“Identifying common patterns via country clustering based on key macroeconomic indicators after banking crises”

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ARTICLE INFO	Nigar Ashurbayli-Huseynova and Nigar Guliyeva (2025). Identifying common patterns via country clustering based on key macroeconomic indicators after banking crises. *Banks and Bank Systems*, *20*(2), 62-82. doi:10.21511/bbs.20(2).2025.06
DOI	http://dx.doi.org/10.21511/bbs.20(2).2025.06
RELEASED ON	Monday, 23 June 2025
RECEIVED ON	Friday, 09 May 2025
ACCEPTED ON	Monday, 09 June 2025

JOURNAL	"Banks and Bank Systems"
ISSN PRINT	1816-7403
ISSN ONLINE	1991-7074
PUBLISHER	LLC “Consulting Publishing Company “Business Perspectives”
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
61	2	11

BUSINESS PERSPECTIVES

LLC "CPC "Business Perspectives"
Hryhorii Skovoroda lane, 10,
Sumy, 40022, Ukraine
www.businessperspectives.org

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IDENTIFYING COMMON PATTERNS VIA COUNTRY CLUSTERING BASED ON KEY MACROECONOMIC INDICATORS AFTER BANKING CRISES

Abstract

Banking crises have posed recurring global challenges over the past decades. The purpose of the article is to identify common patterns among countries after banking crises by clustering them based on the trajectories of key macroeconomic indicators and underlying dynamics during critical post-crisis periods. The study analyzes 50 selected countries based on historical banking crises, data availability, and balanced regional representation. Six crisis peaks are identified: 1990, 1998, 2008, 2015, 2020, and 2023. Recovery is assessed through 12 macroeconomic indicators – GDP growth, investment, government debt, unemployment, poverty, and banking sector health – sourced from World Bank data. Z-score standardization was applied in STATA 19.5. Using Sturges' rule and Ward's method in STATGRAPHICS 19, the clustering revealed country groups sharing similar crisis and post-crisis recovery patterns. The analysis of these 7 formed clusters and countries belonging to each allows us to determine common patterns explained through explicit and implicit common features. Explicit characteristics cover geography, development level, crisis timing, and implicit factors are financial market exposure, banking structures, commodity dependence, policy frameworks, etc. Key findings include persistent groupings (e.g., Albania remaining in the same cluster), countries in prolonged crisis (e.g., Ukraine, Venezuela), stable pairings (e.g., Argentina-Uruguay; Azerbaijan-Iraq-Qatar), and cluster shifts (e.g., Sweden, USA, Malaysia transitioning across crises). Positive recovery cases such as Iceland, Sweden, the USA, Norway, Malaysia, and Argentina demonstrate effective resolution strategies. These insights may inform future crisis response frameworks by identifying successful policy approaches and vulnerabilities tied to institutional and structural dynamics.

Received on: 9th of May, 2025
Accepted on: 9th of June, 2025
Published on: 23rd of June, 2025

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Keywords bank, COVID-19, credit, debt, financial crisis, GDP, investments, loan, rate

JEL Classification G01, G21, E52

INTRODUCTION

Countries around the world have repeatedly faced banking crises, which continue to occur. The scope, consequences, coping mechanisms, common features, and trends must be studied to identify effective tools, methods, and preventive measures.

Over the past five decades, numerous banking crises have emerged globally, often triggered by economic mismanagement, regulatory failures, and external shocks. Key examples include: Franklin National Bank Collapse (USA, 1974), Latin American Debt Crisis (1980s, e.g., Mexico, Brazil, Argentina), Savings and Loan Crisis (USA, 1986–1995), Venezuelan Banking Crisis (1994), Asian Financial Crisis (1997–1998), Uruguayan Banking Crisis (2002), Global Financial Crisis (2007–2009), Icelandic Crisis (2008–2011), Lehman Brothers Bankruptcy (USA, 2008), European Debt Crisis (2010–2015), COVID-19 Financial Shock (2020), and Credit Suisse Crisis (Switzerland, 2023).

Conflict of interest statement:
Author(s) reported no conflict of interest

http://dx.doi.org/10.21511/bbs.20(2).2025.06

These major crises were not isolated – they reshaped economies, changed regulations, and influenced global trade, employment, and inflation. Studying how countries recovered provides insight into financial resilience and vulnerability. Comparing national responses reveals best practices, policy gaps, and socio-political influences. While explicit responses like bailouts or interest rate cuts are well-documented, implicit strategies (e.g., regulatory shifts, informal capital controls) are less explored but equally important.

Clustering countries by macroeconomic shifts around crisis periods helps identify shared strategies, failures, or early-warning signs. This is not just a relevant research topic – it is timely and impactful for both academia and policymaking to study how countries overcame banking crises through clustering at critical macroeconomic turning points.

1. LITERATURE REVIEW

Banking crises are widely acknowledged as recurrent and systemic phenomena, especially under conditions of global volatility. A range of studies has examined their macroeconomic consequences and institutional underpinnings. These works collectively provide insight into the nature, causes, and recovery mechanisms from financial crises, although substantial gaps remain regarding their comparative analysis across different regions and time periods.

Recent global events, such as the 2008 financial crisis and the COVID-19 pandemic, reaffirm the systemic nature of financial instability and its widespread macroeconomic effects. The systemic nature of banking crises and macroeconomic impacts were investigated by Yoshimori (2024), who analyzed the continued dominance of the U.S. dollar as the global reserve currency and its implications for global financial equilibrium, influencing national responses during banking crises. Richardson (2024) and Makarenko et al. (2024) discuss the socioeconomic disruptions caused by the pandemic and stresses the importance of adaptive governance in mitigating crisis consequences. Haugh et al. (2009) further underscore that post-crisis downturns are typically longer and more severe, often involving deeper output losses and slow recoveries, with exports playing a critical role in the rebound.

Several studies have focused on determinants and indicators of crisis vulnerability, and on identifying the macroeconomic indicators that contribute to or result from banking crises. IMF (1998) noted that real interest rates and exchange rates can serve as early warning indicators, though their effectiveness varies by region. Aryal and Singh (2024), Nikhil (2023) examine both macroeconomic and bank-specific determinants of credit risk, providing a clearer understanding of banking system vulnerabilities. Tekin and Eraslan (2024), Antony and Gopal (2023) explore the relationship between macroeconomic conditions and nonperforming loans, further enriching crisis prediction tools. Dahal et al. (2024) examine how remittances and economic growth influence inflation, offering insights into how external inflows interact with domestic stability.

In addition to quantifiable macroeconomic indicators, a range of studies highlight the critical influence of implicit structural and institutional dynamics. Di Caro et al. (2019) argue that financial liberalization and global interdependence have synchronized the impact of crises across similarly structured economies. Yetongnon and Kasztelnik (2024) and Steenbergen et al. (2023) focus on leadership and governance, showing their pivotal roles in building economic resilience and guiding recovery. Dachi and Kasztelnik (2024) stress sustainable governance in microfinance, while Saher et al. (2024) advocate for inclusive policies to achieve equitable recovery outcomes. Kuzior et al. (2024a) explore AI-driven risk management for enhancing financial stability, and Kuzior et al. (2023) examine how solidarity economies contribute to resilience in war-torn Ukraine.

Several studies provide insights through focused case analyses. Gentsoudi (2023) assesses Greece's financial instruments during crisis recovery, while Vasylieva and Chmutova (2015) present a bank life cycle model explaining banks' behavior during crises. Murshudli et al. (2019, 2020a, 2020b) and Murshudli and Zapotichna (2020) examine how foreign bank ownership influenced systemic risk and the transformation of banking strategies in post-Soviet and Eastern European countries during the 2008–2009 crisis and COVID-19 aftermath. Further, Murshudli and Mursalov (2020) provide detailed accounts of banking sector stability in Azerbaijan and Ukraine. Kuzior et al. (2024b) forecast macroeconomic stability post-pandemic recovery, focusing on European countries. Their research provides insights into how countries can navigate the economic challenges following a global crisis.

The issue of clustering and comparative approaches to crisis analysis is also not new among scholars. Cluster analysis has been widely applied to group countries by crisis experience and recovery characteristics. Dias and Ramos (2014) utilize clustering to evaluate post-subprime crisis trends, emphasizing regulatory environments and structural differences. Lucotte (2015) applies hierarchical clustering to the euro area, showing increased heterogeneity in banking structures and calling for deeper integration. Göbel and Araújo (2020) develop a self-calibrated clustering algorithm to isolate macroeconomic variables that distinguish crisis-prone countries, contributing to the literature on early warning systems. Di Caro et al. (2019), through a binary time series for 66 countries, highlight the shared crisis paths among developed economies, particularly in Europe.

Despite the valuable scientific achievements, the selected scientific topics and practical issues still do not lose their relevance. The above works are not comprehensive in the global dimension of the countries of the world, are limited by the selected methods (methodological breadth and practical implications) and limited data. The existing research often focuses on single-country analyses, specific crises, or isolated macroeconomic factors. Few studies offer a comprehensive clustering of countries across multiple crisis events. This makes further research in this direction urgent.

The purpose of the article is to identify common patterns among countries after banking crises by clustering them based on the trajectories of key macroeconomic indicators and underlying dynamics during critical post-crisis periods.

2. METHODS

The research sample includes 50 countries that experienced banking and financial crises, selected to ensure geographical representation and World Bank macroeconomic data availability (World Bank, n.d.). The study focuses on six major crisis peaks:

- 1990 (Savings and Loan Crisis, USA) (Pyle, 1995; Curry & Shibut, 2000);
- 1998 (Asian Financial Crisis) (IMF, 1998);
- 2008 (Global Financial Crisis) (Weinberg, 2007; World Bank, 2011);
- 2015 (European Debt Crisis) (Ruščákováa & Semančíkováa, 2016; James, 2024);
- 2020 (COVID-19 Financial Shock) (Foo & Witkowska, 2024);
- 2023 (Credit Suisse Crisis) (Rossi, 2023).

Appendix A lists the countries included.

Twelve macroeconomic indicators from World Bank data were analyzed to assess crisis impact and recovery:

- i1 – Real interest rate: adjusts borrowing cost for inflation (World Bank data, n.d.k);
- i2 – Credit to private sector: reflects financial support availability (World Bank data, n.d.i);
- i3 – Gross investment: indicates business/government capital spending (World Bank data, n.d.f);
- i4 – FDI inflows: gauges international investor confidence (World Bank data, n.d.c);
- i5 – GDP per capita growth: shows post-crisis economic performance (World Bank data, n.d.d);
- i6 – CPI: tracks inflation/deflation risks (World Bank data, n.d.g);

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- i7 – Nonperforming loans: signal banking sector health (World Bank data, n.d.a);
- i8 – Unemployment: reflects labour market strain/recovery (World Bank data, n.d.l);
- i9 – Gini index: measures income inequality (World Bank data, n.d.e);
- i10 – Poverty headcount: indicates social impact (World Bank data, n.d.j);
- i11 – Interest payments: show fiscal burden from debt (World Bank data, n.d.h);
- i12 – Central government debt: highlights fiscal sustainability risks (World Bank data, n.d.b).

These indicators offer a comprehensive view of crisis effects and recovery dynamics.

When performing cluster analysis, standardizing variables is necessary because the data contain features with different scales and includes both positive and negative values. Clustering algorithms based on distances can be skewed by features with larger ranges. Without this procedure, features with larger values will dominate the distance calculations, leading to biased clustering results.

