Compare the Indian Financial System with other BRIC Members

Shaheed Sukhdev College of Business Studies
University of Delhi

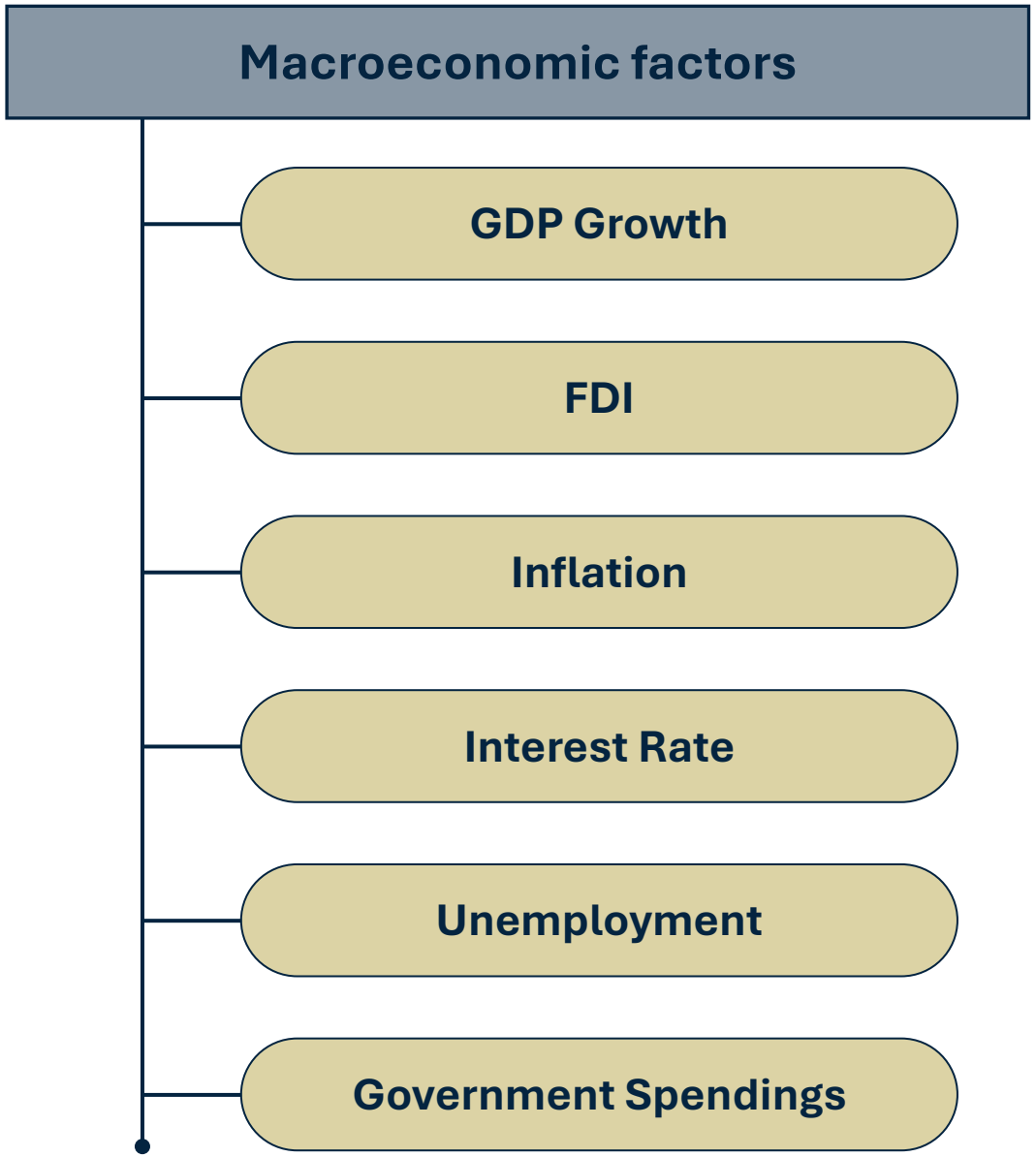
Submitted by

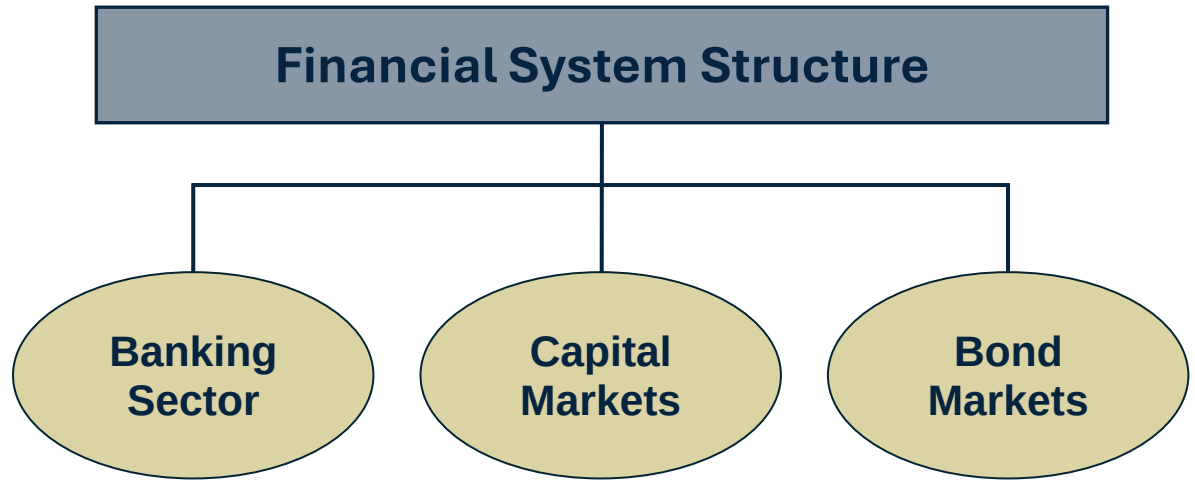
Abhishek Yadav
Roll No.: 23303

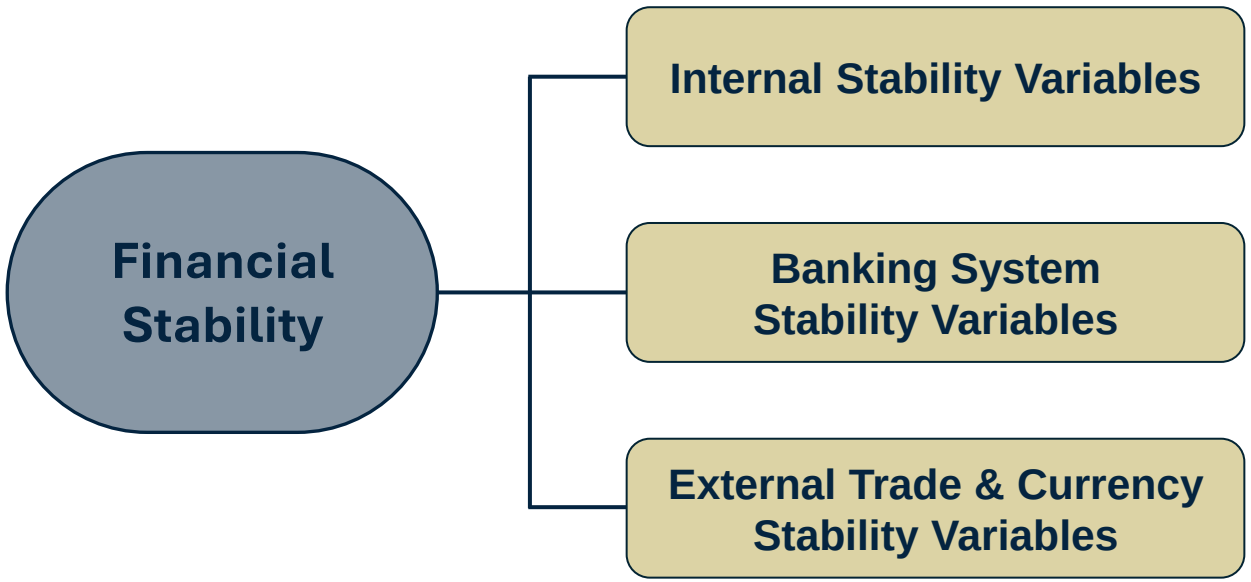
Under the Guidance of

Dr. Kumar Bijoy
(Ph.D. in Finance, M.A. in Economics,
BSc (H) in Chemistry, CFA, ICFAI)

Introduction: Parameters of Financial System Comparison



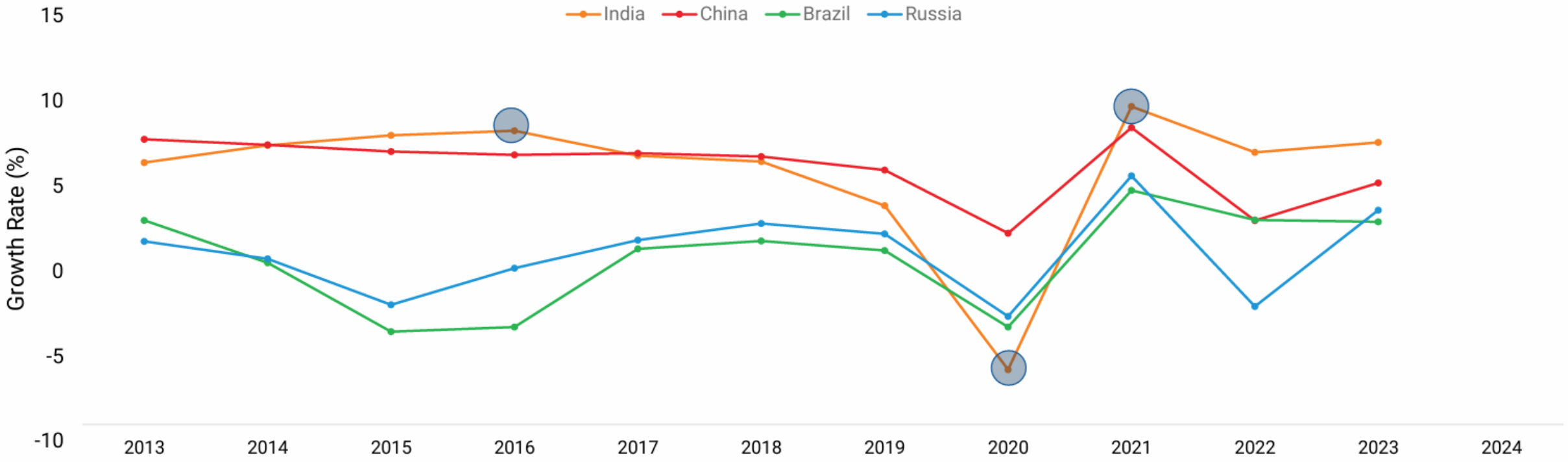




Macroeconomic Factors

GDP growth rate

GDP growth Rate (in %)



Source: BRICS Joint Statistical Publication 2023 (South Africa)

India

India's GDP showed sharp fluctuations, peaking at **8.2%** in 2017 due to reforms like GST and strong FDI. Covid caused a severe decline to **-7.3%** in 2020 due to lockdowns. A robust recovery to **8.7%** in 2021 followed, aided by government stimulus and economic reopening, before stabilizing.

