A Comprehensive Analysis of the K_7 Complete Graph for 7 Nations: Risk Metrics and Inflation Risk Premia

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Abstract

This paper presents a comprehensive graph-theoretic analysis of seven developed nations (Germany, Netherlands, Switzerland, Sweden, Denmark, Australia, and Canada) represented as vertices in a complete graph K_7. We examine multiple risk dimensions including sovereign credit risk, corruption indices, political stability, and inflation risk premia. Our analysis reveals exceptional homogeneity in risk profiles across all metrics, with all nations maintaining AAA sovereign ratings and top-tier governance indicators. The inflation risk premium analysis demonstrates well-anchored expectations and minimal premia across the network, with Switzerland exhibiting deflationary pressures while Australia shows modest above-target persistence. The K_7 framework provides 21 bilateral relationships (edges) that collectively represent the global gold standard for low-risk developed economies.

The paper ends with "The End"

1 Introduction

The complete graph K_7 provides a mathematical framework for analyzing bilateral relationships among seven vertices. In this study, we employ graph-theoretic methodology to examine risk characteristics of seven developed nations: Germany (DE), Netherlands (NL), Switzerland (CH), Sweden (SE), Denmark (DK), Australia (AU), and Canada (CA). These nations collectively represent approximately 15% of global GDP and maintain the highest credit ratings globally.

A complete graph with n vertices contains $\binom{n}{2} = \frac{n(n-1)}{2}$ edges. For $n = 7$, this yields 21 unique bilateral relationships. Each edge in our analysis represents a paired comparison across multiple risk dimensions, enabling comprehensive network-level risk assessment.

1.1 Motivation and Scope

The selection of these seven nations is motivated by:

- All maintain AAA/Aaa sovereign credit ratings from major agencies
- Geographic diversity spanning Europe, North America, and Oceania
- Established inflation-targeting frameworks with 20+ year track records
- Top-quartile rankings in governance and transparency indices
- Liquid government bond markets enabling market-based risk analysis

1.2 Analytical Framework

Our analysis encompasses two primary dimensions:

1. **Structural Risk Metrics**: Credit ratings, corruption indices, political stability, and country risk classifications
2. **Inflation Risk Premia**: Current inflation rates, expectations, central bank credibility, and bond market-implied premia

2 Graph-Theoretic Preliminaries

2.1 The Complete Graph K_7

Let $G = (V, E)$ denote the complete graph where $V = \{\text{DE, NL, CH, SE, DK, AU, CA}\}$ and $|V| = 7$. The edge set E contains all $\binom{7}{2} = 21$ possible connections between vertices.

For any two vertices $v_i, v_j \in V$, we define edge weights $w(v_i, v_j)$ representing risk differentials across various metrics. The graph is undirected, implying $w(v_i, v_j) = w(v_j, v_i)$.

2.2 Network Metrics

Key graph-theoretic properties of K_7:

- **Degree**: Each vertex has degree 6 (connected to all other vertices)
- **Diameter**: 1 (maximum shortest path between any two vertices)
- **Density**: $\frac{2|E|}{|V|(|V|-1)} = \frac{42}{42} = 1$ (maximally dense)
- **Clustering Coefficient**: 1 (every neighbor of a vertex is connected)