Z-score is the most common method when data contains both negative and positive values:

$$z = \frac{x - \mu}{\sigma}, \tag{1}$$

where x – original value, μ – mean of the feature, σ – standard deviation of the feature.

The data will have a mean of 0 and a standard deviation of 1.

In STATA SE 19.5, the egen command is applied to make standardized variables (‘egen zx = std(x)’) (Mitchell, 2020; Stata, n.d.).

Standardized input data for each investigated period are given in Appendix A.

Cluster analysis is applied to identify country groups sharing both explicit and implicit characteristics in the context of addressing the aftermath of banking crises. These groups are distinguished based on shifts in macroeconomic conditions employing Ward’s method and STATGRAPHICS Centurion 19 tools.

Each period is clustered separately. The number of clusters is identified by Sturges’ rule using the following formula (Scott, 2009):

$$n = 1 + 3.322 \cdot \lg N, \tag{2}$$

where n is the optimal number of clusters, and N is the number of observations.

Ward’s method is an agglomerative hierarchical clustering approach, especially suitable for cases where structured macroeconomic data are analyzed. It helps group similar entities (countries) based on minimizing differences within clusters. At each step, it merges the two clusters that lead to the smallest increase in total within-cluster variance (or error sum of squares), repeating until all points are merged into a single cluster (producing a hierarchy/dendrogram). Ward’s method also produces a dendrogram – a tree-like diagram that shows how countries merge into clusters, at what distance (or dissimilarity level) the merges happen (Ward, 1963; Kaufman & Rousseeuw, 1990).

Additionally, cluster analysis highlights instances where countries transition from one cluster to another, illustrating the dynamic process of overcoming the consequences of banking crises. Successful experiences of certain countries are studied using methods of retrospective, comparative, and analytical analysis.

3. RESULTS AND DISCUSSION

Numerous banking crises have occurred globally, typically stemming from a complex interplay of economic mismanagement, regulatory failures, and external shocks. The 1974 collapse of Franklin National Bank was one of the most significant U.S. bank failures, driven by poor management, speculative foreign currency positions, rising interest rates, and instability following the 1973 oil crisis and global inflation (Khactu, 1981; Dematos, 2023).

A 1970s borrowing surge ended with rising rates and falling commodity prices, leading to mass defaults and IMF interventions that triggered the Latin American Debt Crisis (early 1980s, notably in Mexico, Brazil, Argentina). The U.S. Savings and Loan Crisis (1986–1995) saw about one-third of savings and loan associations fail due to deregulation, risky lending, and rising interest rates, costing taxpayers over USD 120 billion (FDIC, 1997; Gerber, 2019).

The Asian Financial Crisis (1997) struck countries like Thailand, Indonesia, Malaysia, the Philippines, and South Korea, where excessive borrowing, currency devaluations, and speculative investments led to banking collapses, IMF bailouts, and deep recessions.

The Global Financial Crisis (2007–2009) began in the U.S. with a housing crash and subprime mortgage meltdown. Lehman Brothers' 2008 bankruptcy triggered a global recession and bailouts. Iceland's banking system collapsed (2008–2011) due to overexpansion and reliance on foreign credit, leading to severe recession and political turmoil.

The European Sovereign Debt Crisis (2010–2015) in Greece, Ireland, Portugal, Spain, and Cyprus stemmed from public debt burdens, triggering banking crises, IMF/EU bailouts, and austerity measures.

The COVID-19 Financial Shock (2020) caused global market panic, addressed by unprecedented stimulus. The Credit Suisse Crisis (2023) resulted in its government-brokered acquisition by UBS after years of scandals.

This research clusters countries at these critical crisis points based on shifts in key macroeconomic indicators to analyze explicit and implicit crisis recovery characteristics.

The optimal number of clusters due to 50 observations (50 countries in the research sample) is identified by Sturges' rule n = 7. Cluster analysis is applied for each time period (1990, 1998, 2008, 2015, 2020, and 2023) based on Ward's method and STATGRAPHICS Centurion 19 tools.

For 1990, this procedure is explained in detail, and for other periods, the results are generalized.

So, for 1990, this procedure grouped the 50 supplied observations into 7 distinct clusters, each representing a set of observations with similar characteristics. The clustering process began by treating each observation as its own group. It then iteratively merged the two closest groups based on their similarity. After each merger, the distances between all groups were recalculated, and the next closest pair was combined. This process continued until only 7 clusters remained.

The agglomeration schedule (Table 1) details the sequence in which observations were merged during the clustering process. For instance, in the first stage, observation 32 was combined with observation 47 at a distance of 0.446708. The schedule also indicates that this newly formed group was next merged with another cluster at stage 23.

Table 1. Agglomeration schedule according to Ward's clustering method (Distance Metric: Euclidean) for 50 sample countries in 1990

Stage	Combined Cluster 1	Combined Cluster 2	Distance	Previous Stage Cluster 1	Previous Stage Cluster 2	Next Stage
1	32	47	*0.446708*	0	0	23
2	7	26	0.938604	0	0	16
3	10	27	1.45166	0	0	13
4	19	34	1.96625	0	0	5
5	19	43	2.54032	4	0	17
6	3	48	3.20607	0	0	21
7	8	11	3.93507	0	0	18
8	29	45	4.66648	0	0	36
9	22	50	5.4097	0	0	34
10	15	16	6.16035	0	0	16
11	28	38	6.97805	0	0	17
12	13	44	7.85657	0	0	20
13	10	17	8.80631	3	0	19
14	24	42	9.79173	0	0	33
15	31	36	10.794	0	0	42
16	7	15	11.8444	2	10	25
17	19	28	12.8989	5	11	28
18	8	49	13.9538	7	0	27
19	2	10	15.0126	0	13	27
20	13	30	16.0893	12	0	23
21	3	37	17.2934	6	0	30
22	4	33	18.551	0	0	29
23	13	32	19.8442	20	1	30
24	20	35	21.1427	0	0	31
25	7	25	22.4586	16	0	39
26	6	14	23.7997	0	0	28
27	2	8	25.3594	19	18	34
28	6	19	26.9382	26	17	41

http://dx.doi.org/10.21511/bbs.20(2).2025.06

Table 1 (cont.). Agglomeration schedule according to Ward's clustering method (Distance Metric: Euclidean) for 50 sample countries in 1990

Stage	Combined Cluster 1	Combined Cluster 2	Distance	Previous Stage Cluster 1	Previous Stage Cluster 2	Next Stage
29	4	9	28.6164	22	0	31
30	3	13	30.3155	21	23	36
31	4	20	32.2586	29	24	40
32	1	21	34.2359	0	0	40
33	12	24	36.2522	0	14	35
34	2	22	38.4535	27	9	0
35	12	41	40.8986	33	0	37
36	3	29	43.4092	30	8	41
37	12	39	46.1561	35	0	39
38	18	40	48.9276	0	0	0
39	7	12	52.3135	25	37	43
40	1	4	55.8098	32	31	0
41	3	6	59.3333	36	28	0
42	5	31	62.9634	0	15	43
43	5	7	67.5193	42	39	0

A dendrogram or tree-like diagram (Figure 1) illustrates the arrangement of clusters produced by hierarchical clustering.

The dendrogram shows how individual observations (e.g., countries) are grouped step-by-step. At the bottom, each leaf represents a country. Moving upward, countries or groups merge into clusters. The height of each merge reflects their dissimilarity – shorter branches indicate greater similarity, longer ones indicate greater differences. This reveals natural groupings or outliers. Countries joined lower on the dendrogram likely shared similar economic indicators in 1990, offering insight into structural similarities or common conditions (e.g., oil shock, inflation, financial openness).

The agglomeration distance plot (Figure 2) is also used as a graphical tool in hierarchical clustering.

The agglomeration plot looks like the smooth, ascending right side of a parabola (i.e., the distances between merged clusters gradually and steadily increase without any sharp jumps), that tells that there is no obvious cutoff point where clusters suddenly become very dissimilar. The choice of 7 clusters is still valid, it just reflects one way to partition gradually differing countries.

The cluster summary is given in Table 2. This table summarizes the distribution of 50 sample countries across seven clusters for the year 1990.

Source: Built in STATGRAPHICS Centurion 19.

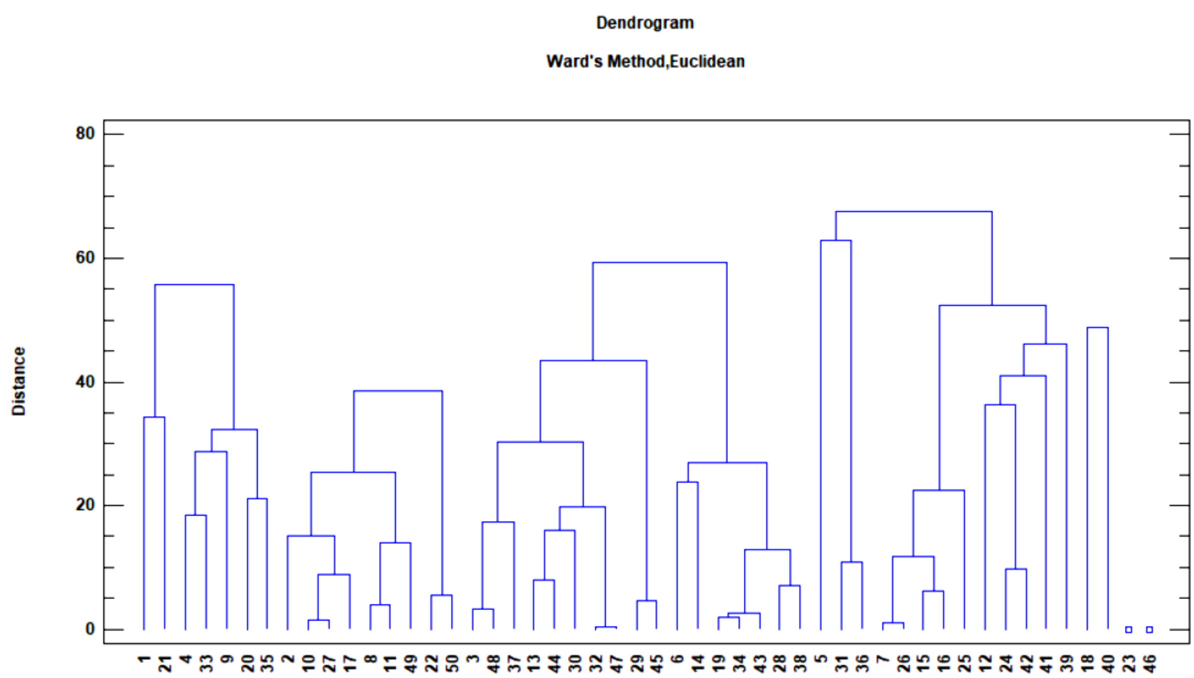

Figure 1. Graphic visualization of the arrangement of clusters produced by Ward's clustering

Source: Built in STATGRAPHICS Centurion 19.