China

China maintained steady growth, averaging **6-7%** from 2013-2019, driven by strong manufacturing and exports. Growth slowed to **2.3%** in 2020 due to COVID-19 but rebounded to **8.1%** in 2021 with rapid stimulus measures and export recovery, stabled the economy.

Brazil

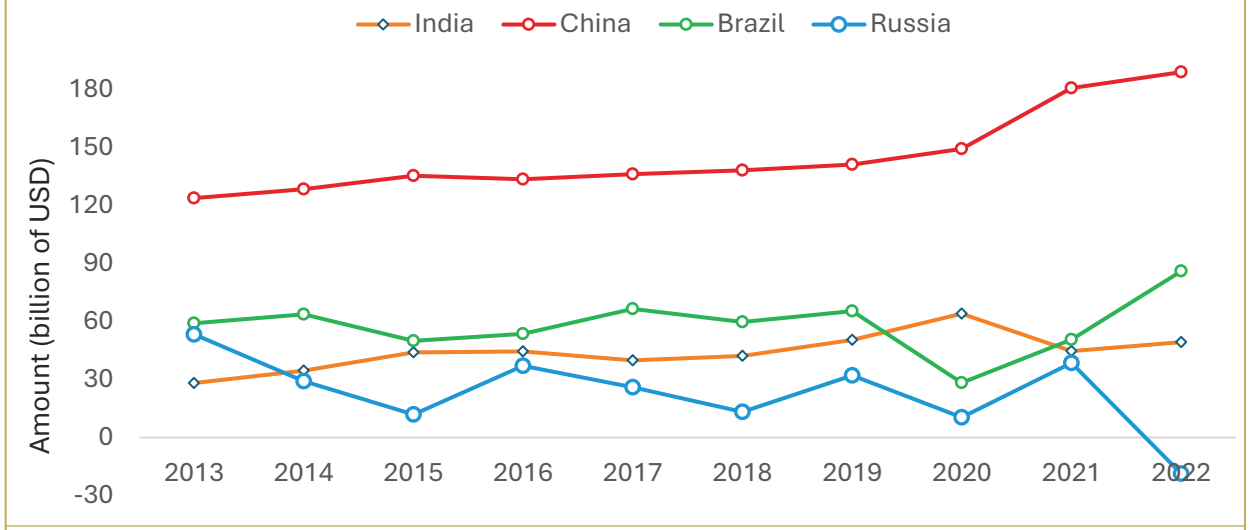
Brazil's growth was marked by volatility, with modest **1-3%** growth until 2014, followed by political and economic crises leading to recessions. A deep drop to **-3.9%** in 2020 resulted from the pandemic's impact. Recovery in 2021 to **4.6%** was spurred by commodity exports and fiscal support.

Russia

Russia saw uneven growth due to geopolitical tensions and reliance on oil exports. Pre-pandemic, it managed **1-3%** growth, dropping to **-3%** in 2020 due to reduced oil demand and pandemic effects. A recovery to **4.7%** in 2021 was driven by oil price rebounds and fiscal policies, stabilizing thereafter..

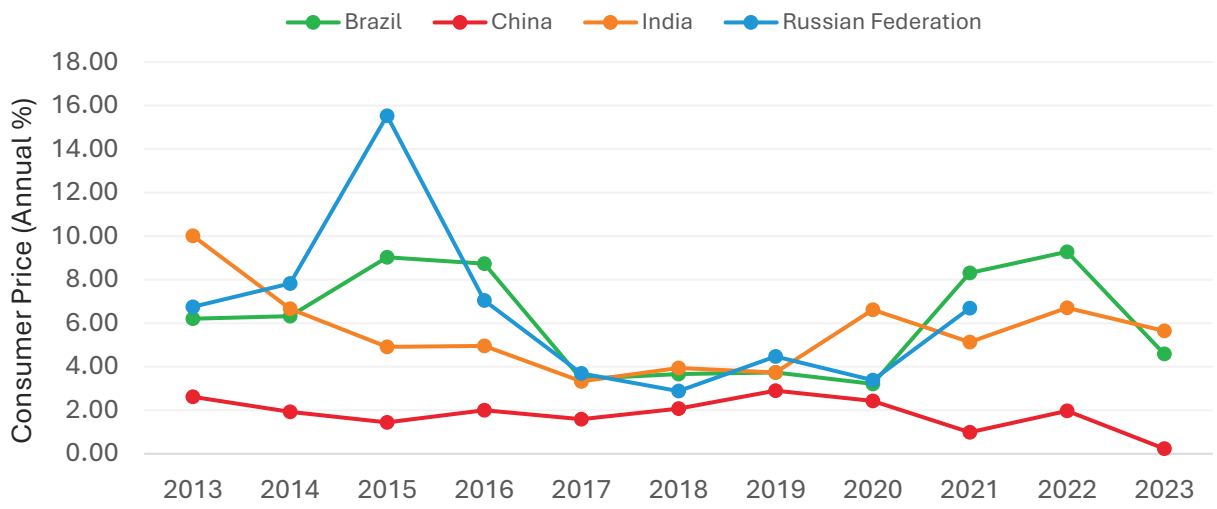
FDI Inflow, CPI, Unemployment...

FDI Inflow



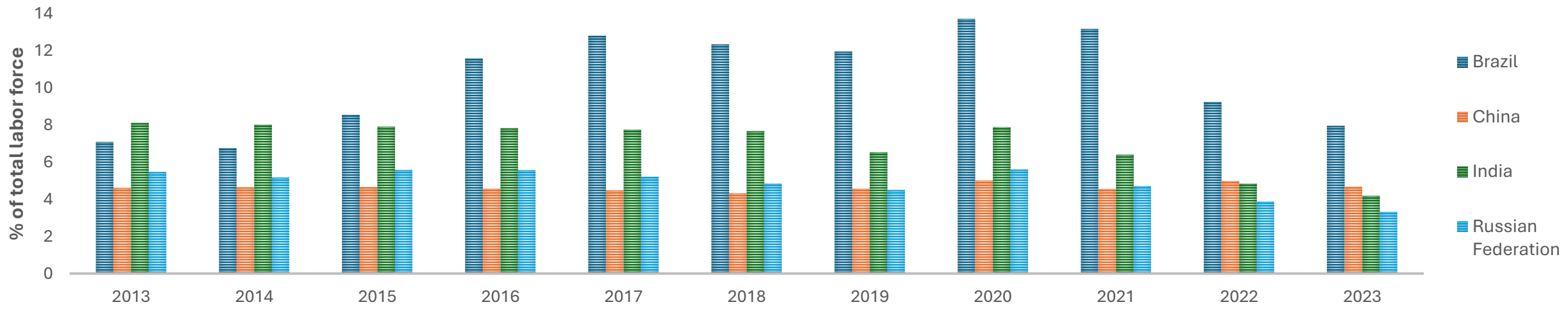
Source: World Bank

Consumer Price (Annual %)



Source: World Bank - Inflation, consumer prices (annual %)

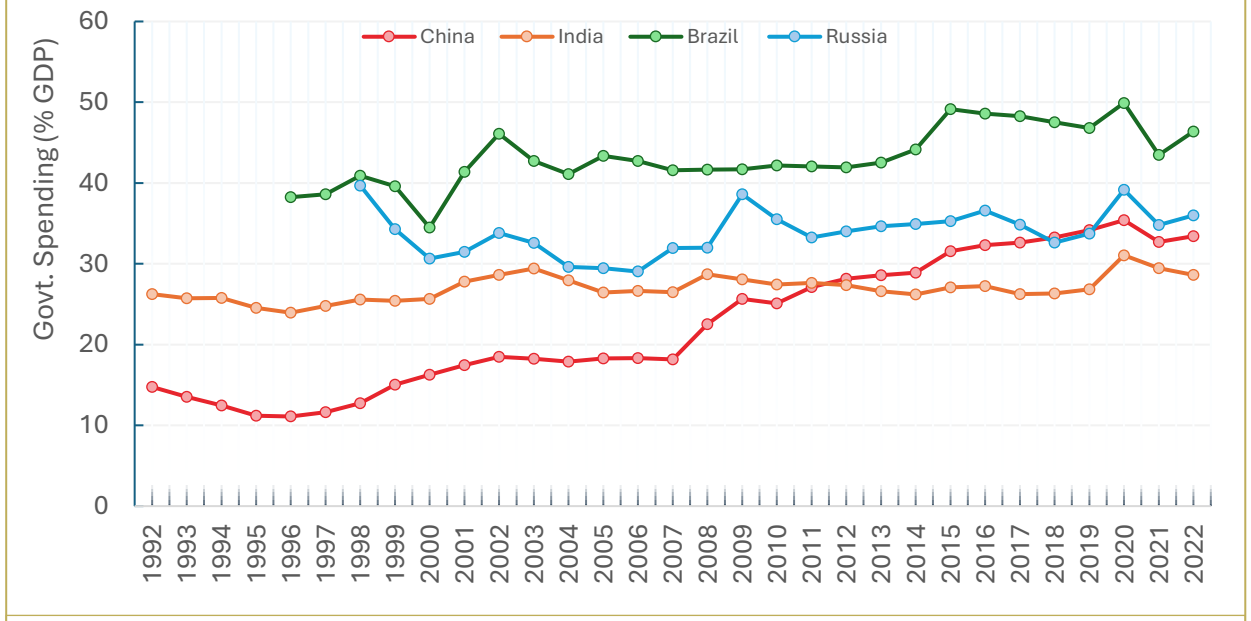
Unemployment (Modelled ILO Estimate)



