

How to measure banking regulation and supervision

Cristina Pereira Pedro* (cristinap@uevora.pt), Joaquim J. S. Ramalho** (jjsro@iscte.pt), Jacinto Vidigal da Silva* (jsilva@uevora.pt)

* Center for Advanced Studies in Management and Economics, Universidade de Évora (CEFAGE-UE)

** Department of Economics & Business Research Unit (BRU-IUL), Instituto Universitário de Lisboa (ISCTE-IUL)

World Finance Conference 2021
Norway, August 3-6

Acknowledgements:



CEFAGE
centro de estudos e formação avançada em gestão e economia



Fundação
para a Ciência
e a Tecnologia



REPÚBLICA
PORTUGUESA

CIÊNCIA, TECNOLOGIA
E ENSINO SUPERIOR



European Union
European Social Fund

SFRH/BPD/108826/2015

Cristina Pereira Pedro

AGENDA

World Finance Conference 2021, August 3-6

1. Objectives of the study
2. Sample and methodology
3. Results and discussion
4. Conclusion and contributions

Acknowledgements:



CEFAGE
centro de estudos e formação avançada em gestão e economia



Fundação
para a Ciência
e a Tecnologia



REPÚBLICA
PORTUGUESA

CIÊNCIA, TECNOLOGIA
E ENSINO SUPERIOR



ALENTEJO
2020



European Union
European Social Fund

SFRH/BPD/108826/2015

Cristina Pereira Pedro

I. OBJECTIVES OF THE STUDY

World Finance Conference 2021, August 3-6

- (Using partial information) Previous studies allowed a better understanding of Regulation and Supervision (RS) progression and its adjustments to systemic events (such as banking crises).



fragmented and limited vision of the phenomenon

Aim of the study: To summarize the vast range of information provided by the World Bank Banking regulation and supervision survey (BRSS) using proper statistical methods to concisely identify variables characterizing RS practices around the world.

In general terms: Offer an extensive perspective of the RS international scenario.

Acknowledgements:



CIÊNCIA, TECNOLOGIA
E ENSINO SUPERIOR



SFRH/BPD/108826/2015

Cristina Pereira Pedro

2. SAMPLE AND METHODOLOGY

World Finance Conference 2021, August 3-6

■ Sample: 141 countries

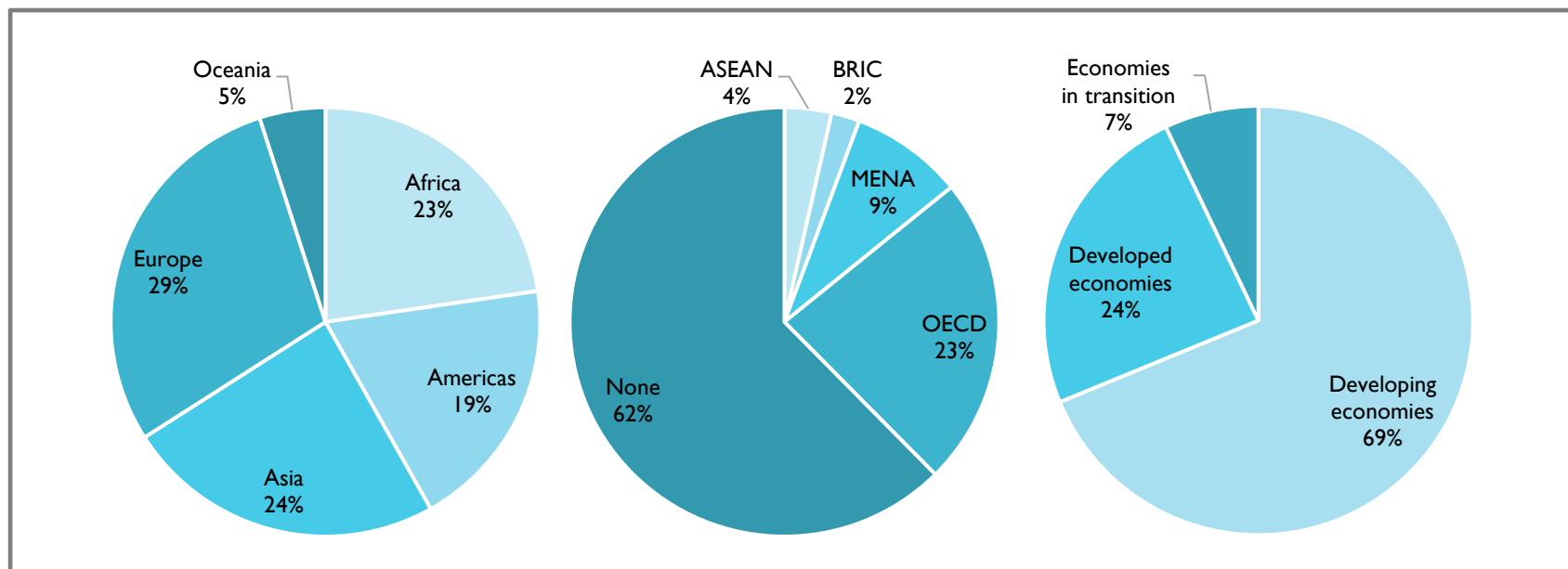


Fig. 1 Sample description, by continental regions, political and economic alliances, and country development level. Source: Authors' calculations.

Acknowledgements:



CIÊNCIA, TECNOLOGIA
E ENSINO SUPERIOR



SFRH/BPD/108826/2015

Cristina Pereira Pedro

2. SAMPLE AND METHODOLOGY

World Finance Conference 2021, August 3-6

- **Data source:** 2012 version of the BRSS2011 (last final version available).

Table 1 - Topics

- entry into banking;
- ownership;
- capital;
- activities;
- external auditing requirements;
- internal management requirements;
- liquidity and diversification requirements;
- depositors' (savings) protection schemes;
- provision requirement);
- information disclosure;
- discipline/problem institution/exit;
- supervision.

Acknowledgements:



CIÊNCIA, TECNOLOGIA
E ENSINO SUPERIOR



SFRH/BPD/108826/2015

Cristina Pereira Pedro

2. SAMPLE AND METHODOLOGY

World Finance Conference 2021, August 3-6

- Selection of variables displaying nonzero variance across countries and common to, at least, 4 out of the 5 editions of the BRSS.
- Quantitative and qualitative variables (119 variables) → **Nonlinear principal components analysis (NLPCA) with optimal variable transformation (optimal scaling)**
- NLPCA is a statistical method useful:
 - the presence of a large number of variables inhibits an efficient analysis of the relationships between subjects (countries in this case) and observed variables (some of which have a categorical nature),
 - promoting a simultaneous quantification of categorical variables and reduction of data dimensionality.

Acknowledgements:



CIÊNCIA, TECNOLOGIA
E ENSINO SUPERIOR



SFRH/BPD/108826/2015

Cristina Pereira Pedro

2. SAMPLE AND METHODOLOGY

World Finance Conference 2021, August 3-6

- The optimal scaling approach of the NLPKA enables variables to be scaled differently, so that categorical variables are optimally quantified and the nonlinear relationships between all types of variables can be modeled (Meulman, 1992).
- The original set of variables is then reduced into a smaller group of uncorrelated components that represent most of the information directly conveyed by the initial variables.
- At the end, the researcher only needs to interpret a small number of components instead of the initial large number of variables.

Acknowledgements:



CIÊNCIA, TECNOLOGIA
E ENSINO SUPERIOR



SFRH/BPD/108826/2015

Cristina Pereira Pedro

2. SAMPLE AND METHODOLOGY

World Finance Conference 2021, August 3-6

- To apply NLPCA to our data, we used the *categorical principal components analysis (CATPCA)* script of the SPSS software:
 - CAPTCA converts string variables into positive integers by ascending alphanumeric order;
 - (to obtain the optimal quantification of each category) it minimizes a least-squares loss function that measures the loss of information resulting from the transformation of the original set of variables into a smaller group (the principal components), Linting *et al.* (2007).



In contrast to the original categorical variables, their numerical quantification has metrical properties and can be represented as a vector in the space determined for the objects.

Acknowledgements:



CIÊNCIA, TECNOLOGIA
E ENSINO SUPERIOR



SFRH/BPD/108826/2015

Cristina Pereira Pedro

2. SAMPLE AND METHODOLOGY

World Finance Conference 2021, August 3-6

- Joint objective function for CATPCA:
 - Linear combination of the loss function of the vector model and the objective function of the centroid model.