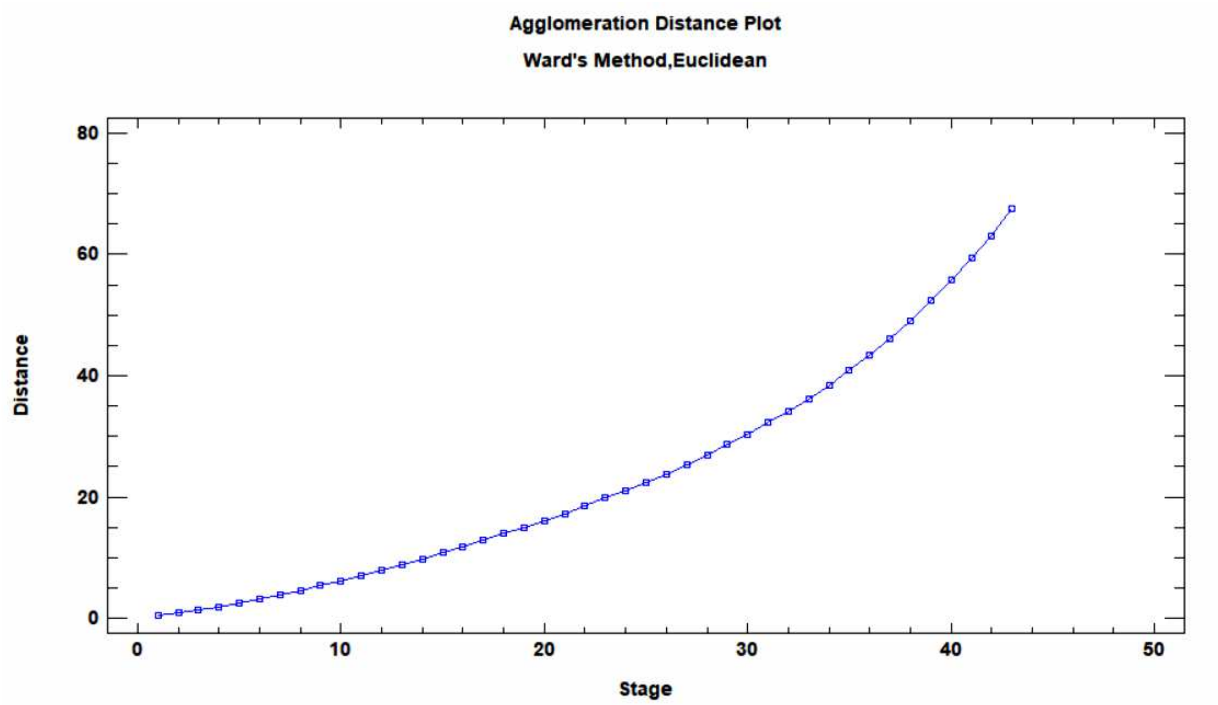

Figure 2. Graphic visualization of the distance at each step of the clustering process

Table 2. Cluster summary for 50 sample countries in 1990

Cluster	Members	Percent
1	7	14.00
2	9	18.00
3	17	34.00
4	13	26.00
5	2	4.00
6	1	2.00
7	1	2.00

Cluster 3 contains nearly a third of the sample, suggesting a significant concentration of countries with similar characteristics, while Cluster 6 (Iraq) and Cluster 7 (Ukraine) represent a unique outlier with only one member. Table 3 presents the detailed results of cluster analysis – the membership table.

The United States appears in Cluster 3, which includes 17 countries (34% of the sample), representing advanced or interconnected economies at the time. As a major financial center, the USA was not insulated from global monetary shifts – its inclusion suggests it shared systemic risks with other nations. In contrast, Cluster 7 includes only Ukraine, likely due to unique characteristics such

Table 3. Membership table for 50 sample countries in 1990 based on Ward's clustering

Row	Country	Cluster	Row	Country	Cluster	Row	Country	Cluster	Row	Country	Cluster	Row	Country	Cluster
1	Albania	1	11	Costa Rica	2	21	Indonesia	1	31	Mexico	4	41	South Africa	4
2	Argentina	2	12	Croatia	4	22	Iran	2	32	Netherlands	3	42	Spain	4
3	Australia	3	13	Cyprus	3	23	Iraq	6	33	Nigeria	1	43	Sweden	3
4	Azerbaijan	1	14	Czechia	3	24	Ireland	4	34	Norway	3	44	Switzerland	3
5	Brazil	4	15	Egypt	4	25	Israel	4	35	Pakistan	1	45	Thailand	3
6	Bulgaria	3	16	Greece	4	26	Italy	4	36	Philippines	4	46	Ukraine	7
7	Canada	4	17	Honduras	2	27	Kenya	2	37	Portugal	3	47	United Kingdom	3
8	Chile	2	18	Hong Kong	5	28	Korea, Rep.	3	38	Qatar	3	48	United States	3
9	China	1	19	Iceland	3	29	Malaysia	3	39	Romania	4	49	Uruguay	2
10	Colombia	2	20	India	1	30	Malta	3	40	Singapore	5	50	Venezuela	2

http://dx.doi.org/10.21511/bbs.20(2).2025.06

Table 4. General cluster summary for 50 sample countries for all studied time peaks connected with six banking crises (based on 12 macro indicators analysis)

1990			1998			2008		
Cluster	Members	Percent	Cluster	Members	Percent	Cluster	Members	Percent
1	7	14.00	1	3	6.00	1	3	6.00
2	9	18.00	2	14	28.00	2	13	26.00
3	17	34.00	3	19	38.00	3	18	36.00
4	13	26.00	4	1	2.00	4	5	10.00
5	2	4.00	5	10	20.00	5	5	10.00
6	1	2.00	6	2	4.00	6	5	10.00
7	1	2.00	7	1	2.00	7	1	2.00
2015			**2020**			**2023**		
Cluster	Members	Percent	Cluster	Members	Percent	Cluster	Members	Percent
1	15	30.00	1	23	46.00	1	25	50.00
2	14	28.00	2	9	18.00	2	6	12.00
3	10	20.00	3	3	6.00	3	12	24.00
4	4	8.00	4	11	22.00	4	3	6.00
5	1	2.00	5	1	2.00	5	2	4.00
6	5	10.00	6	2	4.00	6	1	2.00
7	1	2.00	7	1	2.00	7	1	2.00

as data limitations, a transitional economy, or geopolitical detachment from global markets.

The cluster summary for all studied periods is generalized in Table 4.

The distribution of countries across seven clusters shows how recovery patterns evolved from 1990 to 2023. Cluster 1 begins at 14% in 1990, drops to 6% by 2008, then grows sharply, 30% (2015), 46% (2020), and 50% (2023), possibly reflecting convergence from global shocks (e.g., GFC, COVID-19), increased regulation, or coordinated policy responses.

Cluster 2 shrinks from 18% (1990) to 12% by 2023, suggesting that a once-similar group of economies diverged structurally due to globalization, deregulation, or reform-driven crises.

Cluster 3 rises from 34% in 1990 to 38% in 1998, then falls to 6% by 2020, perhaps representing transitional or high-risk economies during crises like the Asian Financial Crisis, followed by stabilization.

Clusters 5 and 6 show modest fluctuations, likely reflecting niche or outlier economies (e.g., oil-dependent, politically unstable). Cluster 7 consistently includes one country (2%), likely a structural outlier such as Ukraine.

Therefore, it is necessary to analyze the membership of each cluster in more detail (Table 5).

Cluster analysis for 2023 shows ongoing recovery from the pandemic, though some countries still face instability due to political crises, debt, or war. Clusters 3, 4, and 5 reflect lingering pandemic effects, while Cluster 1 includes countries with strong recoveries due to resilient financial systems and policies. Cluster 2 shows moderate recovery; Cluster 7 reflects extreme challenges.

- Cluster 1 includes stable or growing economies with robust recovery mechanisms (e.g., Albania, Argentina, Australia, Canada, China, Iran, Korea, Mexico, Netherlands, Portugal, Spain, Sweden, Switzerland). These countries managed the crisis effectively.
- Cluster 2 (e.g., Brazil, Colombia, Egypt, Kenya) reflects moderate impact and gradual recovery.
- Cluster 3 (e.g., Greece, India, Italy, Malaysia, U.S.) includes economies still stabilizing with ongoing structural issues.
- Cluster 4 (e.g., Hong Kong, Singapore) comprises nations facing unique external pressures.
- Cluster 5 (Iraq, South Africa) includes countries needing significant intervention.

http://dx.doi.org/10.21511/bbs.20(2).2025.06

Table 5. Results of clustering 50 sample countries in 1990–2023

	1990	1998	2008	2015	2020	2023
Cluster 1	Albania, Azerbaijan, China, India, Indonesia, Nigeria, Pakistan	Albania, Bulgaria, Iraq	Albania, Brazil, South Africa	Albania, Brazil, Bulgaria, Croatia, Czechia, Egypt, Greece, Iceland, Italy, Pakistan, Portugal, Romania, South Africa, Spain, Ukraine	Albania, Argentina, Bulgaria, Canada, Chile, Croatia, Czechia, Egypt, Iran, Ireland, Israel, Italy, Malta, Mexico, Netherlands, Nigeria, Pakistan, Portugal, Romania, Spain, Ukraine, United Kingdom, United States, Uruguay	Albania, Argentina, Australia, Azerbaijan, Bulgaria, Canada, Chile, China, Croatia, Cyprus, Czechia, Iran, Ireland, Korea, Rep., Mexico, Netherlands, Nigeria, Norway, Pakistan, Portugal, Qatar, Spain, Sweden, Switzerland, Uruguay
Cluster 2	Argentina, Chile, Colombia, Costa Rica, Honduras, Iran, Kenya, Uruguay, Venezuela	Argentina, Chile, China, Colombia, Costa Rica, Honduras, Iran, Kenya, Mexico, Nigeria, Pakistan, United States, Uruguay, Venezuela	Argentina, Bulgaria, Chile, China, Colombia, Costa Rica, Egypt, India, Indonesia, Mexico, Philippines, Romania, Uruguay	Argentina, Chile, China, Colombia, Costa Rica, Honduras, India, Indonesia, Israel, Kenya, Malaysia, Mexico, Nigeria, Philippines, United States, Uruguay	Australia, China, Hong Kong, Korea Rep., Norway, Singapore, Sweden, Switzerland, Thailand	Brazil, Colombia, Costa Rica, Egypt, Honduras, Kenya
Cluster 3	Australia, Bulgaria, Cyprus, Czechia, Iceland, Korea, Rep., Malaysia, Malta, Netherlands, Norway, Portugal, Qatar, Sweden, Switzerland, Thailand, United Kingdom, United States	Australia, Croatia, Cyprus, Czechia, Hong Kong, Iceland, Ireland, Korea, Rep., Malaysia, Malta, Netherlands, Norway, Portugal, Qatar, Singapore, Sweden, Switzerland, Thailand, United Kingdom	Australia, Canada, Croatia, Cyprus, Czechia, Hong Kong, Iceland, Ireland, Israel, Korea, Rep., Malaysia, Malta, Netherlands, Norway, Pakistan, Portugal, Singapore, Spain, Sweden, Switzerland, Thailand, United Kingdom, United States	Australia, Canada, China, Cyprus, Korea, Rep., Malaysia, Netherlands, Norway, Singapore, Sweden, Switzerland, Thailand, United Kingdom	Azerbaijan, Iraq, Qatar	Greece, Iceland, India, Israel, Italy, Malaysia, Philippines, Romania, Thailand, United States
Cluster 4	Brazil, Canada, Croatia, Egypt, Greece, Ireland, Israel, Italy, Mexico, Philippines, Romania, South Africa, Spain	Azerbaijan	Azerbaijan, Iran, Qatar, Ukraine, Venezuela	Azerbaijan, Iran, Iraq, Qatar	Brazil, Colombia, Costa Rica, Honduras, India, Indonesia, Kenya, Malaysia, Philippines, South Africa	Hong Kong, Malta, Singapore
Cluster 5	Hong Kong, Singapore	Brazil, Canada, Egypt, Greece, India, Israel, Italy, Philippines, South Africa, Spain	Greece, Iceland, Israel, Italy, United Kingdom, United States	Cyprus, Hong Kong, Ireland, Malta, Singapore	Cyprus	Iraq, South Africa
Cluster 6	Iraq	Indonesia, Romania	Honduras, Iraq, Kenya, Nigeria, Pakistan	Hong Kong, Ireland, Malta, Netherlands, Singapore	Greece, Ukraine	Ukraine
Cluster 7	Ukraine	Ukraine	Malta	Venezuela	Venezuela	Venezuela

http://dx.doi.org/10.21511/bbs.20(2).2025.06

- Cluster 6 (Ukraine) shows prolonged crisis and instability.
- Cluster 7 (Venezuela) represents a case of severe and prolonged economic collapse.