International Labour Organization. "ILO Modelled Estimates and Projections database (ILOEST)" ILOSTAT. Accessed June 18, 2024

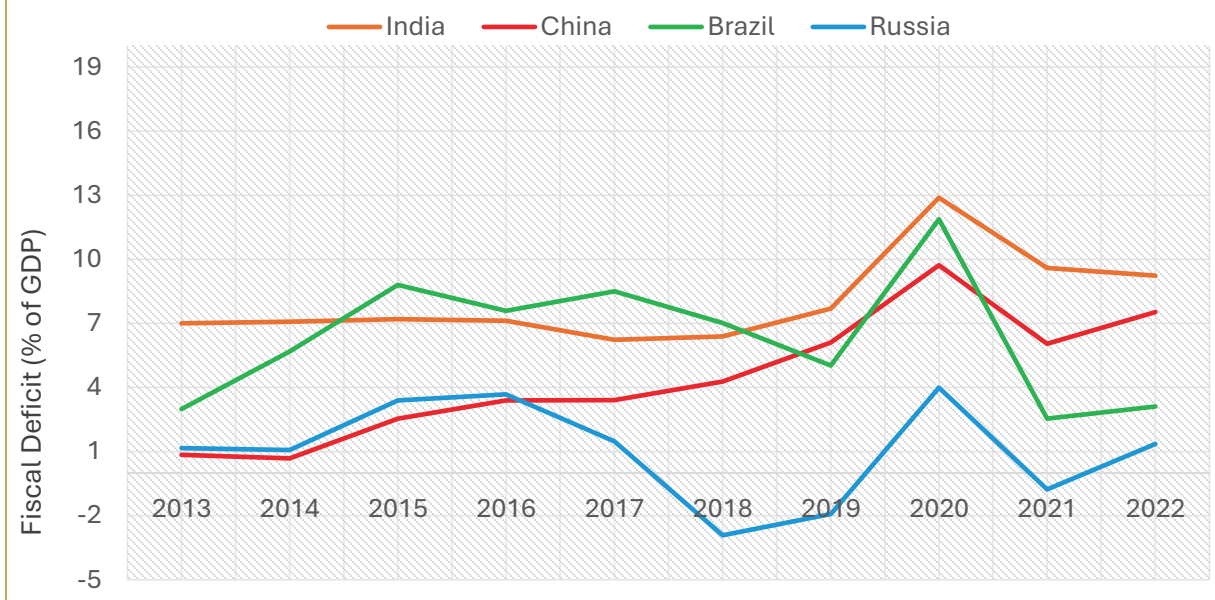
Government Spending, Fiscal Deficit & Interpretation of Correlation

Government Spendings *(%of GDP)*



Source: World Bank

Fiscal Deficit (% of GDP)



Source: BRICS Joint Statistical Publication 2023 (South Africa)

Interpretation of Microeconomic Factors of BRIC members:-

Highlighted (Yellow+Blue)	Strong Correlation
Highlighted (Blue)	Causation

India	Correlation
India GDP and Exports	0.986298403
India GDP and FDI	0.924189
India GDP and Inflation	-0.238111119
India GDP and Govt Spending	0.473108869
India GDP and Fiscal deficit	-0.038236251

China	Correlation
China GDP and Exports	0.981325919
China GDP and FDI	0.83030244
China GDP and Inflation	-0.32324921
China GDP and Govt Spending	0.948308325
China GDP and Fiscal deficit	0.680292438

Brazil	Correlation
Brazil GDP and Exports	0.910251374
Brazil GDP and FDI	0.897808971
Brazil GDP and Inflation	-0.408837476
Brazil GDP and Govt Spending	0.407788293
Brazil GDP and Fiscal deficit	-0.221859664

Russia	Correlation
Russia GDP and Exports	0.977880691
Russia GDP and FDI	0.524080557
Russia GDP and Inflation	-0.322495593
Russia GDP and Govt Spending	0.240713067
Russia GDP and Fiscal deficit	0.080849683

Granger Causality Analysis

Pairwise Granger Causality Tests
Date: 11/17/24 Time: 04:08
Sample: 1992 2023
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
INDIA__FI_ does not Granger Cause INDIA__GDP_	29	4.62725	0.0200
INDIA__GDP_ does not Granger Cause INDIA__FI_		10.0901	0.0007

India's FDI Predicts India's GDP	Foreign Direct Investment (FDI) inflows significantly influence GDP growth, acting as a critical driver of economic development through capital formation and job creation.
India's GDP Predicts India's FDI	GDP growth attracts more FDI inflows, as a growing economy signals stability, improved market opportunities, and better returns for foreign investors.

Pairwise Granger Causality Tests
Date: 11/17/24 Time: 22:01
Sample: 1992 2024
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
RUSSIA__FISCAL_DEFICIT_ does not Granger Cause RUSSIAN___EXPORT_	22	1.77778	0.1990
RUSSIAN___EXPORT_ does not Granger Cause RUSSIA__FISCAL_DEFICIT_		3.89084	0.0406

Russia's Fiscal Deficit Granger Causes Russian Exports	No significant relationship
Russian Exports Granger Cause Russia's Fiscal Deficit	Russian Exports significantly Granger Cause the Fiscal Deficit.

The results suggest that changes in Russian exports can help predict future changes in fiscal deficit. This implies that export performance plays a crucial role in influencing the fiscal health of Russia.

Pairwise Granger Causality Tests
Date: 11/17/24 Time: 04:15
Sample: 1992 2023
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
BRAZIL__FI_ does not Granger Cause BRAZIL__GDP_	29	2.22305	0.1301
BRAZIL__GDP_ does not Granger Cause BRAZIL__FI_		7.13695	0.0037

Brazil's FDI Granger Causes Brazil's GDP	No significant relationship
Brazil's GDP Granger Causes Brazil's FDI	Brazil's GDP significantly Granger Causes FDI

The results suggest that changes in Brazil's GDP can help predict future changes in FDI inflows. This implies that a growing economy attracts more foreign investment.

Pairwise Granger Causality Tests
Date: 11/17/24 Time: 04:11
Sample: 1992 2023
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
CHINA__GOVT_SPENDING_ does not Granger Cause CHINA__GDP_	1033	0.00000	0.0000
CHINA__GDP_ does not Granger Cause CHINA__GOVT_SPENDING_		0.92419	8E-304

China's Government Spending Granger Causes China's GDP	China's Government Spending significantly Granger Causes GDP
China's GDP Granger Causes China's Government Spending	High significant relationship

The results suggest that changes in government spending can help predict future changes in GDP. This implies that government spending plays a crucial role in influencing economic growth in China.

Regression Analysis of Macroeconomic factors (1/2)

India GDP Regression Analysis

Regression Statistics	
Multiple R	0.99218829
R Square	0.9844376
Adjusted R Square	0.98132512
Standard Error	134.278199
Observations	31

ANOVA

	df	SS	MS	F	Significance F
Regression	5	28514293.7	5702858.7	316.28719	9.444E-22
Residual	25	450765.867	18030.635		
Total	30	28965059.6			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	2186.40981	713.992597	3.0622304	0.005197	715.91453	3656.9051	715.914531	3656.90509
India (FI)	10.7660934	3.14436487	3.4239326	0.0021355	4.2901527	17.242034	4.29015272	17.2420341
India (inflation)	-31.742189	8.7126483	-3.6432308	0.0012308	-49.68622	-13.79815	-49.6862238	-13.7981537
India(Govt spending)	-85.948072	32.7957015	-2.6207115	0.0147124	-153.4921	-18.40406	-153.492084	-18.4040607
India (Fiscal deficit)	55.0181581	24.8386542	2.2150217	0.0360973	3.8619922	106.17432	3.86199221	106.174324
India (Export)	3.71402084	0.27048948	13.730741	3.797E-13	3.1569373	4.2711043	3.15693733	4.27110434

China Macroeconomic Factors Regression Analysis

Regression Statistics	
Multiple R	0.993524
R Square	0.98708994
Adjusted R Square	0.98450792
Standard Error	709.521023
Observations	31

ANOVA

	df	SS	MS	F	Significance F
Regression	5	9.62E+08	1.92E+08	382.2948	9.1708E-23
Residual	25	12585502	503420.1		
Total	30	9.75E+08			

	Coefficients	andard Err	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	-1865.8219	817.1635	-2.28329	0.03118	-3548.8016	-182.8421	-3548.8016	-182.84211
China (FI)	-4.0218904	3.865518	-1.04045	0.308088	-11.983073	3.9392926	-11.983073	3.93929264
China (inflation)	34.3463065	26.30146	1.305871	0.203486	-19.822561	88.515174	-19.822561	88.515174
China (Govt spending)	71.2144384	56.27534	1.265464	0.217372	-44.686792	187.11567	-44.686792	187.115669
china (Fiscal deficit)	410.753677	88.9971	4.61536	0.000101	227.460717	594.04664	227.460717	594.046637
China (Export)	4.30446082	0.477422	9.016057	2.48E-09	3.32119253	5.2877291	3.32119253	5.28772911

Factors	Interpretation
FDI	Strong positive impact on GDP, boosting economic activity and job creation.
Inflation	Negative impact on GDP, as higher inflation reduces purchasing power and discourages investment.
Government Spendings	Negative impact on GDP, possibly due to inefficiencies and crowding out of private investment.
Fiscal Deficit	Positive but less significant impact, indicating limited effectiveness of government borrowing in stimulating growth.
Exports	Strong positive impact on GDP, driven by job creation and foreign exchange from exports.

Factors	Interpretation
FDI	No significant impact on GDP, likely due to strict regulations and a focus on domestic investment.
Inflation	No significant impact on GDP, as inflation is effectively managed through government policies.
Government Spendings	No significant impact on GDP, possibly due to spending inefficiencies or reliance on other growth drivers.
Fiscal Deficit	Strong positive impact on GDP, indicating that government borrowing effectively stimulates economic activity.
Exports	Strong positive impact on GDP, driven by job creation and foreign exchange from exports.