Part 1: is minimized for the m variables represented as a vector

$$L(\mathbf{Y}; \mathbf{A}; \mathbf{X}) = \underbrace{(M_V + M_B)^{-1} [M_V L_V(\mathbf{y}_V; \mathbf{A}; \mathbf{X}) + M_B L_B(\mathbf{Y}_B; \mathbf{X})]}_{\text{Part 2: is minimized for the representation of the categorical variables}}$$

Part 2: is minimized for the representation of the categorical variables

Acknowledgements:



CEPAGE
centro de estudos e formação avançada em gestão e economia



Fundação
para a Ciência
e a Tecnologia



REPÚBLICA
PORTUGUESA

CIÊNCIA, TECNOLOGIA
E ENSINO SUPERIOR



European Union
European Social Fund

SFRH/BPD/108826/2015

Cristina Pereira Pedro

2. SAMPLE AND METHODOLOGY

World Finance Conference 2021, August 3-6

- The optimal \hat{X} is given by:

$$\hat{X} = M^{-1} \left[\underbrace{\sum_{m \in K_V} G_m y_m \mathbf{a}'_m + \sum_{m \in K_B} G_m Y_m}_{\text{}} \right]$$

Allows object scores to be orthonormalized as $\hat{X}'\hat{X} = \mathbf{I}$ (uncorrelated).

Acknowledgements:



CEFAGE
centro de estudos e formação avançada em gestão e economia



Fundação
para a Ciência
e a Tecnologia



REPÚBLICA
PORTUGUESA

CIÊNCIA, TECNOLOGIA
E ENSINO SUPERIOR



European Union
European Social Fund

SFRH/BPD/108826/2015

Cristina Pereira Pedro

3. RESULTS AND DISCUSSION

World Finance Conference 2021, August 3-6

- Extraction methods for principal components:

1. Kaiser criterion (in association with C-alpha coefficient > 0);

- Retain PC whose eigenvalues (variance accounted for each PC) > 1

ⓘ Otherwise, they would explain fewer portions of the total variance than the observed for the original variables.

2. Scree plot visual analysis

- Retain PC until the “elbow” shape (little information is added when eigenvalues drop sharply)

Acknowledgements:



CIÊNCIA, TECNOLOGIA
E ENSINO SUPERIOR



SFRH/BPD/108826/2015

Cristina Pereira Pedro

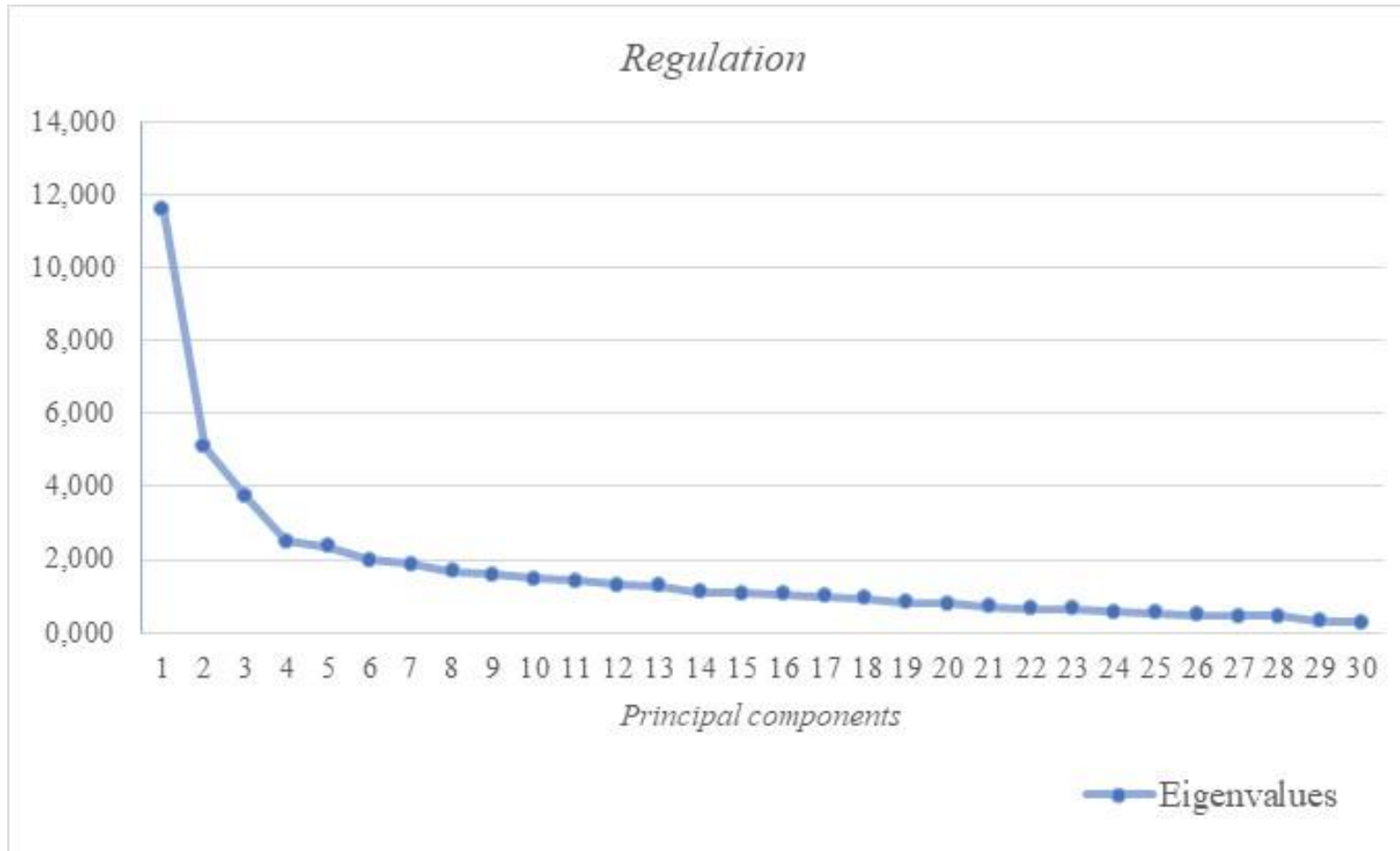


Fig. 2 Scree plot, regulation. *Source:* Authors' calculations.

Scree plot results from CATPCA estimates for 82 variables, including 30 as analysis variables (corresponds to the number of PC in the graphic) and the remaining as supplementary variables. These 30 PC explain 97.59% of the total variance of the model. Hence, only a small % of variance (2.41%) is explained by the supplementary variables (all quantitative variables were assumed as supplementary due to their number of missing values).

Table 2 – CATPCA results: regulation

Model diagnostics

<i>Dimension</i>	<i>Kaiser criterion</i>				<i>Scree plot criterion</i>	
	<i>Cronbach's Alpha</i>	<i>Variance accounted for</i>		<i>Cronbach's Alpha</i>	<i>Variance accounted for</i>	
		<i>Total (Eigenvalue)</i>	<i>% of Variance</i>		<i>Total (Eigenvalue)</i>	<i>% of Variance</i>
1	0.934	11.884	23.302	0.936	12.164	23.852
2	0.829	5.349	10.488	0.851	6.019	11.802
3	0.766	4.009	7.861	0.764	3.991	7.825
4	0.634	2.641	5.179	0.705	3.238	6.349
5	0.608	2.475	4.852			
6	0.590	2.373	4.653			
7	0.469	1.850	3.627			
8	0.432	1.735	3.402			
9	0.345	1.511	2.964			
10	0.312	1.441	2.826			
11	0.290	1.398	2.740			
12	0.210	1.260	2.471			
13	0.196	1.238	2.427			
14	0.126	1.141	2.236			
15	0.100	1.109	2.174			
Total	0.995 ^a	41.413	81.202	0.980 ^a	25.412	49.828

- Small n.^o of PC to allow meaningful interpretations;
- Eigenvalues based on the correlation matrix of the quantified variables = clear interpretation of the plot. (Fabrigar *et al.* 1999 and Linting *et al.* 2007)

a. Total Cronbach's Alpha is based on the total Eigenvalue.