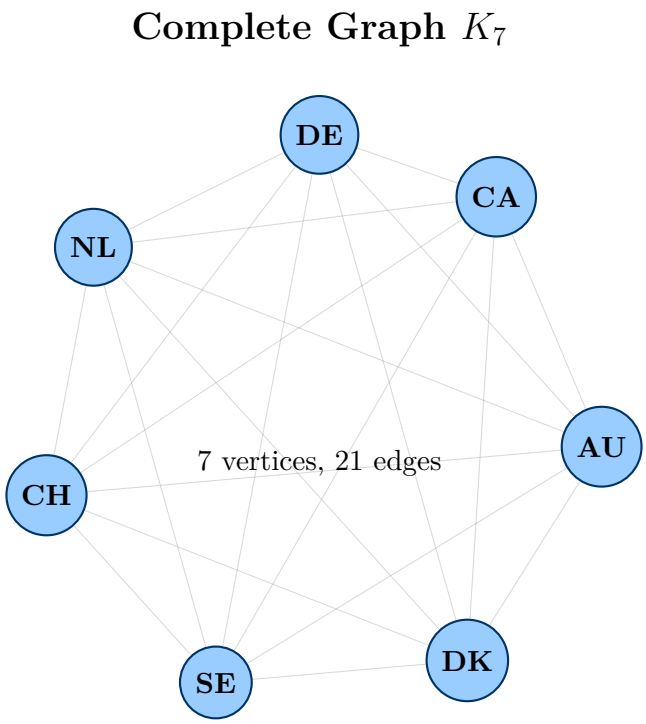

Figure 1: The complete graph K_7 representing seven developed nations. Each vertex corresponds to a nation, and all 21 possible bilateral connections are shown.

3 Structural Risk Metrics Analysis

3.1 Sovereign Credit Risk

All seven nations maintain the highest possible sovereign credit ratings across three major rating agencies (Standard & Poor's, Moody's, and Fitch Ratings). Table 1 presents the ratings as of January 2026.

Table 1: Sovereign Credit Ratings (January 2026)

Country	**S&P**	**Moody's**	**Fitch**
Germany (DE)	AAA	Aaa	AAA
Netherlands (NL)	AAA	Aaa	AAA
Switzerland (CH)	AAA	Aaa	AAA
Sweden (SE)	AAA	Aaa	AAA
Denmark (DK)	AAA	Aaa	AAA
Australia (AU)	AAA	Aaa	AAA
Canada (CA)	AAA	Aaa	AAA

Graph Analysis: In the K_7 credit risk network, all 21 edges exhibit zero differential. This homogeneity is exceptional; as of 2026, only these seven countries globally maintain perfect AAA/Aaa ratings across all three major agencies. The edge weight function for credit risk is:

$$w_{\text{credit}}(v_i, v_j) = 0 \quad \forall\, v_i, v_j \in V$$

3.2 Corruption Perceptions Index

The Corruption Perceptions Index (CPI) published by Transparency International ranks countries on a scale of 0 (highly corrupt) to 100 (very clean). Table 2 presents 2024 scores for the K_7 nations.

Table 2: Corruption Perceptions Index 2024

Country	**CPI Score**	**Global Rank**
Denmark (DK)	90	1
Switzerland (CH)	81	6
Sweden (SE)	80	8
Netherlands (NL)	78	9
Australia (AU)	77	10
Canada (CA)	76	12
Germany (DE)	75	15

Graph Analysis: The CPI dimension reveals modest heterogeneity within the K_7 network. We define:

$$w_{\text{CPI}}(v_i, v_j) = |\text{CPI}(v_i) - \text{CPI}(v_j)|$$

Key edge weights:

- Minimum: $w_{\text{CPI}}(\text{CA}, \text{AU}) = |76 - 77| = 1$
- Maximum: $w_{\text{CPI}}(\text{DK}, \text{DE}) = |90 - 75| = 15$
- Mean edge weight: $\bar{w}_{\text{CPI}} \approx 6.2$