Clustering was based on structural vulnerabilities and macroeconomic profiles, not geography or income. Countries with shared features – like exposure to capital markets, financial openness, or commodity dependence – were often clustered together despite other differences.

From 1990 to 2023, notable patterns emerge. Albania consistently appears in Cluster 1, suggesting persistent fragility tied to weak financial systems, governance issues, and low global financial integration.

Argentina and Uruguay are paired in 6 of 8 periods, reflecting geographical and economic ties, shared exposure to debt and commodity shocks, and cross-border spillovers.

Ukraine appears alone in Cluster 7 from 1990–1998 and shifts later, signaling unique macroeconomic instability, post-Soviet transition issues, and geopolitical tensions.

Azerbaijan often clusters with oil-based economies like Iraq and Qatar (2008–2015), due to shared exposure to commodity price volatility.

Core developed economies such as the U.S., the U.K., the Netherlands, Sweden, Switzerland, and Canada appear together post-2008, reflecting globalized banking systems, shared exposure to the GFC, and similar regulatory responses (e.g., Basel III, Dodd-Frank). These countries form a systemic core with converging crisis response behavior.

Several countries have successfully transitioned from financial crises through robust recovery strategies involving policy reforms, institutional restructuring, and international support. These actions enabled movement between clusters in crisis analyses, reflecting improved economic stability.

Iceland (2008) faced a major banking collapse due to excessive international exposure. The government responded with bank restructuring, capital controls, IMF assistance, and debt renegotiation. Major banks were placed into receivership and replaced with state-owned entities. Capital controls stabilized the currency, and IMF support provided financial and policy backing. By 2011, economic growth resumed, with unemployment and fiscal deficits declining.

In Sweden (1990s), a banking crisis driven by falling real estate prices and a rigid exchange rate was addressed through nationalization, creation of asset management firms (Securum, Retriva), and bank recapitalization (about 4% of GDP). Banks were later privatized, with most costs recovered. Sweden's approach is widely seen as a crisis management model.

In Norway (late 1980s–1990s), the oil sector overexposure led to a crisis. The government provided capital injections, allowed the krone to float, and pursued economic diversification. These measures restored growth and reduced non-performing loans.

Malaysia (1997 Asian Financial Crisis) implemented capital controls and pegged the ringgit to the dollar to prevent capital flight. This approach enabled a faster recovery than other affected nations, with growth returning by 1999.

Argentina (2001) recovered through sovereign debt restructuring and structural economic reforms. These actions led to renewed growth and improved financial standing.

United States' (2007–2009 Global Financial Crisis) response included: bank bailouts (TARP) – USD 700B allocated to prevent collapse of major banks; Federal Reserve interventions – near-zero rates, quantitative easing, and emergency lending programs; Dodd-Frank Act (2010) – regulatory overhaul, including CFPB creation, the Volcker Rule, and systemic risk oversight; stress testing & capital requirements – annual resilience tests for major banks; fiscal stimulus – to support demand and restore growth. By 2010–2012, markets stabilized, bailout funds were repaid, GDP grew, and the dollar strengthened. The U.S. banking sector became more resilient, evident during the 2020 pandemic.

These examples show that the timely, coordinated use of monetary, fiscal, and regulatory tools is key to overcoming crises. Comprehensive strategies are more effective than relying on isolated interventions, enabling countries to recover and improve their structural position in financial system analyses.

Research using cluster analysis to study financial and banking crises across countries over time naturally entails methodological limitations, interpretive challenges, and opportunities for further exploration.

Key limitations stem from the choice of clustering algorithm, distance metric (Ward's method with Euclidean distance), and the normalization method (z-score), all of which influence results. Most clustering techniques provide static snapshots – even when applied over multiple time periods, they do not model path dependence or dynamic transitions between clusters. Countries' crisis trajectories are not fully reflected in discrete cluster assignments. Implicit features like institutional quality or political stability are also difficult to quantify and may be missed.

Data limitations also exist. Financial and macroeconomic data across 50 countries from 1990–2023 vary in quality, completeness, and reliability, especially for low-income or authoritarian regimes. Time lags and structural breaks may be overlooked. Institutional factors such as central bank independence, corruption levels, or legal systems are not directly captured by macro indicators but significantly affect outcomes.

Tiutiunyk et al. (2022) explore how the shadow economy impacts macroeconomic stability and social development, highlighting hidden systemic weaknesses often missed by formal indicators. These can explain unexpected cluster alignments where countries with similar macro profiles show differing resilience.

Despite these challenges, this study offers clear advantages. Most existing research focuses on single crises (e.g., 2008) or shorter timeframes. In contrast, this analysis spans six crisis points (1990, 1998, 2008, 2015, 2020, 2023) across nearly 35 years. It attempts to capture longitudinal dynamics and show how countries evolve and shift clusters over time – an approach rarely pursued.

While many studies are region-specific (e.g., Eurozone, Latin America), this study provides global coverage, using a sample of 50 countries with diverse income levels, regions, and institutional structures. Lyeonov et al. (2024) further support this angle, showing how implicit factors like governance and geopolitical position influence resilience, explaining why some countries cluster together post-crisis while others diverge.

A standout feature of this study is its integration of both implicit and explicit features, with qualitative interpretations of cluster behavior. This connects quantitative clustering outcomes with real-world reforms and recovery paths, offering a more holistic view of crisis dynamics.

This work sets a foundation for future research, including time-series or panel regression modelling. It could also benefit from incorporating institutional indicators (e.g., World Bank governance scores), applying machine learning techniques (decision trees, random forests) to predict crisis risks, or using network analysis to map countries as nodes in financial contagion networks, identifying systemic "hubs" or "buffers."

CONCLUSION

The purpose of the study was to identify common patterns among countries (50) after banking crises by clustering them based on the trajectories of key macroeconomic indicators and underlying dynamics during critical post-crisis periods (1990, 1998, 2008, 2015, 2020, 2023) depending on the change of macroeconomic indicators (12 key indices).

The analysis of seven formed clusters and countries belonging to each of them allowed us to determine common patterns that were explained through both explicit and implicit common features.

 http://dx.doi.org/10.21511/bbs.20(2).2025.06

The following explicit common features were highlighted:

1) Geographic proximity: countries like Sweden, Norway, Iceland often cluster together (Nordic countries); China, India, Indonesia, Pakistan (South/Southeast Asia), etc.;

2) Economic development level: OECD/high-income countries (e.g., USA, UK, Sweden) or lower-income or emerging markets (e.g., Kenya, Nigeria, Honduras) often cluster together;

3) Crisis timing and regional contagion: many Latin American countries (e.g., Argentina, Brazil, Mexico) appear together during the debt crisis years (1990).

East and Southeast Asian countries (e.g., Indonesia, Malaysia, Korea) cluster around the 1998 crisis, reflecting the Asian financial crisis.

The implicit common features were identified and characterized:

Common macroeconomic vulnerabilities: Iceland, Greece, Ireland, Spain, and Portugal (clustered in 2008, 2015) – all had credit booms, housing bubbles, and fragile banking systems, leading to the global financial crisis impact.

Integration with global financial markets: Ireland, Singapore, Hong Kong, Switzerland, and the Netherlands are financial hubs with high exposure to global capital flows, hence often clustering during periods of global financial stress, even if geographically distant.

Banking sector structure: countries with overleveraged banking sectors, often dependent on external wholesale funding, like Iceland (2008), Cyprus (2013), and Ireland (2008), tend to group due to systemic fragility.

Reliance on commodity exports or imports (Brazil, South Africa, Nigeria, Argentina during oil price crashes or commodity booms/busts react similarly and are often grouped.

Capital account liberalization without safeguards (emerging economies like Thailand, Indonesia, and Korea in 1998) led to exposure to rapid inflows/outflows and crisis spillovers;

Transition economies like Czechia, Bulgaria, Romania, Ukraine, and Albania often appear together – they share a post-socialist transition path with banking reforms, liberalization, and institutional vulnerabilities.

Policy synchronization or institutional affiliations: EU countries, regardless of geography, often cluster during Eurozone-linked crises. IMF program recipients or World Bank structural reform implementers may share economic profiles due to standardized conditionalities.

Political and institutional fragility: Venezuela, Ukraine, and Iraq repeatedly form separate or unstable clusters, due to political instability, governance issues, or conflict-related financial volatility, rather than economic structure alone.

The obtained results can become the basis for further analysis of implicit internal factors and reasons for banking crises, effective strategies for managing and mitigating the impacts of banking crises, and will be of interest to a wide range of stakeholders.

AUTHOR CONTRIBUTIONS

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http://dx.doi.org/10.21511/bbs.20(2).2025.06