Variables	Kaiser criterion															Scree plot method			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	1	2	3	4
Q.1.1	-0,131	0,236	-0,102	-0,209	0,035	-0,241	-0,070	0,179	-0,384	0,068	0,525	-0,313	0,058	-0,109	-0,144	-0,080	0,556	-0,021	-0,012
Q.1.3	0,018	-0,202	0,059	-0,108	0,154	-0,078	-0,099	0,036	0,229	0,615	0,190	0,157	-0,111	0,085	0,069	0,029	-0,217	0,068	0,076
Q.1.4.1	0,024	0,021	-0,085	0,021	0,069	-0,158	-0,126	0,364	0,254	0,293	-0,163	0,425	-0,141	-0,355	0,128	0,022	0,042	-0,093	-0,115
Q.1.4.2	0,218	0,683	-0,145	-0,016	-0,013	-0,085	-0,249	-0,047	0,035	-0,117	0,174	-0,009	0,199	-0,210	-0,016	0,225	0,684	-0,108	0,040
Q.1.4.3	0,254	-0,027	-0,130	0,215	0,129	0,211	-0,351	0,056	0,362	0,082	-0,083	-0,017	0,217	-0,018	-0,240	0,267	-0,038	-0,138	0,123
Q.1.5	0,162	0,056	0,135	-0,052	-0,009	0,351	-0,375	0,212	0,059	-0,292	0,171	-0,216	-0,154	-0,053	0,305	0,172	0,044	0,132	0,174
Q.1.6	0,009	-0,205	0,271	0,253	-0,021	0,098	0,310	0,595	-0,253	-0,056	0,017	0,091	0,008	-0,356	0,157	0,115	0,718	-0,092	-0,012
Q.1.8	0,137	0,167	0,075	0,365	0,191	0,412	0,526	0,310	-0,066	0,129	-0,101	-0,074	0,194	-0,028	-0,176	-0,297	0,102	-0,067	0,329
Q.1.13	-0,061	0,069	0,062	0,373	0,555	-0,574	-0,114	0,082	-0,017	0,181	-0,036	-0,117	-0,089	-0,006	0,031	0,196	-0,076	-0,019	0,619
Q.2.5.1	-0,101	0,128	0,786	-0,076	-0,022	-0,027	0,001	0,092	-0,141	0,101	0,027	-0,014	0,021	-0,344	0,174	-0,106	0,104	0,766	0,015
Q.2.6	0,179	0,402	0,428	0,304	0,257	-0,104	0,063	0,350	0,145	-0,183	0,028	0,162	-0,132	0,250	-0,160	0,178	0,384	0,431	-0,069
Q.2.7	0,148	0,459	0,442	0,155	0,110	0,080	0,099	0,372	0,135	-0,254	0,133	0,115	-0,103	0,256	-0,222	0,152	0,432	0,465	-0,027
Q.3.1	-0,268	-0,055	0,101	0,165	-0,608	-0,412	0,296	0,029	-0,031	-0,161	-0,033	0,012	0,178	0,154	0,061	-0,309	-0,039	0,101	-0,661
Q.3.2	-0,230	-0,002	0,031	0,105	-0,650	-0,461	0,082	0,093	0,190	-0,064	-0,010	-0,133	0,053	-0,086	0,062	-0,266	0,054	0,043	-0,717
Q.3.18	0,077	0,060	0,031	-0,231	-0,253	0,461	-0,248	0,325	0,093	0,100	-0,136	-0,129	-0,095	0,213	0,178	0,119	-0,015	0,053	0,285
Q.4.1	-0,065	0,194	0,924	-0,152	-0,002	-0,008	-0,056	-0,193	0,084	0,072	0,003	-0,021	0,078	0,015	0,013	-0,057	0,132	0,952	0,090
Q.4.2	-0,079	0,192	0,920	-0,156	-0,006	-0,020	-0,033	-0,194	0,089	0,078	-0,008	-0,030	0,089	0,019	0,012	-0,099	0,134	0,943	0,074
Q.4.3	-0,087	0,182	0,922	-0,157	-0,005	-0,021	-0,044	-0,194	0,085	0,081	-0,014	-0,033	0,074	0,014	0,015	-0,100	0,129	0,943	0,073
Q.4.4.1	-0,135	-0,079	-0,144	-0,068	-0,062	-0,070	0,189	0,009	0,582	0,129	0,368	-0,390	-0,087	-0,206	-0,166	-0,130	0,134	0,089	-0,461
Q.5.1.1	-0,024	0,006	0,028	0,392	0,310	-0,096	-0,282	-0,049	0,137	-0,074	-0,373	-0,378	-0,041	0,100	0,243	0,115	0,049	0,046	-0,038
Q.5.1.2	-0,089	-0,020	-0,077	-0,481	0,319	-0,096	0,263	0,170	0,247	-0,159	-0,162	-0,126	0,147	-0,074	0,284	-0,101	-0,022	-0,040	0,289
Q.7.2	0,232	0,892	-0,174	-0,053	-0,073	-0,125	-0,105	-0,036	0,079	-0,120	-0,025	0,094	-0,048	-0,108	-0,042	0,233	0,910	-0,119	-0,032
Q.7.2.2	0,235	0,893	-0,172	-0,046	-0,073	-0,120	-0,105	-0,032	0,083	-0,116	-0,022	0,093	-0,048	-0,112	-0,040	0,239	0,910	-0,122	-0,027
Q.7.4	0,082	0,675	-0,172	-0,091	-0,090	-0,165	0,087	-0,008	-0,236	0,191	-0,005	0,002	-0,036	0,228	0,391	0,070	0,678	-0,128	-0,066
Q.7.4.1	0,052	0,704	-0,180	0,035	0,070	0,113	0,260	-0,061	-0,199	0,361	-0,036	-0,071	0,043	0,170	0,304	0,046	0,678	-0,156	0,098
Q.8.1	0,869	-0,073	0,047	-0,077	0,012	0,024	0,058	-0,045	-0,083	-0,044	-0,076	0,070	-0,126	0,059	-0,051	0,861	-0,061	0,058	0,007
Q.8.2.1	0,275	0,066	0,091	-0,163	0,163	0,099	-0,098	0,167	-0,305	0,030	0,165	-0,422	-0,237	-0,078	-0,119	0,280	0,052	0,113	0,184
Q.8.4	0,923	-0,095	0,037	-0,003	-0,101	-0,029	0,116	-0,085	0,006	-0,018	-0,054	0,005	-0,036	-0,008	0,022	0,921	-0,086	0,043	-0,074
Q.8.4.1	0,925	-0,084	0,052	-0,018	-0,047	-0,030	0,067	-0,027	-0,025	0,001	-0,121	-0,033	-0,127	0,044	-0,053	0,921	-0,078	0,058	-0,077
Q.8.4.2	0,925	-0,076	0,054	-0,016	-0,082	-0,021	0,131	-0,054	-0,039	-0,037	-0,107	-0,042	-0,117	0,023	-0,061	0,919	-0,068	0,063	-0,086