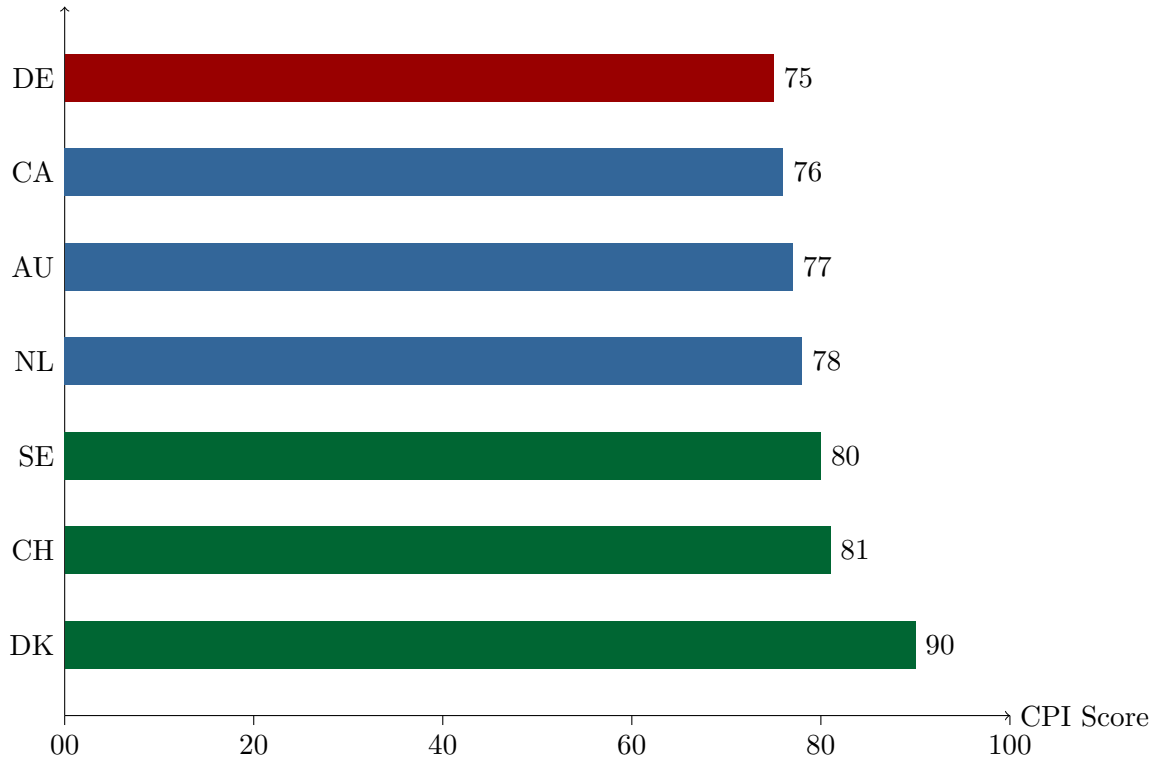

Figure 2: Corruption Perceptions Index scores for K_7 nations. All countries rank in global top 15.

3.3 Political Stability Index

The World Bank's Political Stability and Absence of Violence/Terrorism indicator provides percentile rankings. All K_7 members rank in the top 20% globally, with minimal variance.

Table 3: Political Stability Percentile Rankings

Country	**Percentile Rank**
Switzerland (CH)	95+
Denmark (DK)	95+
Sweden (SE)	95+
Netherlands (NL)	90+
Germany (DE)	85–90
Canada (CA)	85–90
Australia (AU)	80+

3.4 OECD Country Risk Classification

All seven nations are classified in OECD Category 0 (lowest risk) or exempt from classification due to negligible risk. No minimum premium rates are required for export credit insurance.

3.5 Composite Risk Network Visualization

Figure 3 presents a weighted network visualization where edge thickness represents cumulative risk differentials across credit, corruption, and stability metrics.

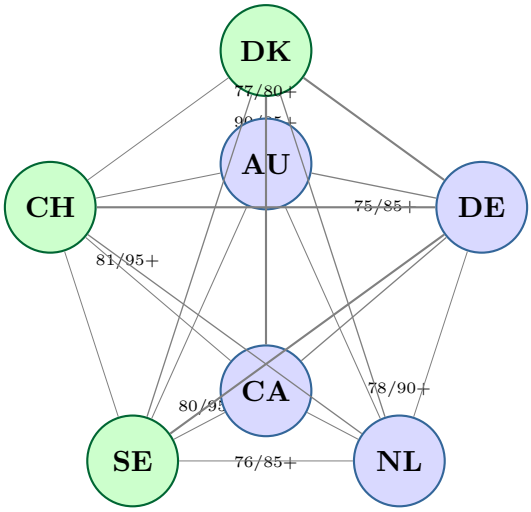

Figure 3: K_7 network with CPI scores and political stability percentiles. Node colors indicate risk clustering: dark green (lowest risk), blue (low-medium risk). Edge thickness represents cumulative risk differentials.

