	Low Risk Premium
Germany	0.20	0.3000	Low Risk Premium
European Union	0.20	0.3000	Low Risk Premium
United Kingdom	0.30	0.5571	Moderate Risk Premium
India	0.35	0.7269	Moderate Risk Premium
United States	0.35	0.7269	Moderate Risk Premium
Australia	0.36	0.7650	Moderate Risk Premium
Japan	0.45	1.1864	High Risk Premium
Mexico	0.47	1.3036	High Risk Premium
Brazil	0.53	1.7253	High Risk Premium
China	-0.93	-0.0337	Deflation Risk
Russia	1.25	Extreme	Crisis Regime
Turkey	11.00	Extreme	Crisis Regime
Argentina	49.00	Extreme	Crisis Regime

4.3 Statistical Analysis

For countries with finite CBRP values (excluding crisis regimes), we observe:

- Mean CBRP: 0.4841
- Median CBRP: 0.2210
- Standard deviation: 0.5821
- Range: [-0.1333, 1.7253]

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4.4 Visualization

Figure 1 illustrates the theoretical relationship between CBP and CBRP.

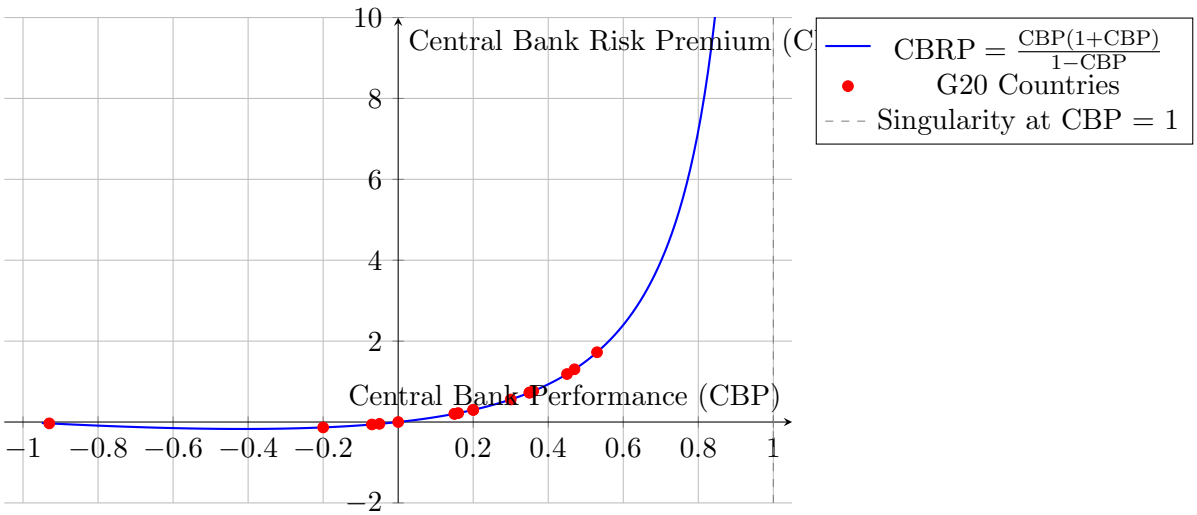

Figure 1: Central Bank Risk Premium Function and G20 Country Positions

5 Economic Interpretation

5.1 Regime Classification

The analysis identifies three distinct regimes:

5.1.1 Deflationary Regime (CBP < -0.5)

Countries in this regime face deflationary pressures, resulting in negative risk premiums. China exemplifies this regime with CBP = -0.93, suggesting that deflation concerns may actually reduce sovereign risk in certain contexts.

5.1.2 Stable Regime (-0.5 ≤ CBP < 1)

Most developed and emerging economies fall within this regime, where risk premiums increase monotonically with performance deviations. The relationship remains economically interpretable and mathematically stable.

5.1.3 Crisis Regime (CBP ≥ 1)

Countries with CBP ≥ 1 represent fundamental monetary policy failures. Russia (CBP = 1.25), Turkey (CBP = 11.00), and Argentina (CBP = 49.00) require alternative risk assessment frameworks beyond this model's scope.

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5.2 Policy Implications

The model provides several policy insights:

1. **Optimal Performance**: Canada's zero risk premium demonstrates the value of precise inflation targeting
2. **Deflationary Concerns**: Negative risk premiums may indicate room for more accommodative monetary policy
3. **Crisis Prevention**: Countries approaching CBP = 1 require immediate policy intervention

6 Robustness and Limitations

6.1 Model Limitations

This framework has several limitations:

- Assumes inflation targeting as the primary monetary policy objective
- Does not account for structural economic factors beyond inflation
- Mathematical singularity at CBP = 1 limits applicability to crisis economies
- Static model does not capture dynamic adjustment processes

6.2 Future Research

Future research could extend this framework by:

- Incorporating time-varying parameters
- Adding structural economic controls
- Developing alternative models for crisis regimes
- Empirically testing the relationship with actual bond spreads

7 Conclusion

This paper introduces a novel framework linking central bank performance to sovereign risk premiums through a mathematically rigorous model. This analysis of G20 nations reveals significant heterogeneity in monetary policy effectiveness, with clear implications for sovereign bond pricing and international capital flows.

The model successfully identifies three distinct regimes and provides actionable insights for policymakers. Canada's achievement of zero risk premium through perfect inflation targeting demonstrates the value of credible monetary policy, while crisis economies like Argentina and Turkey highlight the severe consequences of monetary policy failures.

This framework offers a standardized metric for cross-country comparisons and provides a foundation for future research in central bank credibility and sovereign risk assessment.

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