Table 3 – CATPCA results: component loadings for regulation PC.

Bold values in light shading represent component loadings (correlations between variables and components) above 0.5

Variables	Kaiser criterion															Scree plot method			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	1	2	3	4
Q.8.4.3	0,870	-0,070	0,057	0,021	0,069	-0,146	0,053	0,034	-0,049	-0,039	-0,079	-0,074	-0,174	0,085	-0,131	0,866	-0,055	0,074	-0,095
Q.8.5	0,942	-0,095	0,033	-0,052	-0,060	-0,038	0,071	-0,071	-0,040	0,025	-0,070	0,025	-0,020	-0,056	-0,028	0,939	-0,089	0,046	-0,049
Q.8.6	0,943	-0,083	0,069	-0,023	-0,102	-0,073	0,065	-0,001	-0,081	0,011	-0,029	-0,019	0,008	-0,140	0,032	0,940	-0,070	0,069	-0,107
Q.8.7	0,939	-0,081	0,030	0,005	-0,085	-0,044	-0,013	-0,062	-0,024	-0,018	-0,092	-0,071	0,029	-0,024	0,016	0,937	-0,076	0,025	-0,102
Q.8.10	0,904	-0,087	0,016	-0,013	-0,038	0,033	0,016	-0,104	0,052	0,001	0,019	-0,009	0,025	-0,109	0,042	0,907	-0,083	0,022	0,031
Q.8.12	0,907	-0,058	0,015	-0,035	-0,004	-0,077	-0,007	-0,017	0,003	0,027	0,024	-0,037	-0,011	-0,046	0,006	0,906	-0,051	0,018	-0,051
Q.8.13	0,894	-0,089	0,017	0,062	0,080	-0,111	-0,097	-0,036	0,030	0,052	-0,029	-0,060	0,010	-0,079	0,055	0,895	-0,081	0,009	-0,043
Q.8.14	0,928	-0,089	0,015	-0,030	-0,052	-0,045	-0,031	-0,030	0,011	0,055	0,027	-0,022	0,054	-0,112	0,013	0,927	-0,085	0,021	-0,043
Q.8.17.2	0,670	-0,036	-0,058	-0,012	0,004	0,017	0,109	0,163	0,234	0,072	0,347	-0,016	0,293	0,272	0,155	0,672	-0,048	-0,042	0,004
Q.8.17.3	0,702	-0,072	-0,025	0,095	-0,069	-0,181	-0,021	0,181	0,167	0,050	0,316	0,028	0,218	0,297	0,155	0,706	-0,069	-0,016	-0,177
Q.9.1	-0,097	-0,019	0,013	0,448	0,466	-0,489	0,101	-0,247	-0,021	-0,047	0,115	-0,004	-0,197	-0,022	0,090	-0,221	0,034	-0,079	-0,220
Q.9.2	0,233	0,900	-0,178	-0,097	-0,140	0,017	-0,046	-0,024	0,102	-0,077	-0,038	0,093	-0,021	-0,126	-0,050	0,240	0,922	-0,170	0,036
Q.9.5	-0,010	-0,086	0,045	-0,367	0,186	0,056	0,337	-0,307	-0,028	0,077	0,219	0,245	-0,043	0,000	-0,122	0,037	-0,068	0,088	0,385
Q.10.1	-0,025	-0,041	-0,072	-0,478	0,358	-0,150	0,301	0,018	0,235	-0,288	-0,206	-0,116	0,247	-0,123	0,097	-0,028	-0,033	-0,027	0,268
Q.10.2.1	0,046	-0,116	0,030	-0,366	-0,142	-0,512	-0,366	0,328	-0,152	-0,002	-0,024	0,218	-0,011	0,080	-0,112	-0,004	-0,068	0,074	-0,446
Q.10.2.2	0,059	0,063	0,170	0,582	-0,315	0,303	-0,210	-0,244	-0,046	0,062	0,062	0,004	0,090	-0,091	0,016	0,303	-0,066	-0,117	-0,400