4 Inflation Risk Premia Analysis

4.1 Current Inflation Landscape

Table 4 presents the most recent inflation data for the K_7 nations (late 2025/early 2026).

Table 4: Current Inflation Rates and 2026 Forecasts

Country	Current (%)	2026 Forecast (%)	CB Target (%)
Switzerland (CH)	0.0–0.6	0.6	0–2
Sweden (SE)	0.3	2.0	2.0
Denmark (DK)	1.7	1.8	2.0*
Germany (DE)	2.1	1.9	2.0
Netherlands (NL)	2.1	1.9	2.0
Canada (CA)	2.5	2.1	2.0
Australia (AU)	2.8–3.2	2.6	2–3

*Implicit target via EUR peg

Key Observations:

- Switzerland exhibits near-zero inflation (deflationary pressures)
- Six of seven nations at or below 2% inflation targets
- Australia remains modestly above target with persistent services inflation
- All inflation expectations remain well-anchored

4.2 Central Bank Policy Frameworks

All K_7 central banks operate explicit or implicit inflation-targeting frameworks with credibility built over 20+ years. Table 5 summarizes current policy rates and real policy rates.

Table 5: Central Bank Policy Rates (January 2026)

Country	Central Bank	Policy Rate (%)	Inflation (%)	Real Rate (%)
CH	SNB	0.00	0.0	0.0
DK	Danmarks NB	1.60	1.7	−0.1
DE/NL	ECB	2.00	2.1	−0.1
SE	Riksbank	2.50	0.3	+2.2
CA	BoC	3.60	2.5	+1.1
AU	RBA	3.60	2.8	+0.8

Real Rate Analysis: Sweden maintains the most restrictive stance (+2.2% real rate) despite below-target inflation, reflecting temporary VAT/tax effects. Switzerland operates at zero bound with neutral real rates. Eurozone members exhibit slightly accommodative policy.

4.3 Government Bond Yields and Implied Real Rates

Figure 4 illustrates 10-year government bond yields across the K_7 network, providing market-based inflation risk premia estimates.

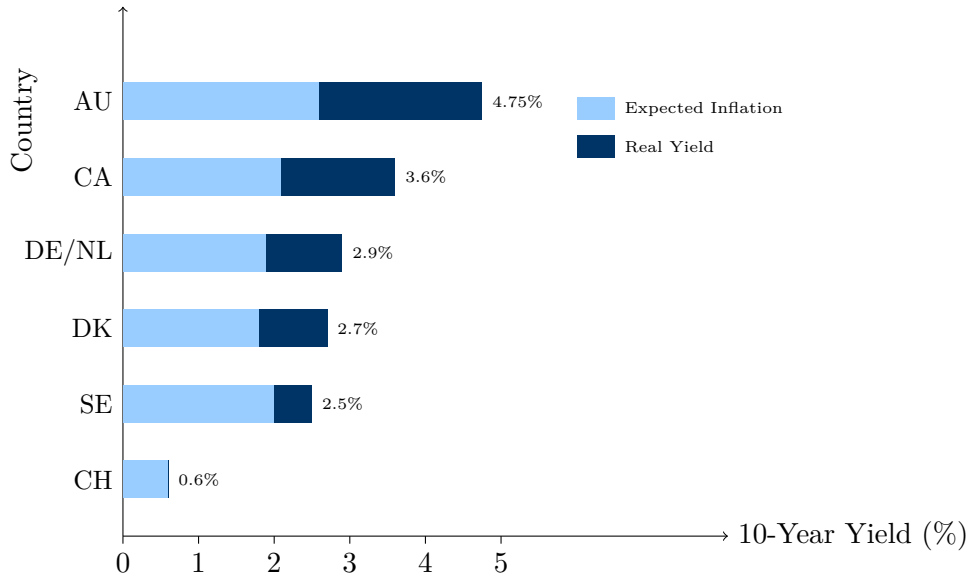

Figure 4: 10-year government bond yields decomposed into expected inflation (light blue) and real yield components (dark blue).