APPENDIX A

Table A1. Standardized input data in 1990

Country	zi1	zi2	zi3	zi4	zi5	zi6	zi7	zi8	zi9	zi10	zi11	zi12
Albania	–0.06	–1.25	3.77	0.63	–1.35	0.05	0.00	0.65	–0.76	–0.34	–0.21	0.03
Argentina	–0.58	–0.96	–0.90	–0.12	–0.60	–0.24	0.00	0.14	0.74	–0.20	–0.27	–1.10
Australia	0.37	0.19	–0.28	0.48	0.02	–0.23	0.00	0.11	–0.25	–0.73	–0.30	–0.71
Azerbaijan	0.96	–1.08	1.40	–0.67	–0.40	–0.25	0.00	–1.31	–0.14	0.42	–1.12	–0.95
Brazil	3.27	–0.28	–0.68	–0.58	–0.82	3.54	0.00	–0.35	1.98	0.87	1.15	0.84
Bulgaria	0.75	0.76	–0.94	–0.66	–0.96	–0.21	0.00	–0.98	–0.05	–0.17	–0.15	0.69
Canada	0.40	0.51	–0.57	–0.08	–0.33	–0.23	0.00	0.36	–0.40	–0.69	1.38	1.34
Chile	0.99	–0.25	–0.08	0.17	–0.03	–0.21	0.00	–0.16	1.72	0.50	–0.08	–0.55
China	0.04	0.85	0.18	–0.26	0.06	–0.24	0.00	–0.81	–0.33	2.85	–1.14	–1.10
Colombia	–0.40	–0.69	–0.32	–0.23	0.03	–0.20	0.00	0.78	1.36	0.59	0.44	–0.92
Costa Rica	0.48	–0.95	–0.01	0.53	–0.09	–0.22	0.00	–0.07	0.73	0.27	0.14	–0.15
Croatia	–0.21	0.41	0.70	–0.62	–2.21	0.40	0.00	0.99	–0.30	–0.46	–1.10	–0.20
Cyprus	–0.14	2.33	–0.55	0.29	0.34	–0.24	0.00	–0.96	–0.51	–0.98	0.38	0.50
Czechia	–0.43	0.21	–1.35	0.00	–1.37	–0.23	0.00	–1.19	–1.28	–1.27	–0.66	–0.60
Egypt	–0.08	–0.70	–0.34	0.05	0.08	–0.22	0.00	0.43	–0.35	0.22	0.49	1.61
Greece	–0.14	–0.04	–0.21	–0.23	–0.30	–0.21	0.00	0.13	0.06	–0.37	0.95	2.47
Honduras	–0.47	–0.86	–0.06	–0.30	–0.20	–0.21	0.00	–0.34	1.61	1.35	–0.64	–1.10
Hong Kong	–0.02	2.75	0.04	1.13	0.17	–0.23	0.00	–1.06	–2.98	–1.53	–1.14	–1.10
Iceland	–0.09	–0.29	–0.30	–0.70	–0.15	–0.22	0.00	–0.80	–0.78	–1.07	–0.11	–0.15
India	0.14	–0.72	0.41	–0.64	0.14	–0.23	0.00	–0.88	–0.31	1.71	1.10	0.50
Indonesia	0.42	–0.03	3.53	–0.24	0.35	–0.23	0.00	–0.80	–0.43	2.23	0.89	0.35
Iran	–0.47	–0.77	0.61	–0.79	0.87	–0.23	0.00	1.63	0.60	0.37	–1.13	–1.10
Iraq	0.19	–1.19	2.52	–0.67	5.56	–0.01	0.00	0.47	–0.63	–0.60	–1.03	–1.10
Ireland	–0.14	0.48	0.60	–0.14	0.67	–0.24	0.00	1.60	–0.06	–0.31	0.97	0.80
Israel	0.00	–0.11	0.68	–0.57	0.22	–0.22	0.00	1.22	0.02	–0.27	0.69	3.07
Italy	0.15	0.18	–0.10	–0.44	0.00	–0.23	0.00	0.71	–0.34	–0.66	0.97	1.15
Kenya	0.25	–0.88	–0.54	–0.39	–0.12	–0.22	0.00	0.75	1.70	0.93	–0.06	–1.10
Korea, Rep.	0.21	–0.06	0.31	–0.52	0.71	–0.23	0.00	–0.82	–0.38	–0.60	–0.66	–0.86
Malaysia	0.11	0.42	0.03	1.57	0.41	–0.24	0.00	–0.39	0.82	0.19	0.30	1.41
Malta	–0.20	1.14	–1.12	–0.17	0.35	–0.24	0.00	–0.52	–0.68	–0.81	–0.89	–0.46
Mexico	–1.03	–0.91	0.13	–0.25	0.14	–0.21	0.00	–0.68	1.14	0.37	3.66	0.37
Netherlands	–0.02	1.46	–0.19	0.75	0.16	–0.24	0.00	0.27	–0.43	–1.03	–0.27	0.63
Nigeria	0.77	–1.23	–0.28	–0.21	0.71	–0.23	0.00	–0.55	0.20	1.55	–1.14	–1.10
Norway	–0.04	0.22	–0.47	–0.32	–0.03	–0.24	0.00	–0.23	–0.96	–1.18	–0.48	–0.47
Pakistan	–0.13	–0.74	–0.09	–0.41	–0.09	–0.23	0.00	–0.92	–0.25	2.43	–1.14	1.39
Philippines	0.38	–0.92	0.30	–0.23	–0.14	–0.23	0.00	0.36	0.94	0.65	2.81	0.32
Portugal	–0.14	1.58	0.11	0.73	0.24	–0.22	0.00	–0.36	0.21	–0.52	0.76	–1.10
Qatar	–0.14	–0.41	–0.55	–0.64	–0.19	–0.24	0.00	–1.02	–0.10	–0.46	–1.14	–0.17
Romania	–2.37	–1.36	–1.44	–0.67	–1.45	0.06	0.00	0.39	0.27	0.23	–1.10	1.36
Singapore	0.00	0.67	–0.28	5.86	0.39	–0.24	0.00	–0.84	–2.98	–1.53	0.55	–0.07
South Africa	0.11	–0.15	–0.70	–0.70	–0.51	–0.22	0.00	3.88	1.89	1.13	0.29	0.01
Spain	–0.14	1.07	–0.05	0.43	0.19	–0.23	0.00	2.06	–0.35	–0.66	–0.20	–0.09
Sweden	0.59	–0.05	–0.25	–0.35	–0.19	–0.23	0.00	–0.95	–1.08	–1.12	0.03	–0.71
Switzerland	–0.04	2.33	0.16	0.21	0.08	–0.23	0.00	–0.90	–0.19	–0.89	–0.78	–0.51
Thailand	0.29	0.77	0.17	0.54	0.77	–0.23	0.00	–0.87	0.74	0.61	0.43	0.83
Ukraine	–4.85	–1.29	–0.96	–0.56	–0.87	5.84	0.00	–0.16	–0.54	–0.07	–0.22	–0.14
United Kingdom	0.20	1.32	–0.50	0.93	–0.15	–0.23	0.00	0.12	–0.05	–0.65	–0.23	0.19
United States	0.18	–0.01	–0.32	–0.17	–0.12	–0.23	0.00	–0.16	0.17	–0.33	0.39	–0.10
Uruguay	1.43	–0.53	–0.60	–0.48	–0.22	–0.10	0.00	0.45	0.50	–0.10	–0.27	–1.10
Venezuela	–0.36	–0.93	–0.57	–0.28	0.21	–0.21	0.00	1.58	0.48	0.12	–1.14	–1.10

Note: zi1-zi12 – z-score for indicators i1-i12; i1 – real interest rate; i2 – monetary sector credit to private sector; i3 – gross domestic investment; i4 – foreign direct investment inflows; i5 – GDP per capita growth; i6 – consumer prices index; i7 – bank nonperforming loans; i8 – unemployment estimate; i9 – Gini index; i10 – poverty headcount ratio; i11 – interest payments; i12 – central government debt.

Table A2. Standardized input data in 1998

Country	zi1	zi2	zi3	zi4	zi5	zi6	zi7	zi8	zi9	zi10	zi11	zi12
Albania	0.73	–1.24	3.03	–0.51	1.21	0.98	–0.27	2.10	–0.83	–0.35	2.36	0.55
Argentina	–1.17	–0.80	0.02	–0.33	0.11	–0.72	0.35	1.04	1.11	0.25	0.48	–1.20
Australia	–0.22	0.45	–0.12	–0.47	0.27	–0.65	–0.20	0.00	–0.37	–0.82	–0.43	–0.67
Azerbaijan	0.57	–1.26	0.54	5.06	1.12	–0.79	–0.27	–1.38	–0.21	0.51	–0.99	–1.05
Brazil	4.70	–0.67	–0.15	–0.09	–0.50	–0.46	0.15	0.51	1.84	0.71	1.41	0.73
Bulgaria	–1.60	–1.13	2.25	–0.03	0.40	0.82	–0.27	0.94	–0.12	–0.15	0.15	0.58
Canada	–0.13	0.47	–0.08	0.06	0.17	–0.64	–0.21	0.12	–0.33	–0.68	1.47	1.08
Chile	0.72	–0.03	–0.02	0.51	0.14	–0.30	–0.08	–0.08	1.50	0.32	–0.80	–0.82
China	–0.09	1.04	0.11	0.19	0.78	–0.79	–0.27	–0.97	–0.16	1.83	–1.21	–1.20
Colombia	1.00	–0.54	–0.30	–0.22	–0.51	0.82	0.06	1.53	1.61	0.77	0.59	–1.03
Costa Rica	0.05	–0.90	0.62	0.21	0.46	0.24	–0.27	–0.35	0.69	0.18	0.59	0.07
Croatia	–0.11	0.23	–0.36	0.05	0.06	–0.20	–0.27	0.77	–0.37	–0.48	–0.81	–0.30
Cyprus	–0.59	1.92	–0.58	–0.09	0.46	–0.54	–0.27	–0.92	–0.58	–1.07	–0.23	0.49
Czechia	–0.41	–0.06	–0.21	0.47	–0.36	0.16	–0.27	–0.26	–0.93	–1.10	–0.90	–0.76
Egypt	0.12	–0.28	–0.75	–0.64	0.21	–0.40	–0.27	0.07	–0.58	0.16	1.54	1.50
Greece	–0.59	–0.17	0.31	–0.96	0.14	–0.33	–0.27	0.95	–0.01	–0.38	0.89	2.31
Honduras	0.67	–0.64	–0.05	–0.56	–0.17	0.40	–0.27	–0.77	1.65	0.97	–0.64	–1.20
Hong Kong	–0.01	2.43	0.13	1.19	–1.38	–0.48	–0.27	–0.65	–3.05	–1.69	–1.21	–1.20
Iceland	–0.06	0.07	0.78	–0.50	0.68	–0.59	–0.27	–0.97	–0.85	–1.17	0.01	0.79
India	–0.24	–0.80	–0.01	–0.81	0.35	0.37	0.26	–1.17	–0.46	1.87	2.08	0.38
Indonesia	–2.27	–0.13	–4.84	–1.04	–2.63	4.09	0.48	–0.47	–0.51	3.00	1.59	0.54
Iran	–1.03	–0.93	–0.08	–0.96	–0.20	0.75	–0.27	0.29	0.57	0.34	–1.13	–1.20
Iraq	–0.16	–1.19	2.06	–0.96	4.61	0.49	–0.27	0.20	–0.70	–0.64	–1.09	–1.20
Ireland	–0.59	0.28	0.32	1.60	0.91	–0.52	–0.21	0.00	–0.13	–0.61	0.01	0.69
Israel	–0.41	0.16	–0.17	–0.59	–0.04	–0.27	–0.27	0.64	0.08	–0.20	0.25	1.77
Italy	–0.17	0.02	–0.02	–0.92	–0.03	–0.56	0.57	0.93	–0.04	–0.44	0.96	1.23
Kenya	0.85	–0.79	0.47	–0.92	–0.24	–0.17	–0.27	0.48	0.64	1.06	0.02	–1.20
Korea, Rep.	0.11	0.06	–0.91	–0.56	–1.24	–0.10	–0.27	–0.15	–0.45	–0.64	–0.74	–0.92
Malaysia	–0.36	2.24	–1.36	–0.18	–1.85	–0.29	0.85	–0.94	0.98	0.22	0.46	0.09
Malta	–0.14	0.87	–0.78	1.14	0.40	–0.53	0.71	–0.55	–0.75	–0.88	–0.34	–0.26
Mexico	0.04	–0.95	0.09	–0.37	0.40	0.59	–0.05	–0.83	1.32	0.69	0.56	–0.54
Netherlands	–0.45	1.15	0.07	1.28	0.33	–0.56	–0.27	–0.69	–0.55	–1.00	–0.16	0.50
Nigeria	0.19	–1.16	–0.12	–0.93	–0.32	0.10	–0.27	–0.82	1.21	2.32	–1.21	–1.20
Norway	–0.47	0.22	0.23	–0.01	0.02	–0.54	–0.27	–0.83	–0.92	–1.21	–0.69	–0.23
Pakistan	–0.59	–0.77	–0.03	–0.76	–0.35	–0.21	–0.27	–0.42	–0.33	1.25	–1.21	1.28
Philippines	–0.20	–0.39	–0.55	–0.17	–0.79	0.04	–0.27	0.54	0.86	0.77	2.53	0.63
Portugal	–0.59	1.26	0.23	0.31	0.37	–0.51	–0.27	–0.64	0.13	–0.55	–0.24	–1.20
Qatar	–0.44	–0.46	–0.33	–0.08	0.56	–0.48	–0.27	–1.31	–0.17	–0.49	–1.21	–0.27
Romania	–0.26	–1.07	–0.25	0.31	–0.61	4.14	–0.27	–0.43	0.20	0.30	0.22	1.40
Singapore	0.02	1.10	–0.12	0.85	–1.19	–0.74	–0.27	–0.90	–3.05	–1.69	–0.71	0.20
South Africa	0.28	0.02	–0.03	–0.88	–0.43	–0.16	–0.27	3.63	1.82	1.32	1.06	0.82
Spain	–0.59	0.81	0.21	–0.30	0.31	–0.57	–0.27	2.30	–0.21	–0.56	0.22	1.56
Sweden	–0.21	–0.53	0.14	1.29	0.36	–0.74	–0.27	0.26	–0.98	–1.09	0.01	–0.34
Switzerland	–0.46	1.92	0.16	0.01	0.12	–0.72	–0.03	–0.87	–0.27	–0.92	–0.72	–0.86
Thailand	–0.19	2.12	0.23	0.72	–1.73	–0.06	–0.27	–0.90	0.36	0.23	–1.08	0.72
Ukraine	2.00	–1.16	–0.05	–0.51	–0.49	0.15	6.66	0.76	–0.16	0.27	–0.16	1.64
United Kingdom	–0.19	0.98	0.08	0.77	0.18	–0.57	–0.15	–0.32	–0.05	–0.64	–0.17	0.09
United States	–0.10	–0.27	0.13	–0.36	0.21	–0.59	–0.27	–0.67	0.23	–0.35	0.50	–0.43
Uruguay	2.06	–0.42	0.08	–0.80	0.33	0.17	–0.27	0.35	0.44	–0.07	–0.64	–1.20
Venezuela	0.98	–1.06	0.00	0.47	–0.59	1.51	–0.27	0.85	0.89	0.52	–1.21	–1.20