Regression Analysis of Macroeconomic factors (2/2)

Brazil Macroeconomic Factors Regression Analysis

Regression Statistics	
Multiple R	0.959613268
R Square	0.920857624
Adjusted R Square	0.902014201
Standard Error	215.5809771
Observations	27

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	5	11355952.53	2271190.507	48.86891448	7.33866E-11
Residual	21	975978.3115	46475.15769		
Total	26	12331930.85			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1015.616756	678.5829472	1.496672972	0.149357829	-395.5737356	2426.807248	-395.5737356	2426.807248
Brazil (FI)	13.91214181	2.859866135	4.86461294	8.25673E-05	7.964724598	19.85955902	7.964724598	19.85955902
Brazil (inflation)	-5.080369822	14.28813898	-0.355565538	0.72571265	-34.79418146	24.63344181	-34.79418146	24.63344181
Brazil (Govt spending)	-20.28207523	18.78426864	-1.079737286	0.292504667	-59.34610035	18.78194989	-59.34610035	18.78194989
Brazil (Fiscal deficit)	11.13362324	21.80448808	0.51061154	0.614948973	-34.21129206	56.47853853	-34.21129206	56.47853853
Brazil (Export)	3.332399601	1.048716201	3.177599045	0.004532935	1.151474869	5.513324332	1.151474869	5.513324332

Factors	Interpretation
FDI	Strong positive impact on GDP, boosting economic activity and job creation.
Inflation	No significant impact on GDP, indicating that inflation rate changes do not strongly influence growth.
Government Spendings	No significant impact on GDP, suggesting inefficiencies in stimulating economic activity.
Fiscal Deficit	Positive but not significant impact, indicating limited effectiveness of government borrowing in driving growth.
Exports	Significant positive impact on GDP, driven by job creation and foreign exchange from exports.

Russia Macroeconomic Factors Regression Analysis

Regression Statistics	
Multiple R	0.994802235
R Square	0.989631487
Adjusted R Square	0.986751345
Standard Error	78.08503854
Observations	24

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	5	10475269.62	2095053.925	343.6050578	3.36874E-17
Residual	18	109750.9184	6097.273243		
Total	23	10585020.54			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	187.7878002	672.800674	0.279113573	0.783339271	-1225.713964	1601.289565	-1225.713964	1601.289565
Russian (FI)	0.463057839	1.118322663	0.414064611	0.683718962	-1.886450892	2.812566569	-1.886450892	2.812566569
Russian (inflation)	-1.89843407	1.375056572	-1.380622521	0.184299503	-4.787320728	0.990452588	-4.787320728	0.990452588
Russia (Govt spending)	-7.669987534	19.55702632	-0.392185775	0.699525845	-48.75777518	33.41780011	-48.75777518	33.41780011
Russia (Fiscal deficit)	4.733319041	14.11268491	1.752559432	0.096693867	-4.916331727	54.38296981	-4.916331727	54.38296981
Russian (Export)	13.70690118	0.159979418	23.17111302	7.48561E-15	3.370796893	4.043005463	3.370796893	4.043005463

Factors	Interpretation
FDI	No significant impact on GDP growth, likely due to geopolitical risks and lack of investment-friendly policies.
Inflation	No significant impact on GDP, possibly due to the economy's reliance on commodities and effective inflation control by the Central Bank.
Government Spendings	No significant impact on GDP, suggesting inefficiency in stimulating private investment.
Fiscal Deficit	Positive but insignificant impact, indicating limited effectiveness of government borrowing in stimulating growth.
Exports	Strong positive impact on GDP, driven by the significant role of commodity exports in the economy.

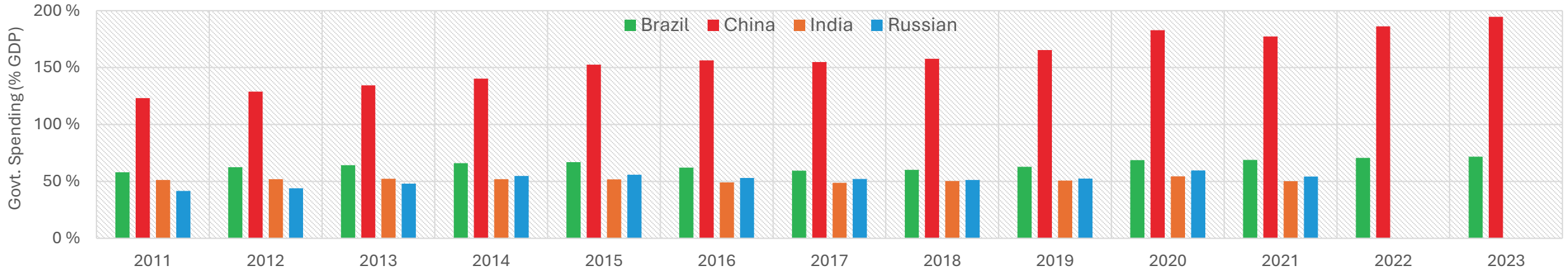
Findings so far...

India	➢ India's financial system is shaped by its dynamic nature and capacity for reforms, exemplified by initiatives like *Make in India* and GST, which attract FDI and strengthen export performance.
	➢ Persistent issues with inflation management erode purchasing power and stifle investments, while high fiscal deficits strain public finances and hinder sustainability.
	➢ Strengthening fiscal discipline and improving government spending efficiency are crucial for achieving long-term stability and resilience in the financial system.
China	❑ China's financial system is anchored by its dominance in manufacturing and exports, with strong government-driven fiscal policies ensuring resource allocation efficiency.
	❑ As the economy matures, growth is slowing, exposing vulnerabilities such as overreliance on external trade and challenges in boosting domestic consumption.
	❑ To ensure long-term robustness, China must transition to a balanced economy by reducing export dependency and leveraging fiscal policies to stimulate innovation and internal demand.
Brazil	➢ Brazil relies on exports and FDI for GDP growth, but systemic weaknesses and inefficiencies limit their overall impact.
	➢ High unemployment and dependence on commodity exports make the financial system susceptible to global demand fluctuations and external shocks.
	➢ Structural and social reforms, including improving labor market efficiency and reducing inequality, are critical to diversifying and strengthening Brazil's financial system.
Russia	❑ Russia's financial system relies heavily on energy exports, providing short-term revenue but making the economy vulnerable to commodity cycles and global market shifts.
	❑ Weak integration of factors like FDI and government spending highlights inefficiencies in diversifying the economy and leveraging fiscal policies.
	❑ To build a more balanced and robust financial system, Russia must invest in non-energy sectors and implement reforms to reduce its reliance on volatile external markets.

Analyzing the Structure of Financial System

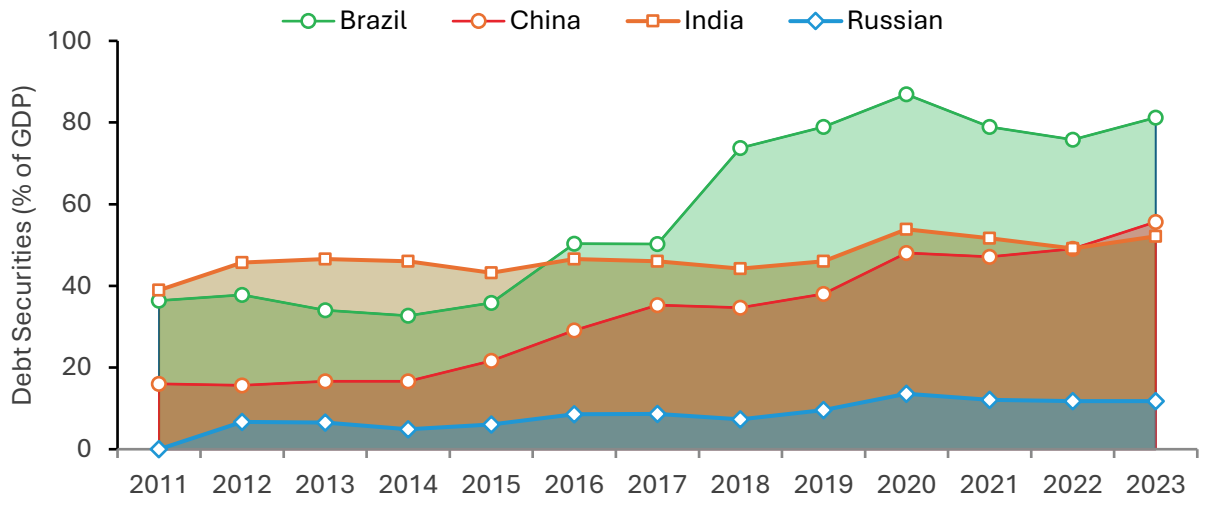
Market Structure data in BRIC Economies

Domestic credit to private sector (%of GDP)



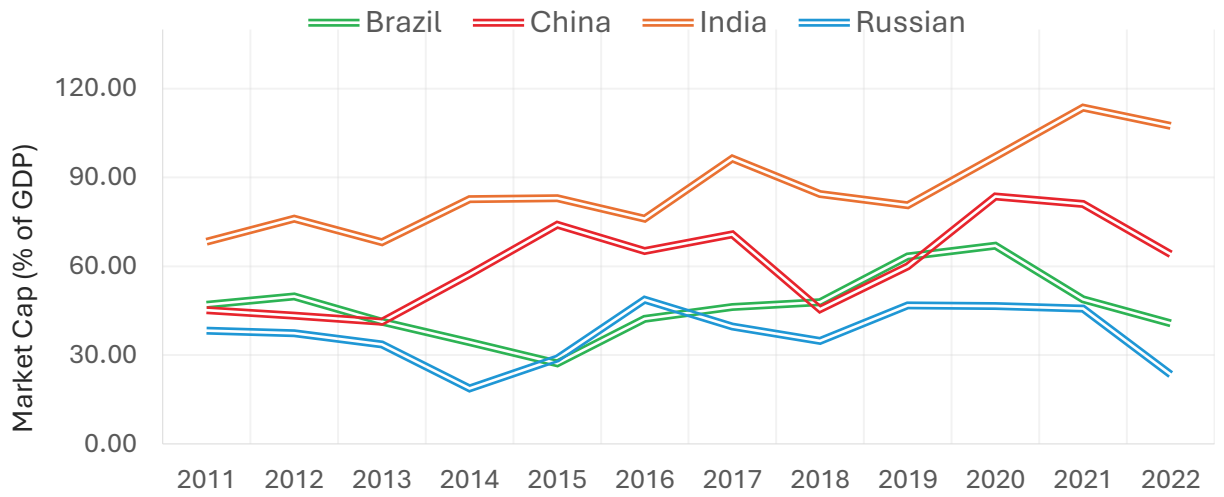
Source: World Bank - Domestic credit to private sector (%of GDP)