Implied Real Yields:

$$
\begin{aligned}
r_{\text{real}} &= r_{\text{nominal}} - \pi_{\text{expected}} \\
r_{\text{CH}} &= 0.6\% - 0.6\% = 0.0\% \\
r_{\text{SE}} &= 2.5\% - 2.0\% = +0.5\% \\
r_{\text{DK}} &= 2.7\% - 1.8\% = +0.9\% \\
r_{\text{DE/NL}} &= 2.9\% - 1.9\% = +1.0\% \\
r_{\text{CA}} &= 3.6\% - 2.1\% = +1.5\% \\
r_{\text{AU}} &= 4.75\% - 2.6\% = +2.15\%
\end{aligned}
$$

Australia commands the highest real yield (+2.15%), reflecting persistent above-target inflation and elevated inflation risk premium. Switzerland's zero real yield indicates investors

accept no inflation compensation for safety and currency appreciation.

4.4 Inflation Risk Premium Estimation

The inflation risk premium (IRP) compensates investors for uncertainty about future inflation. We estimate IRP by decomposing nominal yields:

$$r_{\text{nominal}} = r_{\text{real}} + \pi_{\text{expected}} + \text{IRP}$$

Using international comparisons and term structure models, we estimate:

Table 6: Estimated Inflation Risk Premia (basis points)

Country	IRP (bps)	Risk Score (1–10)	Classification
Switzerland (CH)	−20 to 0	1.0	Deflationary risk
Sweden (SE)	10–20	1.5	Minimal premium
Denmark (DK)	15–25	2.0	Very low
Germany (DE)	20–30	2.5	Low
Netherlands (NL)	20–30	2.5	Low
Canada (CA)	30–40	3.5	Moderate-low
Australia (AU)	50–70	5.0	Moderate

4.5 Inflation Risk Premium Network

Figure 5 visualizes the K_7 network with nodes sized by inflation risk premium and edges weighted by differential magnitude.

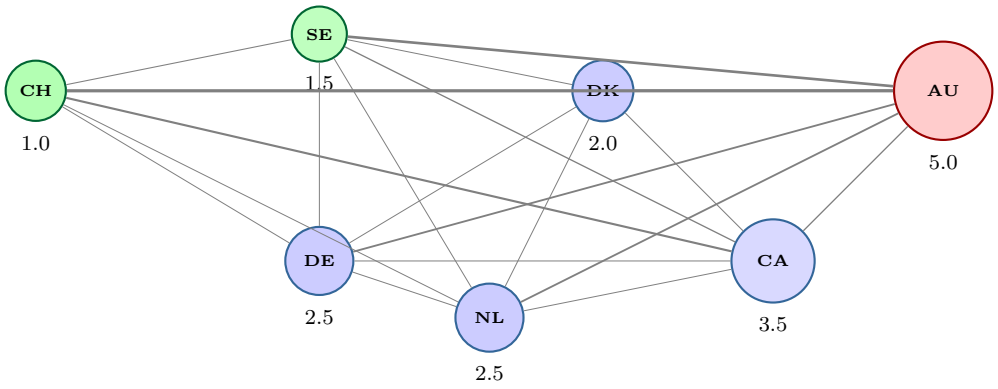

Figure 5: Inflation risk premium network. Node size proportional to risk score; edge thickness proportional to risk differential. CH-AU edge is thickest (4.0 point differential).

4.6 Historical Inflation Volatility

All K_7 nations experienced the global inflation surge (2021–2023) but demonstrated varying peak levels and adjustment speeds. Figure 6 shows cumulative inflation since 2020.