Q.10.2.4	0,169	-0,048	0,012	0,225	0,325	-0,104	-0,211	-0,069	-0,247	-0,204	0,057	0,084	0,598	-0,021	-0,014	0,180	-0,075	-0,011	0,185
Q.10.2.5	0,291	-0,275	-0,064	0,380	-0,052	0,133	-0,058	-0,012	0,056	0,066	0,229	0,154	0,161	-0,191	0,202	0,299	-0,299	-0,117	-0,004
Q.10.5.1	0,297	-0,157	-0,055	-0,368	0,431	0,266	-0,206	-0,047	-0,097	-0,187	0,196	0,280	0,031	0,037	0,125	0,269	-0,146	-0,064	0,634
Q.10.5.2	-0,066	-0,015	0,023	0,271	0,000	0,118	0,198	-0,251	0,151	-0,410	0,357	0,167	-0,382	-0,044	0,301	0,109	-0,082	-0,040	0,285
Q.10.7	0,150	0,787	-0,173	0,098	0,151	0,252	0,205	-0,104	0,043	0,188	-0,050	-0,037	0,072	-0,097	-0,090	0,143	0,771	-0,150	0,198
Q.1.7a.*	-0,031	0,419	0,219	0,047	0,029	0,115	0,052	-0,208	-0,078	0,034	-0,093	-0,078	0,025	-0,085	-0,039	-0,025	0,399	0,233	0,064
Q.1.7b.*	-0,020	0,420	0,221	0,035	0,040	0,111	0,045	-0,199	-0,072	0,058	-0,094	-0,075	0,035	-0,083	-0,043	-0,019	0,398	0,233	0,068
Q.1.10a.*	-0,016	0,377	0,246	0,154	0,072	0,151	0,145	0,078	-0,058	-0,090	-0,192	-0,045	-0,032	0,036	-0,110	-0,019	0,353	0,250	-0,009
Q.1.10b.*	0,017	0,326	0,232	0,226	0,240	0,053	0,078	0,052	-0,091	-0,059	-0,161	-0,091	-0,035	0,039	-0,098	0,020	0,309	0,229	0,045
Q.1.10c.*	-0,010	0,350	0,242	0,235	0,245	0,023	0,082	0,090	-0,063	-0,029	-0,178	-0,045	-0,052	0,045	-0,092	-0,022	0,332	0,233	0,022
Q.1.11a.*	0,025	0,331	0,229	0,175	0,030	0,165	0,147	0,022	-0,089	-0,108	-0,182	-0,184	-0,041	-0,026	-0,150	-0,023	-0,342	-0,247	0,011
Q.1.11b.*	0,035	0,315	0,228	0,239	0,251	0,054	0,050	0,046	-0,080	-0,032	-0,158	-0,099	-0,030	-0,015	-0,136	0,015	0,309	0,227	0,054
Q.1.11c.*	-0,034	0,340	0,231	0,272	0,221	0,048	0,074	0,049	-0,088	-0,051	-0,168	-0,106	-0,049	-0,027	-0,124	-0,028	0,330	0,230	0,034
Q.1.12a.*	-0,105	-0,278	-0,268	-0,207	-0,095	-0,130	-0,162	-0,021	0,174	0,128	0,073	-0,027	0,041	0,136	-0,026	-0,097	-0,259	-0,246	-0,001
Q.1.12b.*	0,094	0,263	0,266	0,300	0,228	0,025	0,107	0,011	-0,188	-0,100	-0,060	0,009	-0,031	-0,151	0,021	-0,087	-0,247	-0,239	-0,039
Q.1.12c.*	0,057	0,281	0,271	0,315	0,211	0,018	0,122	0,025	-0,182	-0,099	-0,083	0,009	-0,062	-0,156	0,020	0,050	0,266	0,242	0,013
Q.2.3.1*	-0,079	0,017	-0,037	-0,258	-0,180	-0,055	0,033	-0,157	-0,057	0,037	-0,143	-0,154	-0,119	-0,151	-0,078	-0,099	0,054	-0,019	-0,073

Table 3 – CATPCA results: component loadings for regulation PC.