Note: zi1-zi12 – z-score for indicators i1-i12; i1 – real interest rate; i2 – monetary sector credit to private sector; i3 – gross domestic investment; i4 – foreign direct investment inflows; i5 – GDP per capita growth; i6 – consumer prices index; i7 – bank nonperforming loans; i8 – unemployment estimate; i9 – Gini index; i10 – poverty headcount ratio; i11 – interest payments; i12 – central government debt.

http://dx.doi.org/10.21511/bbs.20(2).2025.06

Table A3. Standardized input data in 2008

Country	zi1	zi2	zi3	zi4	zi5	zi6	zi7	zi8	zi9	zi10	zi11	zi12
Albania	0.95	–0.80	0.71	0.01	1.89	–0.79	3.40	1.89	–0.56	–0.37	1.34	0.50
Argentina	–1.39	–1.24	0.05	–0.29	0.30	–1.27	–0.24	0.45	0.75	0.41	2.68	–1.11
Australia	0.32	0.80	–0.42	–0.22	–0.15	–0.64	–0.69	–0.53	–0.09	–0.81	–0.86	–0.58
Azerbaijan	–1.17	–1.17	–0.31	–0.05	1.93	1.75	–0.28	–0.09	–0.85	–1.10	–1.01	–0.98
Brazil	4.78	–0.61	0.58	–0.27	0.62	–0.45	–0.10	0.57	1.53	0.78	2.18	0.67
Bulgaria	0.09	–0.22	0.75	0.41	1.46	0.52	–0.33	–0.16	–0.24	–0.34	–0.71	–0.59
Canada	–0.18	0.85	–0.30	–0.21	–0.63	–0.92	–0.88	0.03	–0.22	–0.53	0.47	0.20
Chile	1.57	–0.09	1.40	0.04	0.22	–0.01	–0.82	0.85	0.98	0.28	–0.71	–0.73
China	–0.61	0.44	0.55	–0.24	2.12	–0.41	–0.76	–0.54	0.58	1.31	–1.07	–1.11
Colombia	0.99	–0.88	0.22	–0.22	0.01	–0.25	0.18	1.40	1.64	1.01	0.74	0.78
Costa Rica	0.29	–0.55	0.22	–0.06	0.39	0.68	–0.63	–0.34	1.06	0.25	0.32	0.03
Croatia	0.34	–0.17	0.21	–0.07	–0.01	–0.39	0.54	0.65	–0.35	–0.31	–0.37	0.21
Cyprus	–0.28	2.49	1.09	1.50	–0.28	–0.59	0.07	–0.66	–0.41	–1.03	–0.13	0.44
Czechia	0.32	–0.66	–0.38	–0.24	–0.08	–0.35	–0.19	–0.49	–0.88	–1.17	–0.65	–0.70
Egypt	–0.26	–0.67	0.67	–0.15	0.95	1.39	–1.14	0.64	–0.46	0.19	1.08	1.38
Greece	–0.28	0.22	–0.87	–0.33	–0.67	–0.67	–0.31	0.41	–0.24	–0.53	0.43	2.62
Honduras	1.07	–0.52	0.21	–0.03	–0.03	0.38	0.32	–0.83	1.66	1.18	–0.67	–1.11
Hong Kong	0.29	1.15	0.19	0.90	–0.15	–0.64	–0.73	–0.72	–3.16	–1.80	–1.07	–1.11
Iceland	0.75	2.13	–1.61	–0.12	–0.51	0.57	0.82	–0.89	–0.40	–1.12	2.06	2.65
India	0.26	–0.54	–0.61	–0.25	–0.12	–0.06	–0.32	–0.65	–0.21	2.27	1.74	0.55
Indonesia	–0.83	–0.97	–1.69	–0.32	0.79	0.21	–0.18	0.28	–0.33	1.35	0.31	–0.12
Iran	–1.17	–0.62	0.26	–0.38	–0.89	2.41	–1.14	1.22	0.73	0.36	–0.91	–1.11
Iraq	–1.48	–1.41	4.94	–0.34	1.21	0.57	1.89	0.68	–0.68	–0.52	–0.92	–1.11
Ireland	–0.28	1.63	–1.38	–0.04	–2.53	–0.68	–0.50	0.16	–0.48	–0.83	–0.58	0.24
Israel	0.11	–0.17	–0.30	–0.20	–0.17	–0.61	0.02	0.42	0.45	0.27	0.92	1.45
Italy	0.34	0.09	–0.70	–0.42	–1.11	–0.78	0.97	0.15	–0.22	–0.52	0.56	1.13
Kenya	–0.42	–0.99	0.58	–0.39	–1.43	2.53	1.88	0.94	0.87	2.06	0.46	–1.11
Korea, Rep.	0.33	1.18	–0.44	–0.36	0.06	–0.59	–0.95	–0.88	–0.36	–0.52	–0.10	–0.86
Malaysia	–0.84	0.34	–0.41	–0.26	0.19	–0.48	0.47	–0.78	0.79	0.41	0.14	0.04
Malta	0.07	0.67	–0.07	6.54	0.51	–0.65	0.54	–0.06	–0.64	–0.76	0.06	–0.24
Mexico	0.05	–1.16	–0.03	–0.29	–0.76	–0.53	–0.06	–0.63	1.25	0.74	0.83	–0.58
Netherlands	0.03	0.59	–0.58	0.47	–0.09	–0.91	–0.58	–0.69	–0.62	–0.97	–0.41	0.46
Nigeria	0.68	–1.12	–0.42	–0.30	0.54	0.41	1.28	–0.66	0.32	2.49	–1.07	–1.11
Norway	–0.03	0.43	–0.38	–0.21	–0.83	–0.72	–0.90	–1.00	–0.82	–1.10	–0.32	–0.22
Pakistan	–0.02	–1.01	–0.17	–0.29	–0.78	1.67	3.22	–1.58	–0.58	1.21	–1.07	1.18
Philippines	–0.07	–0.94	1.47	–0.37	0.15	–0.07	0.02	–0.67	0.94	1.25	2.61	0.41
Portugal	–0.28	1.36	–0.36	–0.28	–0.55	–0.89	–0.10	0.38	0.02	–0.54	0.02	–1.11
Qatar	–2.15	–0.70	–0.94	–0.26	–0.71	0.91	–1.14	–1.61	–0.11	–0.32	–1.07	–0.58
Romania	–0.40	–0.79	0.36	–0.13	2.74	–0.13	–0.22	–0.11	0.00	0.20	–0.78	1.68
Singapore	0.70	0.36	–0.42	–0.10	–1.63	–0.31	–0.66	–0.61	–3.16	–1.80	–1.06	0.04
South Africa	0.69	–0.17	0.20	–0.27	0.00	0.17	0.18	4.45	2.31	1.41	0.02	–0.08
Spain	–0.28	1.72	–0.71	–0.21	–0.85	–0.68	0.78	1.39	–0.19	–0.41	–0.49	0.22
Sweden	0.00	0.74	–0.56	–0.06	–1.11	–0.77	–0.78	0.02	–0.72	–0.96	–0.50	–0.44
Switzerland	–0.01	1.25	–0.04	–0.38	–0.15	–0.92	–0.65	–0.78	–0.22	–0.74	–0.56	–0.46
Thailand	–0.18	0.17	0.45	–0.28	–0.32	–0.48	0.74	–1.37	0.34	0.24	–0.30	–0.73
Ukraine	–1.55	–0.15	–0.31	–0.16	0.23	2.39	0.16	0.05	–0.85	–0.71	–0.89	1.94
United Kingdom	–0.10	2.10	–0.87	–0.03	–0.91	–0.76	–0.62	–0.12	–0.09	–0.56	–0.29	0.74
United States	0.17	–0.35	–0.86	–0.30	–0.85	–0.71	0.53	–0.11	0.38	–0.14	0.17	0.51
Uruguay	0.19	–0.96	1.34	–0.11	1.48	–0.13	–0.97	0.51	0.76	0.25	0.53	–1.11
Venezuela	–1.13	–1.06	–0.27	–0.37	0.52	2.66	–1.14	0.02	0.72	0.60	–1.07	–1.11

Note: zi1-zi12 – z-score for indicators i1-i12; i1 – real interest rate; i2 – monetary sector credit to private sector; i3 – gross domestic investment; i4 – foreign direct investment inflows; i5 – GDP per capita growth; i6 – consumer prices index; i7 – bank nonperforming loans; i8 – unemployment estimate; i9 – Gini index; i10 – poverty headcount ratio; i11 – interest payments; i12 – central government debt.