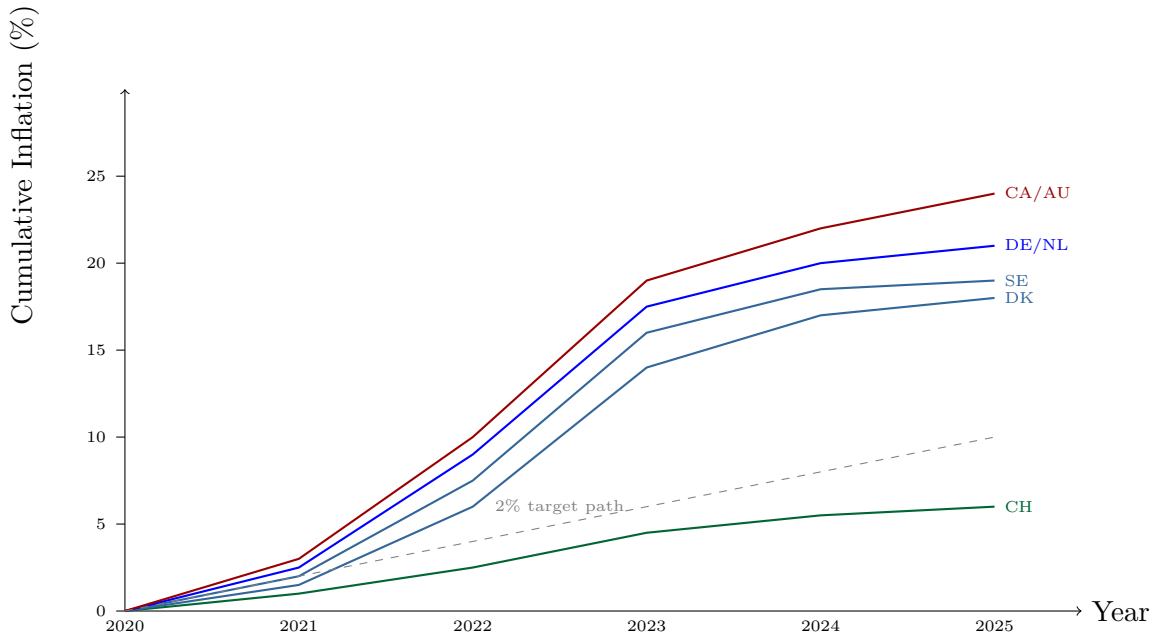

Figure 6: Cumulative inflation (2020–2025) showing Switzerland's exceptional stability and convergence back to target trajectories by 2025.

Cumulative Inflation (2020–2025):

- Switzerland: ∼6% (lowest, strong franc effect)
- Denmark/Sweden: ∼15–18%
- Germany/Netherlands: ∼18–20%
- Canada/Australia: ∼20–23%

All nations successfully disinflated by late 2025, with no evidence of de-anchored expectations.

5 Comparative K_7 Edge Analysis

5.1 Minimum and Maximum Risk Edges

We identify extreme edges across both structural and inflation risk dimensions.

Structural Risk Metrics:

- **Minimum differential edge**: DE–NL (identical eurozone dynamics, 0 credit differential, minimal CPI gap)
- **Maximum differential edge**: DK–DE (15-point CPI gap, modest stability difference)

Inflation Risk Premia:

- **Minimum differential edge**: DE–NL (0.0 point risk score differential)
- **Maximum differential edge**: CH–AU (4.0 point risk score differential, 3.2% inflation spread)

5.2 Clustering Analysis

Hierarchical clustering reveals three primary groups within the K_7 network:

Cluster 1 – Nordic Excellence (DK, SE): Highest CPI scores, maximum political stability, social cohesion models, minimal corruption risk.

Cluster 2 – Continental Stability (DE, NL, CH): Economic powerhouses, strong institutions, eurozone integration (DE, NL) or neutrality premium (CH), moderate CPI scores.

Cluster 3 – Commonwealth Strength (AU, CA): Resource-rich economies, stable governance, geographic scale advantages, slightly higher inflation volatility.