Debt Securities (% of GDP)



Source: BIS Data Portal- Debt Securities (% of GDP)

Market capitalization of listed domestic companies (% of GDP)



Source: World Bank - Market capitalization of listed domestic companies (% of GDP)

Regression Analysis of Market Structure (1/2)

INDIA REGRESSION ANALYSIS

Regression Statistics	
Multiple R	0.932698129
R Square	0.869925800
Adjusted R Square	0.867617133
Standard Error	0.057862827
Observations	10

ANOVA

	df	*SS*	*MS*	*F*	*ignificance F*
Regression	3	0.041336481	0.013778827	4.115408457	0.041418
Residual	6	0.020088641	0.003348107		
Total	9	0.061425122			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*pper 95.0%*
Intercept	3.63309443	0.629011027	5.775883531	0.001176661	2.09396	5.172229	2.09396	5.172229
Domestic creditor to private sector	0.016401593	0.014357143	-1.142399476	0.029681736	-0.05153	0.018729	-0.05153	0.018729
Market Capitalisation of Domestic	0.02772464	0.002205074	1.689122742	0.001421579	-0.00167	0.00912	-0.00167	0.00912
Debt outstanding (% GDP)	0.005585651	0.009574663	0.583378342	0.480888943	-0.01784	0.029014	-0.01784	0.029014

Factors	Coefficient & P-values	Interpretation
Domestic creditor to private sector	**Coefficient = 0.016401** (positive & impactful) **P-value = 0.029681** (significant)	Suggests a reliance on **bank-based financing.**
Market Capitalization of Domestic Companies	**Coefficient = 0.027724** (positive) **P-value = 0.001421** (significant)	Indicates a strong reliance on **market-based financial activities**
Debt Outstanding	**Coefficient = 0.005585** (positive & less influence) **P-value = 0.480888** (less significant)	Suggests minimal reliance on **debt financing.**
India's financial system shows a balanced reliance on **both bank-based and market-based activities**, with significant contributions from domestic credit and market capitalization. However, debt financing plays a negligible role in the system.		

CHINA REGRESSION ANALYSIS

Regression Statistics	
Multiple R	0.959979533
R Square	0.921560703
Adjusted R Square	0.887943862
Standard Error	0.035122713
Observations	11

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	0.101452887	0.033817629	27.413661	0.00030494
Residual	7	0.008635235	0.001233605		
Total	10	0.110088122			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	3.484308161	0.270672807	12.87276767	3.964E-06	2.84426868	4.124347646	2.84426868	4.124347646
Domestic creditor to private se	0.006533955	0.002551185	1.424418761	0.0197343	-0.00239864	0.009666548	-0.00239864	0.009666548
Market Capitalisation of Dome	-0.001521526	0.001122611	-0.909955087	0.3930995	-0.00367608	0.001633028	-0.00367608	0.001633028
Debt outstanding (% GDP)	0.004060647	0.003398088	0.959553211	0.3692427	-0.00477456	0.011295849	-0.00477456	0.011295849

Factors	Coefficient & P-values	Interpretation
Domestic creditor to private sector	**Coefficient = 0.006533** (positive) **P-value = 0.019734** (significant)	Significant positive relationship; supports the argument for a **bank-based economy.**
Market Capitalization of Domestic Companies	**Coefficient = -0.001521** (negative) **P-value = 0.393099** (insignificant)	Not significant; weak or no evidence of a **market-based** financial structure.
Debt Outstanding	**Coefficient = 0.0040606** (positive & less influence) **P-value = 0.369242** (very less significant)	Not more significant; does not provide strong evidence of being bank-based or market-based.
China appears to be more **bank-based** than market-based, as evidenced by the significance of the domestic credit variable. The lack of significance for market capitalization further strengthens this conclusion.		

Regression Analysis of Market Structure (2/2)

RUSSIA - REGRESSION ANLAYSIS

Regression Statistics	
Multiple R	0.902479235
R Square	0.81446877
Adjusted R Square	0.734955386
Standard Error	0.04608304
Observations	11

ANOVA

	df	SS	MS	F	Significance F
Regression	3	0.065258591	0.021752864	10.24316571	0.00592329
Residual	7	0.014865526	0.002123647		
Total	10	0.080124117			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	4.386088802	0.229601023	19.10308907	2.68147E-07	3.843168653	4.92900895	3.843168653	4.92900895
Domestic creditor to private sector (% GDP)	0.025067749	0.004476518	-4.48289281	0.00285634	0.010065303	0.020094825	0.010065303	0.020094825
Market Capitalisation of Domestic compnaies (% GDP)	-0.012044198	0.001857772	-4.760648594	0.002057914	-0.01323713	-0.004451266	-0.01323713	-0.004451266
Debt outstanding (% GDP)	0.015014211	0.007836592	3.591116174	0.008843958	0.009611516	0.046672706	0.009611516	0.046672706

Factors	Coefficient & P-values	Interpretation
Domestic creditor to private sector	**Coefficient = 0.025067** (positive & impactful) **P-value = 0.002856** (significant)	Credit to the private sector shows a strong influence, Suggesting a **bank-based financial system.**
Market Capitalization of Domestic Companies	**Coefficient = -0.012044** (negative) **P-value = 0.002057** (significant)	The negative relationship indicates that higher market capitalization corresponds to weaker reliance on **market-based financing.**
Debt Outstanding	**Coefficient = 0.015014** (positive & less influence) **P-value = 0.008843** (significant)	The positive coefficient indicates debt levels are relevant in explaining financial dynamics, potentially reflecting a mixed financial structure.
Russia's financial system is mixed but leans heavily toward being **bank-based**, with state-controlled banks dominating and capital markets less developed compared to other BRIC nations.		

BRAZIL - REGRESSION ANLAYSIS

Regression Statistics	
Multiple R	0.766808949
R Square	0.587995964
Adjusted R Square	0.411422806
Standard Error	0.056058948
Observations	11

ANOVA

	df	SS	MS	F	Significance F
Regression	3	0.031395023	0.010465008	3.330041613	0.08603734
Residual	7	0.021998239	0.003142606		
Total	10	0.053393262			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	ower 95.0%	pper 95.0%
Intercept	3.524363725	0.374148581	9.419690199	3.16842E-05	2.639642916	4.409085	2.639643	4.409085
Domestic creditor to private	-0.001750112	0.005538347	-0.315998907	0.761217042	-0.014846221	0.011346	-0.01485	0.011346
Market Capitalisation of Dom	0.021100297	0.002424812	0.453765962	0.006637308	-0.004633473	0.006834	-0.00463	0.006834
Debt outstanding (% GDP)	-0.002901991	0.001367809	-2.121635389	0.071548507	-0.006136345	0.000332	-0.00614	0.000332

Factors	Coefficient & P-values	Interpretation
Domestic creditor to private sector	**Coefficient = -0.0017501** (negative) **P-value = 0.761217** (insignificant)	Weak relationship with the financial system, suggesting limited dependence on private-sector lending.
Market Capitalization of Domestic Companies	**Coefficient = 0.021100** (positive) **P-value = 0.004633** (significant)	Indicates a notable relationship, suggesting some reliance on **market-based** financial activities.
Debt Outstanding	**Coefficient = -0.002901** (negative) **P-value = 0.071548** (insignificant)	Weak negative relationship, indicating limited dependence on debt financing as a measure of financial activity.
The financial system leans slightly toward **market-based activities**, with market capitalization showing a significant positive impact, while bank financing and debt reliance appear weaker and less significant.		

PCA test

Comparative Analysis of Financial Stability in BRIC Nations Using PCA (2010–2023)

PCA is a statistical tool used for dimensionality reduction and identifying patterns in data. We have used this analysis to identify the primary factors responsible for the variation in the data.