Table A4. Standardized input data in 2015

Country	zi1	zi2	zi3	zi4	zi5	zi6	zi7	zi8	zi9	zi10	zi11	zi12
Albania	0.09	–0.83	–0.18	–0.05	0.12	–0.11	1.00	1.69	–0.24	0.00	0.57	0.75
Argentina	–0.64	–1.25	–0.09	–0.34	–0.08	–0.31	–0.53	–0.10	0.61	0.41	0.02	–1.16
Australia	0.01	1.12	–0.38	–0.27	–0.30	–0.22	–0.59	–0.31	–0.09	–0.86	–0.56	–0.05
Azerbaijan	1.94	–0.77	–0.29	–0.10	–0.50	–0.09	–0.43	–0.51	–0.83	–1.16	–0.86	–1.01
Brazil	2.36	–0.22	–1.60	–0.27	–1.49	0.19	–0.40	0.13	1.56	0.84	3.70	0.46
Bulgaria	–0.15	–0.46	–0.30	–0.23	0.48	–0.31	0.77	0.24	0.30	0.03	–0.71	–0.42
Canada	–0.21	0.89	–0.82	–0.26	–0.50	–0.24	–0.63	–0.15	–0.16	–0.46	–0.04	0.18
Chile	–0.48	0.06	–0.25	–0.11	–0.21	–0.07	–0.51	–0.27	0.94	–0.04	–0.64	–0.85
China	–0.16	1.44	–0.16	–0.33	1.04	–0.23	–0.52	–0.67	0.30	0.56	–1.10	–1.16
Colombia	0.22	–0.61	–0.46	–0.25	0.01	–0.03	–0.40	0.14	1.48	0.93	0.23	0.11
Costa Rica	0.32	–0.46	–0.13	–0.20	0.13	–0.26	–0.52	0.11	1.23	0.40	0.32	–0.22
Croatia	0.19	–0.29	0.27	–0.38	0.36	–0.33	1.13	1.51	–0.41	–0.21	0.28	1.13
Cyprus	–0.53	3.20	–0.20	5.36	0.47	–0.42	4.07	1.30	–0.13	–0.81	0.02	0.12
Czechia	–0.27	–0.56	0.36	–0.38	0.65	–0.29	–0.14	–0.50	–0.90	–1.20	–0.63	–0.83
Egypt	–0.39	–1.01	0.17	–0.33	0.05	0.26	–0.68	0.94	–0.34	–0.04	2.58	0.89
Greece	–0.53	0.68	–0.34	–0.39	–0.37	–0.40	2.87	3.09	0.06	0.10	–0.02	3.40
Honduras	0.57	–0.47	1.05	–0.15	–0.03	–0.13	–0.38	–0.30	1.31	1.55	0.14	–1.16
Hong Kong	–0.41	2.51	0.17	2.05	–0.11	–0.14	–0.61	–0.81	–3.35	–2.00	–1.10	–1.16
Iceland	–0.40	0.17	0.96	–0.14	0.32	–0.22	–0.10	–0.69	–0.81	–1.27	1.95	1.65
India	0.12	–0.51	–0.08	–0.33	1.11	–0.04	–0.10	–0.82	–0.07	1.76	2.04	0.03
Indonesia	0.19	–0.88	–0.19	–0.32	0.40	0.04	–0.45	–0.59	0.27	1.25	0.55	–0.44
Iran	0.67	–0.43	–2.86	–0.40	–1.12	0.38	–0.68	0.60	–0.01	–0.03	–0.99	–1.16
Iraq	4.39	–1.33	1.16	–0.61	–0.51	–0.23	0.22	0.50	–0.56	–0.46	–0.91	–0.51
Ireland	–0.53	–0.53	3.11	2.73	5.04	–0.32	1.00	0.38	–0.34	–0.83	0.35	0.89
Israel	–0.43	–0.24	–0.32	–0.26	–0.40	–0.34	–0.50	–0.47	0.41	0.30	–0.20	0.96
Italy	–0.24	0.17	–0.27	–0.39	–0.24	–0.30	1.12	0.74	0.00	–0.20	0.33	0.69
Kenya	0.01	–0.81	–0.64	–0.38	0.15	0.05	–0.09	–0.91	0.51	2.29	0.69	–1.16
Korea, Rep.	–0.50	1.04	0.03	–0.41	0.06	–0.27	–0.64	–0.77	–0.40	–0.56	–0.29	–0.26
Malaysia	–0.24	0.87	0.70	–0.28	0.30	–0.19	–0.52	–0.85	0.54	0.05	0.61	0.12
Malta	–0.32	0.10	3.68	0.93	1.18	–0.25	0.02	–0.43	–0.57	–0.91	–0.12	–0.45
Mexico	–0.51	–1.07	–0.12	–0.29	–0.09	–0.16	–0.42	–0.63	1.28	0.73	0.41	–0.73
Netherlands	–0.50	0.62	1.48	1.62	–0.08	–0.27	–0.41	–0.17	–0.68	–1.06	–0.63	0.14
Nigeria	0.63	–1.27	–0.38	–0.39	–0.45	0.19	–0.20	–0.63	0.05	2.40	–1.10	–1.16
Norway	0.03	0.76	–0.56	–0.34	–0.27	–0.19	–0.58	–0.63	–0.75	–1.08	–0.93	–0.43
Pakistan	–0.06	–1.25	0.42	–0.40	0.18	–0.17	0.45	–0.76	–0.39	0.90	–1.10	0.73
Philippines	0.01	–0.75	0.47	–0.34	0.65	–0.27	–0.49	–0.85	0.87	1.16	1.43	–0.12
Portugal	–0.53	0.81	–0.01	–0.39	0.00	–0.28	1.08	0.83	0.01	–0.41	0.47	–1.16
Qatar	2.84	–0.15	–0.85	–0.39	–1.38	–0.21	–0.68	–1.37	–0.03	–0.23	–1.10	–0.08
Romania	–0.24	–0.94	–0.01	–0.32	0.38	–0.34	0.66	–0.18	0.05	0.61	–0.39	1.32
Singapore	–0.34	0.85	–0.38	0.54	–0.06	–0.33	–0.59	–0.72	–3.35	–2.00	–1.10	0.10
South Africa	–0.21	–0.31	–0.13	–0.40	–0.64	–0.06	–0.37	3.12	2.61	1.91	0.28	1.34
Spain	–0.53	0.77	0.32	–0.34	0.50	–0.33	–0.17	2.56	0.08	–0.07	0.10	–0.02
Sweden	–0.36	0.95	0.16	–0.34	0.31	–0.31	–0.58	–0.07	–0.59	–0.89	–0.88	–0.67
Switzerland	–0.19	1.71	–0.29	0.30	–0.36	–0.37	–0.61	–0.54	–0.29	–0.76	–0.84	–0.28
Thailand	–0.19	0.73	0.40	–0.33	0.15	–0.36	–0.41	–1.30	0.06	–0.18	–0.33	0.52
Ukraine	–1.57	–0.61	0.38	–0.43	–2.66	2.36	2.84	0.24	–0.94	–0.85	0.67	2.39
United Kingdom	–0.60	1.02	–0.17	–0.35	–0.14	–0.29	–0.58	–0.41	–0.20	–0.58	–0.14	1.14
United States	–0.33	–0.53	–0.02	–0.30	0.04	–0.30	–0.54	–0.45	0.55	–0.10	0.04	–0.03
Uruguay	–0.06	–0.98	–0.96	–0.22	–0.47	0.17	–0.52	–0.06	0.45	0.20	–0.01	–1.16
Venezuela	–1.94	–0.94	–1.84	–0.41	–1.64	6.35	–0.68	–0.22	0.88	0.88	–1.10	–1.16

Note: zi1-zi12 – z-score for indicators i1-i12; i1 – real interest rate; i2 – monetary sector credit to private sector; i3 – gross domestic investment; i4 – foreign direct investment inflows; i5 – GDP per capita growth; i6 – consumer prices index; i7 – bank nonperforming loans; i8 – unemployment estimate; i9 – Gini index; i10 – poverty headcount ratio; i11 – interest payments; i12 – central government debt.

http://dx.doi.org/10.21511/bbs.20(2).2025.06

Table A5. Standardized input data in 2020

Country	zi1	zi2	zi3	zi4	zi5	zi6	zi7	zi8	zi9	zi10	zi11	zi12
Albania	0.23	–0.82	0.65	0.15	0.62	–0.17	0.36	0.75	–0.50	–0.29	0.41	0.52
Argentina	–1.63	–1.22	0.04	0.03	–1.33	–0.21	–0.09	0.71	0.76	0.71	0.26	–1.10
Australia	–0.38	1.17	0.60	0.04	0.98	–0.19	–0.49	–0.31	–0.04	–0.62	–0.53	0.24
Azerbaijan	3.00	–1.01	0.73	0.03	0.06	–0.13	–0.30	–0.13	–0.77	–1.07	–0.63	–0.67
Brazil	2.28	–0.20	0.24	0.06	0.34	–0.12	–0.39	1.16	1.35	0.46	1.47	0.81
Bulgaria	–0.60	–0.52	0.27	0.10	0.65	–0.16	0.12	–0.56	0.55	–0.34	–0.80	–0.48
Canada	–0.58	0.83	–0.18	0.04	–0.23	–0.19	–0.57	0.35	–0.28	–0.64	–0.40	0.34
Chile	–0.25	0.16	–0.96	0.10	–0.46	–0.13	–0.43	0.61	1.17	0.17	–0.44	–0.84
China	–0.08	1.92	0.97	0.04	1.84	–0.14	–0.40	–0.46	0.23	0.20	–1.04	–1.10
Colombia	0.52	–0.51	–1.21	0.06	–0.86	–0.14	–0.16	1.62	1.79	1.20	0.59	0.67
Costa Rica	0.19	–0.38	0.40	0.08	0.06	–0.19	–0.32	1.71	1.38	0.68	1.49	–0.34
Croatia	0.55	–0.38	0.33	0.06	–0.59	–0.21	0.36	–0.08	–0.49	–0.48	–0.18	0.81
Cyprus	–0.60	0.50	0.64	–5.78	0.22	–0.23	1.33	–0.03	–0.28	–0.99	–0.25	–0.06
Czechia	–0.75	–0.51	–0.21	0.08	–0.09	–0.12	–0.39	–1.08	–0.81	–1.21	–0.71	–0.83
Egypt	0.07	–1.00	–1.04	0.04	1.81	–0.07	–0.64	0.01	–0.26	0.25	3.16	0.56
Greece	–0.60	0.03	0.61	0.04	–0.98	–0.25	3.39	1.61	–0.10	–0.12	–0.11	3.72
Honduras	1.19	–0.19	–0.84	0.03	–1.38	–0.11	–0.22	0.62	1.29	1.61	0.68	–1.10
Hong Kong	–0.01	3.33	1.35	0.68	–0.27	–0.20	–0.52	–0.42	–3.30	–1.90	–1.04	–1.10
Iceland	–0.37	0.39	0.04	–0.07	–0.84	–0.13	–0.26	–0.49	–0.82	–1.19	0.64	0.84
India	–0.03	–0.46	–0.05	0.06	–0.39	–0.03	0.40	–0.01	–0.08	1.60	2.32	–0.20
Indonesia	0.76	–0.86	–0.01	0.05	0.59	–0.16	–0.29	–0.74	0.06	0.75	0.85	–0.52
Iran	0.47	–0.36	2.33	0.02	1.98	0.64	–0.64	0.36	0.11	0.26	–0.92	–1.10
Iraq	2.98	–1.23	–2.45	–0.02	–2.26	–0.19	1.48	1.03	–0.49	–0.37	–1.04	–0.57
Ireland	–0.60	–0.87	–0.70	0.17	2.89	–0.22	–0.20	–0.46	–0.52	–1.12	–0.35	0.26
Israel	–0.28	–0.22	0.71	0.11	0.51	–0.23	–0.46	–0.75	0.30	0.31	–0.23	0.61
Italy	–0.49	0.06	–0.27	–0.01	–0.83	–0.21	–0.07	0.25	0.05	–0.16	0.15	0.40
Kenya	0.31	–0.88	0.79	0.01	0.76	–0.06	0.91	–0.58	0.14	2.60	2.51	–1.10
Korea, Rep.	–0.43	1.57	0.67	0.02	1.11	–0.20	–0.60	–0.80	–0.19	–0.49	–0.41	–0.20
Malaysia	0.06	1.01	–0.46	0.03	–0.39	–0.24	–0.43	–0.68	0.62	0.13	1.24	0.10
Malta	–0.27	–0.08	0.91	3.77	–0.11	–0.19	–0.16	–0.71	–0.31	–0.82	–0.52	–0.52
Mexico	–0.37	–0.96	–1.00	0.07	–1.01	–0.12	–0.30	–0.70	0.94	0.58	1.26	–0.21
Netherlands	–0.55	0.39	0.03	–0.45	0.20	–0.18	–0.39	–0.82	–0.83	–1.00	–0.77	–0.05
Nigeria	0.13	–1.25	0.60	0.02	0.34	0.16	0.15	0.56	0.04	2.39	–1.04	–1.10
Norway	0.13	1.10	0.32	–0.01	0.85	–0.17	–0.54	–0.70	–0.66	–0.96	–0.92	–0.50
Pakistan	–0.49	–1.20	0.07	0.02	0.55	0.06	0.56	–0.62	–0.48	0.90	–1.04	0.43
Philippines	0.27	–0.51	–2.39	0.05	–1.38	–0.14	–0.18	–1.08	0.72	1.23	0.84	–0.26
Portugal	–0.60	0.46	0.17	0.05	–0.80	–0.21	0.10	–0.22	0.00	–0.48	0.07	–1.10
Qatar	2.47	1.10	–0.31	–0.02	–0.96	–0.28	–0.64	–1.56	0.04	–0.14	–1.04	0.01
Romania	–0.29	–1.00	0.49	0.04	0.52	–0.14	–0.14	–0.58	–0.01	0.26	–0.41	1.83
Singapore	0.47	0.92	0.60	0.46	0.41	–0.22	–0.47	–0.77	–3.30	–1.90	–0.98	0.37
South Africa	–0.30	–0.32	–1.65	0.03	–0.64	–0.12	0.04	4.29	2.69	1.98	0.94	1.59
Spain	–0.60	0.52	–0.44	0.07	–1.59	–0.22	–0.26	1.53	0.02	–0.10	–0.19	–0.24
Sweden	–0.34	1.09	0.47	0.08	0.63	–0.20	–0.57	0.08	–0.55	–0.80	–0.93	–0.69
Switzerland	–0.14	1.69	0.89	–0.63	0.60	–0.23	–0.54	–0.62	–0.09	–0.72	–0.92	–0.12
Thailand	0.04	0.85	1.67	–0.01	–0.27	–0.23	–0.21	–1.37	0.03	–0.09	–0.31	0.04
Ukraine	–0.10	–1.09	–2.68	0.01	0.54	–0.13	5.04	0.31	–0.86	–0.89	0.29	2.70
United Kingdom	–0.70	1.26	–0.41	0.12	–1.40	–0.18	–0.51	–0.68	–0.20	–0.57	–0.30	1.31
United States	–0.30	–0.48	0.14	0.02	0.53	–0.18	–0.50	0.03	0.48	–0.07	0.01	0.07
Uruguay	–0.56	–0.96	0.95	0.05	–0.58	0.06	–0.33	0.50	0.52	0.31	0.31	–1.10
Venezuela	–2.84	–0.92	–1.40	0.01	0.05	6.86	–0.64	–0.08	0.95	0.95	–1.04	–1.10