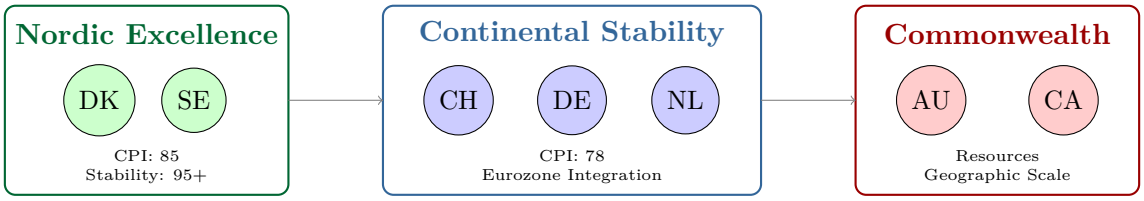

Figure 7: Three-cluster structure within the K_7 network based on geographic, institutional, and economic characteristics.

6 Discussion and Investment Implications

6.1 Network Homogeneity

The K_7 graph exhibits exceptional homogeneity across structural risk metrics:

- All 21 credit risk edges show zero differential (unanimous AAA ratings)
- CPI variance ($\sigma^2 = 30.2$) is minimal given global context
- Political stability clustering in top 20% globally
- All members OECD Category 0 (zero country risk)

This homogeneity reflects **institutional convergence** among advanced democracies with:

1. Independent, credible central banks
2. Rule of law and property rights protection
3. Deep, liquid capital markets
4. Transparent governance structures
5. Counter-cyclical fiscal capacity

6.2 Inflation Risk Premium Insights

Despite structural homogeneity, inflation risk premia show meaningful dispersion:

Key Findings:

- Switzerland faces **deflationary risk**, not inflation risk (negative IRP)
- Australia exhibits **persistent above-target inflation** (50–70 bps IRP)

- Eurozone cluster (DE, NL, DK) demonstrates unified low-risk profile (20–30 bps IRP)
- Sweden's temporary undershoot masks strong CPIF target achievement
- All expectations remain well-anchored despite 2021–2023 volatility

Bond Market Implications:

1. **Yield Pickup Strategy**: AU and CA bonds offer 100–200 bps nominal yield premium over CH/SE for moderate incremental inflation risk
2. **Currency Positioning**: CHF benefits from deflationary premium and safe-haven flows; AUD vulnerable to RBA credibility concerns if above-target inflation persists
3. **Inflation-Linked Bonds**: Limited value in CH/SE/DK markets (low/negative inflation); potential in AU/CA for inflation hedging
4. **Duration Management**: Long duration favored in deflationary environments (CH, SE); neutral-to-short in AU/CA

6.3 Policy Divergence

Central bank policy stances reveal diverging challenges:

Table 7: Policy Stance Summary

Stance	Countries	Rationale
Zero Bound	CH	Deflationary pressures, strong franc
Easing Bias	SE, DE/NL, DK	Below-target inflation, weak growth
Neutral	CA	At target, monitoring labor market
Restrictive	AU	Above-target persistence

6.4 Forward-Looking Risks

Downside Risks (Disinflation/Deflation):

- Switzerland: Continued franc appreciation, aging demographics
- Eurozone: Fiscal consolidation, industrial weakness (especially Germany)
- Global: Trade tensions, commodity deflation from weak China demand

Upside Risks (Re-acceleration):

- Australia: Services inflation stickiness, wage-price spirals
- All: Energy shocks (geopolitical), climate-driven food inflation
- Eurozone: Defense spending surge (Germany), fiscal expansion

7 Conclusion

The complete graph K_7 analysis of seven developed nations reveals a network characterized by exceptional structural risk homogeneity alongside meaningful inflation risk premium dispersion. All members maintain AAA sovereign ratings, top-tier governance indicators, and credible monetary frameworks—collectively representing the global gold standard for low-risk developed economies.