Zoom In to view Data

Data Used

Year	Country	Growth Volatility	CPI Volatility	Fiscal Deficit % GDP	CAR	NPL % Gross Loans	Banks ROE % After Tax	Banks ROA %	Current Account Balance % GDP	Total Reserves in Months of Import	Exchange Rate Z Score
2010	Brazil	2.6	0.7063	3.11	14.3	2.17	11.63	1.13	-3.9	15.67	-0.43
2010	China	1.86	2.3505	0.36	13	1.24	13.46	1.062	3.9	16.95	-1.12
2010	India	1.99	2.672	8.63	12.4	4	1.77	0.333	-3.3	9.32	-1.18
2010	Russia	5.97	2.4588	3.19	12.6	6.44	6.72	0.338	4.4	12.95	0.3
2011	Brazil	2.59	0.9841	2.34	14.53	2.44	11.73	1.175	-3.2	16.03	-1.19
2011	China	1.82	2.429	0.1	13.34	1.37	13.51	1.037	1.8	16.7	-1.13
2011	India	2.02	3.0045	8.35	12.5	4.93	2.74	0.39	-3.4	9.52	-1.02
2011	Russia	5.58	2.5658	-1.43	12.51	7.11	9.49	0.603	4.8	13.11	0.31
2012	Brazil	2.63	0.619	1.67	14.76	2.71	11.83	1.22	-3.8	16.4	-2.11
2012	China	0.89	2.395	0.3	13.67	1.5	13.56	1.012	2.5	16.44	-1.94
2012	India	1.95	2.8259	7.55	12.6	5.85	3.7	0.447	-5	9.71	-2.01
2012	Russia	4.94	3.2586	-0.38	12.41	7.78	12.26	0.868	3.2	13.27	0.21
2013	Brazil	2.53	0.6774	2.98	15	2.98	11.93	1.265	-3.6	16.77	-2.09
2013	China	1.09	2.0058	0.84	14.01	1.63	13.61	0.987	1.5	16.18	-1.97
2013	India	1.29	2.7948	7	12.7	6.78	4.67	0.504	-2.6	9.91	-1.93
2013	Russia	4.68	2.2188	1.16	12.31	8.45	15.02	1.133	1.5	13.43	0.22
2014	Brazil	2.37	0.6008	5.69	15.23	3.25	12.03	1.31	-4.5	17.14	0.62
2014	China	1.24	1.2315	0.68	14.34	1.76	13.66	0.962	2.3	15.91	0.62
2014	India	1.22	1.5021	7.07	12.8	7.71	5.63	0.561	-1.3	10.1	0.61
2014	Russia	1.53	1.1397	1.07	12.21	9.12	17.78	1.397	2.8	13.59	0.52
2015	Brazil	2.63	1.2244	8.8	15.88	2.25	12.6	1.22	-3.5	14.65	0.89
2015	China	0.86	1.3974	2.54	13.08	1.25	14.8	1.063	2.6	17.94	0.64
2015	India	1.07	1.6354	7.2	12.7	4.35	3.4	0.249	-1.1	8	0.63
2015	Russia	2.3	3.5865	3.39	12.71	6.81	2.4	0.34	5	12.38	0.49
2016	Brazil	2.68	1.4615	7.58	16.36	2.85	11.9	1.153	-1.7	16.6	0.34
2016	China	0.4	0.389	3.39	13.3	1.67	13.2	0.958	1.7	16.72	0.66
2016	India	1.04	0.9958	7.12	12.98	5.88	5.4	0.408	-0.5	8.43	0.61
2016	Russia	1.96	3.651	3.67	12.43	8.38	11	1.133	1.9	13.23	0.45
2017	Brazil	2.59	2.0271	8.5	17.2	3.08	11.6	1.196	-1.2	14.86	0.53
2017	China	0.34	0.393	3.4	13.23	1.74	13.4	0.987	1.5	15.42	0.55
2017	India	0.7	1.1257	6.23	12.9	9.19	-3.2	-0.248	-1.4	8.16	0.53
2017	Russia	1.39	3.9434	1.47	12.65	9.24	9	0.603	2	12.49	0.46
2018	Brazil	2.3	2.3865	7.01	17.49	2.88	12.6	1.33	-2.9	13.16	0.66
2018	China	0.23	0.254	4.28	13.66	1.74	11.7	0.895	0.2	13.14	0.65
2018	India	0.69	1.0488	6.38	14.27	9.98	-1.6	-0.122	-2.4	6.9	0.67
2018	Russia	1.62	4.4872	-2.92	12.4	9.66	13.5	1.699	7	12.87	0.48
2019	Brazil	2.39	2.5852	5.03	17.84	2.6	15.6	1.693	-3.6	12.13	0.54
2019	China	0.39	0.5531	6.1	14.23	1.83	11.2	0.904	0.7	13.75	0.61
2019	India	1.56	0.6492	7.69	14.41	9.46	2	0.164	-1	8.27	0.61
2019	Russia	1.72	4.6223	-1.93	12.18	9.75	15.6	1.988	3.9	14.49	0.46
2020	Brazil	2.32	2.0982	11.87	16.35	2.66	9.3	0.987	-1.9	14.77	0.76
2020	China	1.79	0.5234	9.72	14.42	1.86	10.3	0.85	1.7	14.68	0.55
2020	India	5.05	1.1827	12.88	15.1	9.23	8	0.664	1.2	12.93	0.61
2020	Russia	1.96	1.4727	3.99	12.5	8.83	11	1.376	2.4	18.62	0.48
2021	Brazil	2.57	1.9238	2.54	16.57	1.87	13.2	1.324	-2.8	10.97	0.58
2021	China	2.08	0.7677	6.04	14.59	1.84	10.2	0.86	2	11.6	0.58
2021	India	5.32	1.1988	9.6	14.28	7.94	10.2	0.849	-1.1	9.84	0.6
2021	Russia	2.66	1.3387	-0.77	13.5	8.16	6.55	0.229	6.8	15.12	0.47
2022	Brazil	2.68	2.5988	3.1	16.05	2.08	12	1.326	-2.5	8.24	0.47
2022	China	2.33	0.7363	7.52	15	1.73	11	0.862	2.5	11.13	0.67
2022	India	5.34	1.266	9.24	15.75	6.54	10.6	0.85	-2.4	7.01	0.68
2022	Russia	3.12	3.9846	1.36	14	6.1	7	0.23	10.5	16.1	-2.21
2023	Brazil	2.74	2.4816	3.1	15.77	2.64	11.5	1.328	-1.4	9.37	0.43
2023	China	2.21	1.0419	7.52	14.85	1.66	12	0.864	1.4	11.78	0.63
2023	India	5.45	1.0933	9.24	16.43	4.81	11	0.851	-0.9	7.99	0.59
2023	Russia	3.22	3.6464	1.36	14.5	5.51	7.5	0.231	2.5	16.27	-2.65

Methodology

Deciding variables to be considered

↓

Collection of Data

↓

Formatting the Data in Suitable Format

↓

Importing Data in Minitab

↓

Click on Stat > Multivariate > Principal Components

↓

Select Variables and select needed graphs

↓

Window pops up with PCA table and graphs

Data collection from:-

- https://databank.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG
- https://data.bis.org/topics/DSS/tables-and-dashboards
- https://prosperitydata360.worldbank.org/en/indicator/WB+CCDFS+fby
- https://www.ceicdata.com/en/indicator/capital-adequacy-ratio
- https://data.worldbank.org/indicator/FB.AST.NPER.ZS
- https://data.worldbank.org/indicator/FI.RES.TOTL.MO?view=map
- https://fred.stlouisfed.org/seriesBeta/DDEI06INA156NWDB

Variables Considered

Internal Stability Variables

- **Growth Volatility:** Measures fluctuations in economic growth rates, indicating macroeconomic stability.
- **CPI Volatility:** Tracks variations in inflation rates, which influence monetary policy effectiveness
- **Fiscal Deficit (% of GDP):** Represents the government's budgetary discipline and fiscal health.

Banking System Stability Variables

- **Capital Adequacy Ratio (CAR):** Indicates the resilience of banks to financial shocks.
- **Non-Performing Loans (% of Gross Loans):** Measures the quality of assets held by banks.
- **Banks' Return on Equity (ROE % After Tax):** Evaluates profitability relative to shareholder equity.
- **Banks' Return on Assets (ROA %):** Assesses profitability relative to total assets.

External Trade and Currency Stability Variables

- **Current Account Balance (% of GDP):** Reflects the trade balance and net income from abroad.
- **Total Reserves (Months of Import):** Indicates the country's ability to meet import obligations using foreign reserves.
- **Exchange Rate Z Score:** Quantifies the volatility of the domestic currency in global markets.

PCA Insights for India (1/4)

Key Observations

Variance Explained

- **PC1 explains 44.8% of the variability, with PC2 adding 29.4%,** bringing the cumulative variance explained to 74.2%. This indicates a balanced distribution of influence across the components.

Dominant Variables in PC1

- **Growth Volatility (0.421)**
  - India's growth dynamics dominate the first component, showing the critical role of economic expansion in explaining variability.
- **CAR (0.396)**
  - A strong banking system is equally important in India, highlighting the interconnectedness of financial stability and economic growth.
- **Fiscal Deficit (0.378)**
  - The fiscal deficit plays a significant role, reflecting India's reliance on fiscal policies to drive growth and manage development.

CPI Volatility (-0.255)

- While CPI volatility appears in PC1, its impact is weaker than in Brazil, showing a relatively lower sensitivity to inflation variability.

PC2 - Banks ROE (-0.247) and Exchange Rate (0.438)

- Banking profitability and currency fluctuations significantly impact PC2, indicating their secondary importance.

Interpretation

- India's data highlights a dual focus on growth management and financial stability. Growth volatility, fiscal deficits, and banking capital adequacy jointly define economic variability, underscoring the challenge of balancing expansion with fiscal discipline.
- Unlike China and Brazil, India's sensitivity to banking profitability (ROE, ROA) is less pronounced, indicating broader economic diversification.

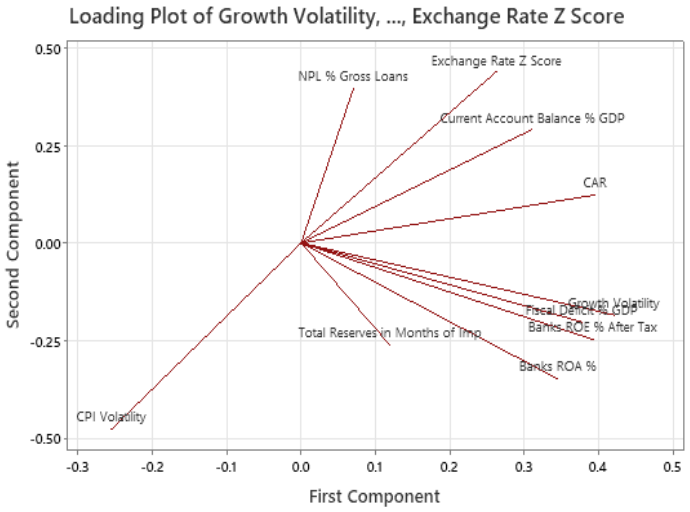
Eigenanalysis of the Correlation Matrix

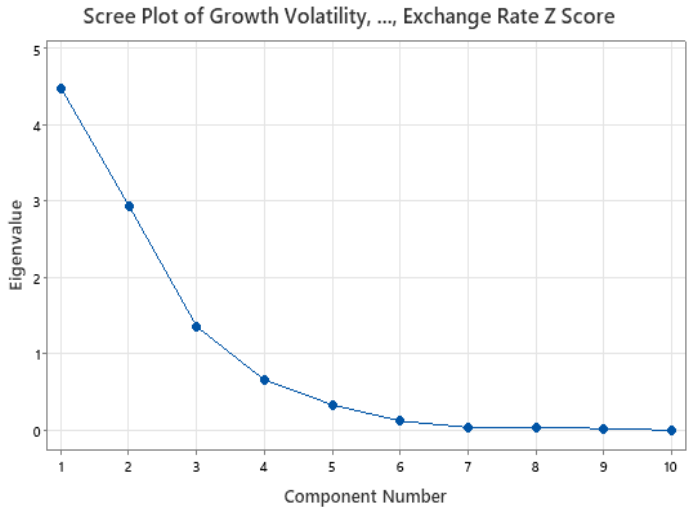
Eigenvalue	4.479	2.940	1.359	0.658	0.335	0.123	0.039	0.038	0.025	0.003
Proportion	0.448	0.294	0.136	0.066	0.034	0.012	0.004	0.004	0.003	0.000
Cumulative	0.448	0.742	0.878	0.944	0.977	0.990	0.993	0.997	1.000	1.000