Note: zi1-zi12 – z-score for indicators i1-i12; i1 – real interest rate; i2 – monetary sector credit to private sector; i3 – gross domestic investment; i4 – foreign direct investment inflows; i5 – GDP per capita growth; i6 – consumer prices index; i7 – bank nonperforming loans; i8 – unemployment estimate; i9 – Gini index; i10 – poverty headcount ratio; i11 – interest payments; i12 – central government debt.

Table A6. Standardized input data in 2023

Country	zi1	zi2	zi3	zi4	zi5	zi6	zi7	zi8	zi9	zi10	zi11	zi12
Albania	−0.40	−0.80	−0.62	0.17	1.10	−0.22	0.22	0.92	−0.49	−0.25	0.12	0.70
Argentina	−2.24	−1.15	0.21	0.00	−0.91	−0.35	−0.07	−0.02	0.59	0.45	0.11	−1.18
Australia	−0.26	1.07	0.14	−0.10	−0.10	−0.20	−0.48	−0.53	−0.02	−0.59	−0.61	0.15
Azerbaijan	2.32	−0.95	0.28	−0.19	−0.08	−0.11	−0.16	−0.12	−0.76	−1.04	−0.75	−0.80
Brazil	3.59	0.00	−0.53	−0.05	0.35	−0.22	−0.15	0.35	1.67	0.90	2.57	0.74
Bulgaria	−0.79	−0.51	−1.07	0.01	1.06	−0.09	0.18	−0.40	0.43	−0.27	−0.86	−0.49
Canada	−0.42	1.01	−0.42	−0.10	−0.85	−0.24	−0.55	−0.17	−0.27	−0.61	0.09	0.25
Chile	−0.16	0.16	−0.36	0.15	−0.46	−0.14	−0.32	0.58	0.81	−0.03	−0.41	−0.88
China	0.10	2.36	0.48	−0.19	1.17	−0.35	−0.32	−0.23	0.11	0.06	−1.06	−1.18
Colombia	1.06	−0.57	−2.31	0.05	−0.52	−0.03	−0.18	0.70	1.94	1.12	0.92	0.47
Costa Rica	0.56	−0.42	−0.01	0.09	0.96	−0.34	−0.24	0.43	1.17	0.58	1.45	−0.28
Croatia	0.48	−0.47	−0.48	0.01	0.55	−0.13	0.14	−0.03	−0.54	−0.53	−0.43	0.55
Cyprus	−0.43	−0.17	0.31	−0.79	−0.08	−0.25	0.72	−0.08	−0.31	−0.90	−0.59	0.05
Czechia	−0.78	−0.46	−0.48	−0.08	−0.90	−0.06	−0.35	−0.76	−0.79	−1.19	−0.60	−0.86
Egypt	−1.04	−0.82	−1.90	−0.07	0.21	0.59	−0.61	0.11	−0.25	0.30	2.58	0.79
Greece	−0.43	−0.44	0.22	−0.10	0.39	−0.26	0.80	0.99	−0.15	−0.18	0.03	3.19
Honduras	0.40	0.04	−1.27	−0.03	0.15	−0.17	−0.20	−0.03	1.31	1.69	0.44	−1.18
Hong Kong	−0.12	3.40	0.96	1.55	−0.18	−0.29	−0.43	−0.68	−3.30	−1.90	−1.06	−1.18
Iceland	0.16	0.34	0.50	0.08	0.20	−0.11	−0.36	−0.56	−0.80	−1.17	1.15	0.68
India	−0.25	−0.42	1.03	−0.16	1.70	−0.19	0.22	−0.43	−0.16	1.51	2.43	−0.11
Indonesia	0.35	−0.78	0.69	−0.12	0.82	−0.25	−0.24	−0.61	0.15	0.53	0.58	−0.49
Iran	0.42	−0.22	0.26	−0.19	0.72	0.89	−0.61	0.59	0.03	0.16	−0.95	−1.18
Iraq	2.42	−1.12	2.22	−0.32	−1.83	−0.23	2.18	2.06	−0.48	−0.33	−1.05	−0.55
Ireland	−0.43	−0.88	0.91	−1.60	−2.68	−0.18	−0.33	−0.40	−0.42	−1.09	−0.56	−0.14
Israel	−0.61	−0.05	−0.12	−0.05	−0.28	−0.23	−0.48	−0.59	0.33	0.39	0.10	0.85
Italy	−0.53	−0.16	−0.11	−0.11	−0.16	−0.20	−0.12	0.29	0.03	−0.19	0.09	0.59
Kenya	0.33	−0.77	−0.38	−0.17	0.63	−0.14	1.25	−0.11	0.40	2.80	1.40	−1.18
Korea, Rep.	−0.10	2.01	0.20	−0.16	0.00	−0.25	−0.56	−0.74	−0.15	−0.44	−0.39	0.02
Malaysia	0.36	0.87	0.67	−0.10	0.28	−0.28	−0.31	−0.48	0.59	0.15	1.18	0.29
Malta	−0.17	−0.13	−1.51	5.99	0.60	−0.21	0.00	−0.65	−0.30	−0.79	−0.59	−0.49
Mexico	0.31	−0.89	1.83	−0.11	0.29	−0.20	−0.25	−0.72	0.86	0.42	1.31	−0.14
Netherlands	−0.39	0.24	−0.72	−1.68	−0.63	−0.24	−0.33	−0.56	−0.84	−0.99	−0.81	0.06
Nigeria	−0.30	−1.13	0.14	−0.18	−0.16	0.33	0.09	−0.65	0.06	2.49	−1.06	−1.18
Norway	1.49	0.69	0.00	−0.07	−0.56	−0.20	−0.56	−0.55	−0.65	−0.93	−0.82	−0.48
Pakistan	−0.59	−1.15	−1.10	−0.17	−0.82	0.50	0.52	0.02	−0.47	0.97	−1.06	0.63
Philippines	0.25	−0.45	0.70	−0.09	0.98	−0.19	−0.07	−0.75	0.59	0.81	−0.20	−0.19
Portugal	−0.43	0.18	0.33	−0.02	−0.05	−0.23	0.02	0.06	0.01	−0.58	−0.20	−1.18
Qatar	1.64	0.89	−0.85	−0.22	−0.02	−0.27	−0.61	−1.26	0.06	−0.10	−1.06	−0.01
Romania	−0.76	−0.94	−0.13	−0.07	0.30	−0.06	−0.15	−0.13	−0.06	0.17	−0.47	2.88
Singapore	−0.92	1.10	0.14	1.72	−1.44	−0.22	−0.38	−0.58	−3.30	−1.90	−0.99	0.57
South Africa	0.26	−0.27	0.11	−0.16	−0.55	−0.18	0.22	5.36	2.73	2.07	1.06	1.28
Spain	−0.43	0.13	−0.01	−0.06	0.04	−0.25	−0.08	1.23	−0.06	−0.16	−0.17	−0.34
Sweden	−0.23	1.08	−0.47	−0.04	−0.60	−0.11	−0.55	0.29	−0.45	−0.65	−0.84	−0.72
Switzerland	−0.23	1.90	0.15	−0.76	−0.53	−0.29	−0.49	−0.45	−0.08	−0.69	−0.91	0.22
Thailand	−0.10	0.91	1.30	−0.14	0.18	−0.32	−0.12	−1.14	0.04	−0.14	−0.23	0.16
Ukraine	−0.10	−1.11	3.36	−0.07	4.00	0.01	5.97	0.75	−0.85	−0.86	−0.19	1.99
United Kingdom	−0.52	0.92	−0.22	−0.35	−0.51	−0.16	−0.44	−0.46	−0.20	−0.54	0.11	1.45
United States	−0.57	−0.43	0.09	−0.14	0.31	−0.24	−0.48	−0.54	0.65	0.08	0.88	0.26
Uruguay	0.45	−0.82	−0.12	−0.60	−0.24	−0.19	−0.37	0.44	0.58	0.34	−0.10	−1.18
Venezuela	−2.22	−0.80	−2.03	−0.19	−1.80	6.74	−0.61	0.27	0.98	1.02	−1.06	−1.18

Note: zi1-zi12 – z-score for indicators i1-i12; i1 – real interest rate; i2 – monetary sector credit to private sector; i3 – gross domestic investment; i4 – foreign direct investment inflows; i5 – GDP per capita growth; i6 – consumer prices index; i7 – bank nonperforming loans; i8 – unemployment estimate; i9 – Gini index; i10 – poverty headcount ratio; i11 – interest payments; i12 – central government debt.

http://dx.doi.org/10.21511/bbs.20(2).2025.06