Principal Conclusions:

1. **Structural Risk Convergence**: Zero credit risk differentials across all 21 edges; minimal variance in corruption and stability metrics
2. **Inflation Risk Spectrum**: Despite structural homogeneity, inflation risk premia range from negative (Switzerland) to moderate (Australia), reflecting idiosyncratic monetary challenges
3. **Central Bank Credibility**: All K_7 members maintain well-anchored inflation expectations despite 2021–2023 volatility, validating 20+ years of inflation-targeting frameworks
4. **Network Clustering**: Three distinct clusters emerge: Nordic excellence (DK, SE), Continental stability (CH, DE, NL), and Commonwealth strength (AU, CA)
5. **Investment Framework**: The K_7 network provides a low-risk opportunity set with differentiated inflation compensation, enabling portfolio construction based on inflation regime views

The graph-theoretic approach illuminates both aggregate network properties and bilateral edge characteristics, facilitating granular risk assessment for sovereign fixed income allocation. Future research could extend this framework to incorporate credit default swap spreads, term premium decompositions, and dynamic network analysis of time-varying correlations.

8 Glossary

Complete Graph (K_n) A graph in which every pair of distinct vertices is connected by a unique edge. For K_7, this yields $\binom{7}{2} = 21$ edges.

Corruption Perceptions Index (CPI) An annual ranking published by Transparency International measuring perceived levels of public sector corruption worldwide, scaled 0 (highly corrupt) to 100 (very clean).

Inflation Risk Premium (IRP) The additional yield investors demand to compensate for uncertainty about future inflation, typically extracted from the difference between nominal and inflation-indexed bond yields.

Real Interest Rate The nominal interest rate adjusted for inflation, calculated as $r_{\text{real}} = r_{\text{nominal}} - \pi$, where π represents inflation.

Sovereign Credit Rating An assessment of a country's creditworthiness issued by rating agencies (S&P, Moody's, Fitch), with AAA/Aaa representing the highest quality (lowest default risk).

Break-Even Inflation Rate The difference between nominal and inflation-indexed bond yields of the same maturity, representing the market's implied inflation expectations.

Central Bank Independence The degree to which a central bank operates free from political interference, generally associated with better inflation outcomes and enhanced credibility.

OECD Country Risk Classification A system categorizing countries from 0 (lowest risk) to 7 (highest risk) for export credit purposes, based on economic and political risk assessments.

Political Stability Index A World Bank governance indicator measuring perceptions of the likelihood of political instability and/or politically-motivated violence, expressed as percentile rank.

Inflation Targeting A monetary policy framework where a central bank sets an explicit inflation target (typically around 2%) and adjusts policy rates to achieve this objective over the medium term.

Graph Density The ratio of actual edges to possible edges in a graph. For a complete graph, density equals 1 (maximally dense).

Real Yield The yield on inflation-indexed bonds, or the inflation-adjusted return on nominal bonds, representing compensation for real purchasing power erosion and risk.

Basis Point (bp) One-hundredth of a percentage point (0.01%), commonly used to describe small changes in interest rates or yield spreads.

Harmonized Index of Consumer Prices (HICP) The inflation measure used by the European Central Bank for eurozone monetary policy, designed to allow cross-country comparisons.

Consumer Price Index (CPI) A measure of the average change over time in prices paid by consumers for a basket of goods and services, the most common inflation metric.

Term Premium The extra yield investors demand for holding longer-maturity bonds relative to rolling over short-term bonds, compensating for interest rate risk.

Disinflation A decrease in the rate of inflation (prices still rising but at a slower pace), distinct from deflation (absolute price declines).

Phillips Curve The inverse relationship between unemployment and inflation, suggesting that lower unemployment leads to higher inflation through wage pressures.

Quantitative Easing (QE) An unconventional monetary policy where a central bank purchases government bonds or other securities to increase money supply and stimulate the economy.

Fiscal Dominance A situation where fiscal policy constraints force the central bank to accommodate government financing needs, potentially compromising inflation objectives.

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