May capture noise or less critical inter-variable relationships

Eigenvectors

Variable	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10
Growth Volatility	0.421	-0.184	-0.117	-0.262	-0.185	0.273	-0.046	0.717	0.282	0.033
CPI Volatility	-0.255	-0.476	0.072	-0.082	-0.110	0.000	0.819	0.055	-0.043	-0.091
Fiscal Deficit % GDP	0.378	-0.202	0.292	-0.117	-0.546	0.187	-0.122	-0.276	-0.541	-0.007
CAR	0.396	0.123	-0.252	-0.411	-0.192	-0.532	0.191	-0.357	0.333	-0.003
NPL % Gross Loans	0.070	0.395	0.391	-0.602	0.445	0.115	0.196	0.089	-0.255	-0.009
Banks ROE % After Tax	0.393	-0.247	-0.190	0.150	0.433	-0.038	-0.017	-0.040	-0.185	-0.708
Banks ROA %	0.346	-0.348	-0.140	0.105	0.458	0.067	0.072	-0.170	-0.105	0.685
Current Account Balance % GDP	0.311	0.290	0.296	0.496	-0.066	-0.479	0.257	0.373	-0.188	0.104
Total Reserves in Months of Imp	0.120	-0.262	0.725	0.093	0.113	0.003	-0.122	-0.182	0.562	-0.082
Exchange Rate Z Score	0.262	0.438	-0.100	0.300	-0.078	0.599	0.388	-0.260	0.232	-0.053





PCA Insights for Russia (2/4)

Key Observations

Variance Explained

- PC1 explains 41.5% of the variance, with PC2 and PC3 contributing an additional 17.6% and 15.1%, respectively. This distribution indicates moderate complexity in Russia's economic structure.

Dominant Variables in PC1

- **CAR (0.432)**
  - Like other countries, Russia's capital adequacy ratio heavily influences the first component, reflecting its importance in ensuring financial stability amid external shocks.
- **Current Account Balance (0.215)**
  - Russia's reliance on exports and external trade heavily ties the current account to its financial stability.
- **Exchange Rate (-0.381)**
  - Negative correlation with PC1 underscores Russia's high sensitivity to exchange rate volatility, likely due to reliance on commodity exports priced in foreign currencies.

NPL % Gross Loans (-0.456)

- Non-performing loans contribute significantly but negatively, reflecting the challenges of maintaining banking sector health in Russia's volatile economic environment.

Interpretation

- Russia's data highlights a heavy reliance on banking stability (CAR) and external trade (current account balance). The negative influence of exchange rate fluctuations and NPL ratios highlights vulnerabilities in currency management and banking risks.
- Unlike China and India, profitability measures (ROA, ROE) play a minor role, suggesting a less efficient banking sector or weaker focus on profitability as a policy priority.

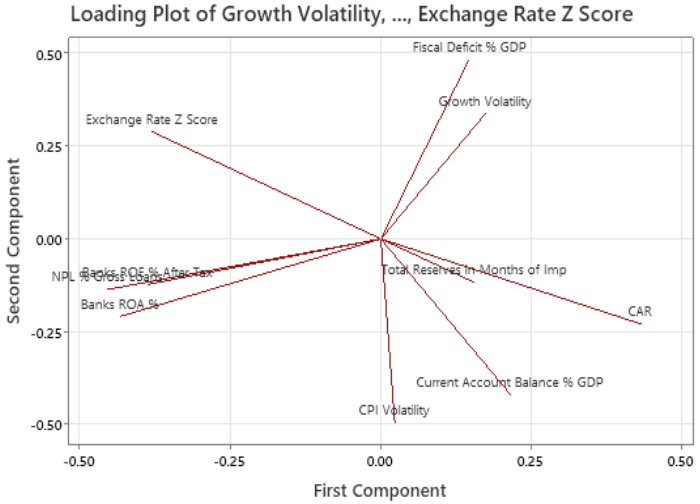
Eigenanalysis of the Correlation Matrix

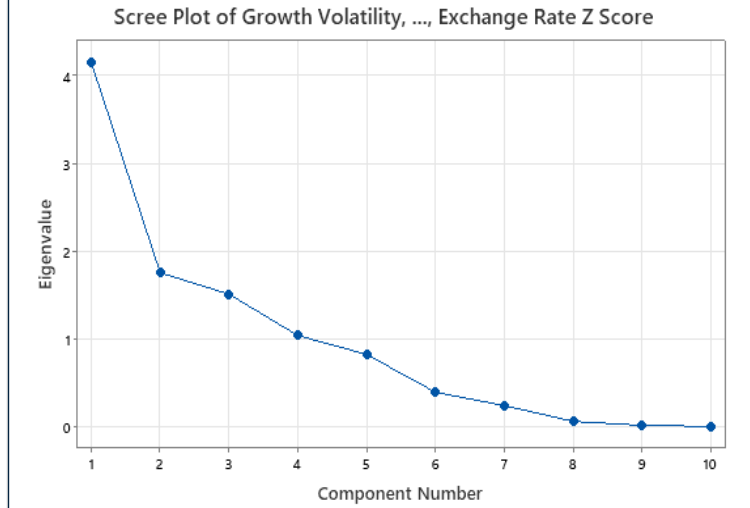
Eigenvalue	4.149	1.756	1.511	1.040	0.825	0.393	0.243	0.062	0.017	0.005
Proportion	0.415	0.176	0.151	0.104	0.082	0.039	0.024	0.006	0.002	0.000
Cumulative	0.415	0.590	0.742	0.846	0.928	0.967	0.992	0.998	1.000	1.000

May capture noise or less critical inter-variable relationships

Eigenvectors

Variable	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10
Growth Volatility	0.174	0.339	0.394	-0.546	-0.280	0.345	0.207	0.302	0.250	0.088
CPI Volatility	0.023	-0.498	0.293	0.467	-0.430	0.308	0.245	0.204	-0.052	-0.254
Fiscal Deficit % GDP	0.146	0.483	-0.322	0.479	-0.067	0.399	-0.381	0.244	0.205	-0.039
CAR	0.432	-0.230	-0.193	-0.033	-0.037	-0.401	0.042	0.089	0.699	-0.247
NPL % Gross Loans	-0.456	-0.137	-0.111	0.075	0.206	-0.149	0.149	0.703	0.171	0.381
Banks ROE % After Tax	-0.388	-0.123	-0.170	-0.380	-0.331	-0.060	-0.501	0.217	-0.089	-0.492
Banks ROA %	-0.433	-0.209	-0.175	-0.067	-0.159	0.376	-0.008	-0.484	0.511	0.268
Current Account Balance % GDP	0.215	-0.420	0.206	-0.160	0.603	0.419	-0.394	0.107	0.050	-0.031
Total Reserves in Months of Imp	0.155	-0.117	-0.682	-0.249	0.091	0.345	0.469	0.088	-0.230	-0.165
Exchange Rate Z Score	-0.381	0.290	0.198	0.108	0.426	0.064	0.320	-0.071	0.223	-0.614





PCA Insights for China (3/4)

Key Observations

Variance Explained

- ❑ PC1 alone explains 61.4% of the variability, indicating that a single dimension is highly representative of the dataset.
- ❑ Adding PC2 raises the cumulative variance explained to 81.8%, showing a significant reduction in complexity compared to Brazil.

Dominant Variables in PC1

- ❑ **Banks ROA % (0.396)**:
  - Return on Assets (ROA) is highly correlated with PC1, reflecting the strong focus on the banking sector's efficiency.
- ❑ **Banks ROE % (0.360)**
  - Return on Equity (ROE) also plays a major role, consistent with China's efforts to optimize financial performance in its banking sector.
- ❑ **CAR (-0.320)**
  - Negative correlation of CAR suggests a unique inverse relationship where stronger capital adequacy might align with lower profitability or different risk dynamics.

Current Account Balance (-0.428) and Growth Volatility (-0.079)

- ❑ Growth and current account balance negatively contribute, reflecting their indirect relationship with China's economic policies focusing on financial and price stability.

Interpretation

- ❑ China's economic variability is overwhelmingly driven by banking profitability and financial stability, reflecting the country's focus on using banks as tools for economic control.
- ❑ The negative loading of CAR in PC1 suggests that efforts to maintain strong capital reserves might come at the cost of banking profitability, a trade-off that highlights policy-driven efficiency over profitability.

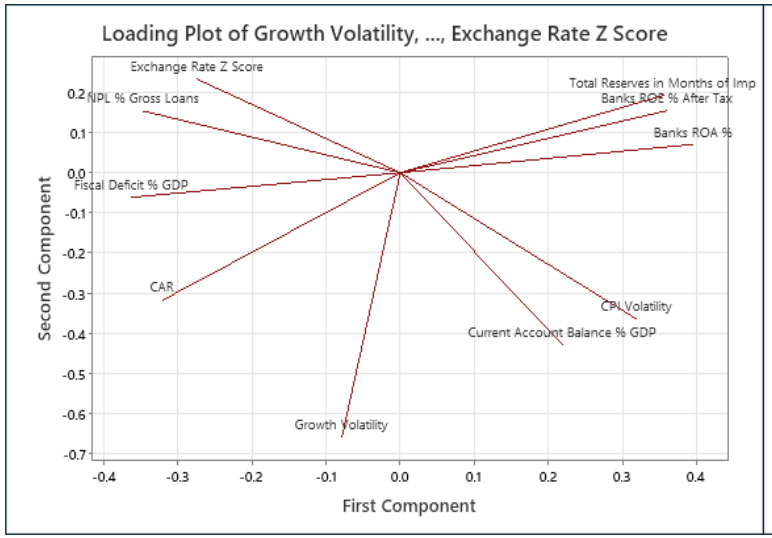
Eigenanalysis of the Correlation Matrix

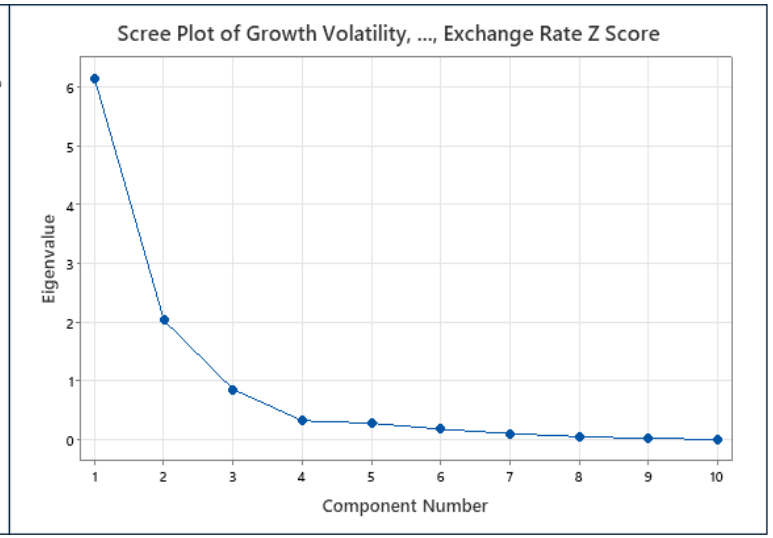
Eigenvalue	6.144	2.032	0.857	0.323	0.281	0.179	0.104	0.052	0.021	0.006
Proportion	0.614	0.203	0.086	0.032	0.028	0.018	0.010	0.005	0.002	0.001
Cumulative	0.614	0.818	0.903	0.936	0.964	0.982	0.992	0.997	0.999	1.000

May capture noise or less critical inter-variable relationships

Eigenvectors

Variable	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10
Growth Volatility	-0.079	-0.659	-0.159	-0.053	-0.189	-0.174	-0.560	-0.371	-0.026	-0.113
CPI Volatility	0.319	-0.365	0.312	-0.057	-0.114	-0.113	-0.037	0.444	-0.198	0.633
Fiscal Deficit % GDP	-0.363	-0.061	-0.241	-0.418	0.110	-0.516	0.436	-0.159	-0.316	0.195
CAR	-0.320	-0.317	0.210	0.514	-0.191	-0.280	0.310	0.351	-0.010	-0.393
NPL % Gross Loans	-0.348	0.154	0.272	0.470	0.449	-0.015	-0.283	-0.239	-0.373	0.285
Banks ROE % After Tax	0.360	0.154	-0.089	0.450	-0.431	-0.247	0.255	-0.507	0.048	0.255
Banks ROA %	0.396	0.071	-0.103	-0.001	-0.059	0.058	-0.024	0.052	-0.811	-0.400
Current Account Balance % GDP	0.219	-0.428	-0.495	0.287	0.517	0.260	0.308	0.005	0.062	0.087
Total Reserves in Months of Imp	0.355	0.193	-0.102	0.069	0.387	-0.692	-0.282	0.200	0.222	-0.153
Exchange Rate Z Score	-0.275	0.234	-0.653	0.211	-0.307	0.019	-0.281	0.400	-0.090	0.237





PCA Insights for Brazil (4/4)

Key Observations

Variance Explained

- PC1 accounts for **37.2%** of the variability, PC2 adds another **25.3%**, and PC3 adds **20.0%**, bringing the cumulative total to **82.5%**. This indicates that most of the variability in Brazil's data is captured in just three components.
- This level of explained variance suggests moderate complexity in the data structure.

Dominant Variables in PC1

- **CPI Volatility (0.491)**
  - High inflation variability in Brazil dominates this principal component, reflecting the historical struggles with price stability in its economy.
- **CAR (0.467)**
  - The capital adequacy ratio of banks contributes significantly. A strong banking system is crucial for financial stability in emerging markets like Brazil.
- **Exchange Rate Z Score (0.405)**
  - Exchange rate volatility also plays a crucial role, consistent with Brazil's dependency on external trade and sensitivity to foreign currency movements.

Growth Volatility (-0.095)

- Growth volatility has minimal impact on PC1, which is unusual for an emerging market. This suggests Brazil's growth dynamics are less correlated with other financial and economic indicators.

Interpretation

- Brazil's economy is primarily influenced by inflation variability, bank capital adequacy, and exchange rate stability. These factors likely reflect the economy's exposure to macroeconomic shocks and its reliance on banking strength to cushion volatility.
- PC2 highlights variables like fiscal deficit (-0.526), showing Brazil's vulnerability to government fiscal policies & their impact on economic stability.

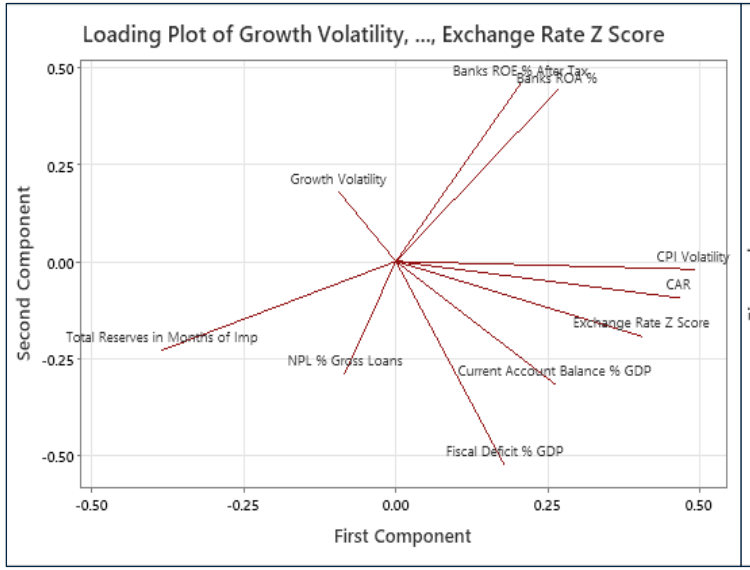
Eigenanalysis of the Correlation Matrix

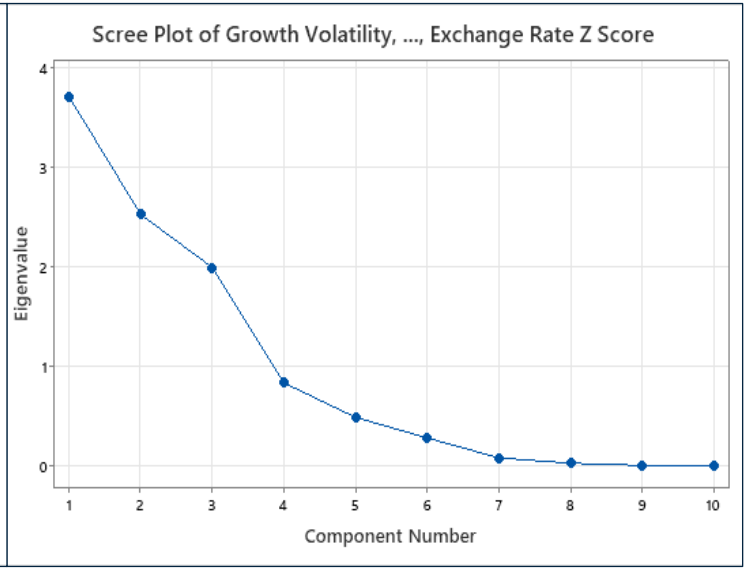
Eigenvalue	3.718	2.533	2.000	0.839	0.493	0.286	0.086	0.033	0.010	0.002
Proportion	0.372	0.253	0.200	0.084	0.049	0.029	0.009	0.003	0.001	0.000
Cumulative	0.372	0.625	0.825	0.909	0.958	0.987	0.996	0.999	1.000	1.000

May capture noise or less critical inter-variable relationships

Eigenvectors

Variable	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10
Growth Volatility	-0.095	0.181	0.552	-0.313	-0.602	0.146	0.270	0.182	0.194	-0.168
CPI Volatility	0.491	-0.020	0.133	-0.101	0.307	-0.086	0.181	-0.331	0.687	-0.120
Fiscal Deficit % GDP	0.179	-0.526	-0.165	0.207	-0.309	-0.121	0.667	-0.125	-0.167	0.152
CAR	0.467	-0.094	-0.203	-0.142	-0.102	-0.404	-0.141	0.654	-0.022	-0.298
NPL % Gross Loans	-0.085	-0.290	-0.406	-0.661	0.064	0.459	0.033	0.149	0.162	0.207
Banks ROE % After Tax	0.206	0.461	-0.312	-0.051	-0.424	-0.228	-0.118	-0.144	0.146	0.598
Banks ROA %	0.267	0.443	-0.298	-0.217	-0.014	0.200	0.243	-0.320	-0.420	-0.468
Current Account Balance % GDP	0.261	-0.315	0.389	-0.440	-0.041	-0.215	-0.348	-0.367	-0.403	0.149
Total Reserves in Months of Imp	-0.384	-0.229	-0.327	-0.058	-0.367	-0.294	-0.264	-0.362	0.267	-0.444
Exchange Rate Z Score	0.405	-0.193	-0.015	0.381	-0.342	0.598	-0.407	-0.047	0.061	-0.087





Conclusion

Nation	Strengths	Weaknesses	Opportunities
India	Strong CAR, balanced banking sector, improving external stability (exchange rate & current account).	Inflationary pressures, credit quality concerns (NPL).	Inflation targeting and credit risk reform.
Russia	High reserves, fiscal discipline, stable current account.	Banking sector inefficiency, high exchange rate volatility.	Strengthen monetary policy frameworks to reduce exchange rate exposure.
China	Strong reserves and profitability metrics.	Growth volatility, declining CAR.	Policy shifts to stabilize growth and enhance capital adequacy.
Brazil	Robust CPI management, consistent banking profitability.	Weak reserves, persistent credit quality issues (NPL).	Build external buffers and monitor systemic credit risks.

Strategic Takeaways for Financial Stability Analysis

- **India**: Prioritize inflation control and targeted interventions in the banking sector to improve asset quality.
- **Russia**: Focus on stabilizing the currency and addressing the structural inefficiencies in the banking system.
- **China**: Sustain high reserves while diversifying economic drivers to manage growth volatility.
- **Brazil**: Balance internal banking strengths with external macroeconomic resilience through reserve accumulation and fiscal improvements.

Thank You