Bold values in light shading represent component loadings (correlations between variables and components) above 0.5

Variables	Kaiser criterion															Scree plot method			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	1	2	3	4
Q.2.5.2*	-0,180	-0,053	-0,299	-0,179	-0,179	-0,037	-0,069	-0,102	-0,013	-0,198	0,025	0,005	0,056	0,224	-0,003	-0,232	-0,093	-0,232	-0,101
Q.2.6.1*	0,131	0,115	0,112	0,005	0,187	-0,111	0,197	0,048	0,128	-0,095	0,113	0,018	-0,006	-0,072	0,154	0,115	0,129	0,143	-0,001
Q.3.3.1*	0,159	-0,139	-0,059	-0,031	0,127	0,160	-0,163	0,036	0,116	0,040	-0,160	-0,074	-0,028	-0,008	0,030	0,168	-0,157	-0,063	0,150
Q.3.4.1*	0,104	0,022	-0,015	0,185	0,132	0,268	-0,010	-0,020	0,133	0,034	0,130	0,015	0,263	0,042	-0,076	0,194	-0,118	-0,036	0,169
Q.3.18.2*	-0,074	0,060	0,036	-0,074	-0,047	-0,099	0,145	0,048	0,105	-0,156	0,110	0,073	-0,078	-0,070	0,017	-0,083	0,014	-0,074	0,088
Q.8.11*	-0,603	-0,021	-0,152	-0,101	-0,137	-0,008	-0,048	0,008	-0,063	-0,104	0,053	-0,017	-0,139	0,004	-0,204	-0,603	-0,009	-0,133	-0,039
Q.8.11.1*	0,495	-0,002	0,152	0,140	0,045	0,025	0,084	-0,087	-0,047	-0,072	0,045	-0,062	-0,063	0,023	0,093	-0,494	0,004	-0,133	0,039
Q.8.13.1*	0,490	-0,054	-0,065	0,033	0,080	-0,028	0,004	-0,019	-0,035	0,215	0,001	-0,031	-0,005	-0,073	0,001	0,489	-0,045	-0,078	0,076
Q.8.17.1*	-0,466	0,000	-0,080	-0,001	-0,098	0,021	0,011	-0,129	-0,086	-0,174	-0,046	0,001	-0,218	-0,144	-0,250	0,464	-0,015	0,080	0,048
Q.9.1.3a.*	0,273	-0,195	-0,041	0,043	0,130	0,242	-0,036	0,165	0,172	-0,051	-0,037	-0,020	0,128	0,009	-0,059	0,287	-0,219	-0,052	0,233
Q.9.1.3b.*	0,274	-0,192	-0,041	0,118	0,160	0,262	-0,081	0,154	0,206	-0,038	-0,029	-0,008	0,123	-0,021	-0,013	0,284	-0,221	-0,052	0,242
Q.9.1.3c.*	0,320	-0,153	-0,017	0,128	0,231	0,280	-0,070	0,100	0,100	-0,008	-0,069	0,005	0,056	-0,098	-0,017	0,335	-0,170	-0,036	0,263
Q.9.6.3a.*	0,227	-0,217	-0,004	0,188	0,031	0,171	-0,293	0,146	0,086	-0,053	-0,041	0,134	0,003	-0,062	-0,060	0,298	-0,207	-0,011	0,040
Q.9.6.3b.*	0,298	-0,190	-0,040	0,211	0,136	0,275	-0,240	0,050	0,119	-0,037	-0,049	0,105	-0,006	0,048	-0,108	0,330	-0,196	-0,047	0,145
Q.9.6.3c.*	0,297	-0,198	-0,008	0,244	0,106	0,266	-0,224	0,108	0,103	-0,021	-0,059	0,119	0,017	-0,063	-0,048	0,336	-0,212	-0,030	0,133
Q.10.8*	-0,127	-0,200	0,069	-0,178	-0,429	-0,163	0,062	0,100	-0,044	0,131	-0,051	0,006	0,110	-0,031	0,040	-0,368	0,024	0,116	-0,175
Q.10.9*	-0,065	0,220	-0,060	0,138	0,124	0,159	0,077	-0,018	0,116	-0,198	-0,019	0,047	-0,031	0,029	0,032	-0,116	0,195	-0,054	0,080
Q.13.7.1*	-0,155	-0,257	0,064	-0,249	-0,019	-0,156	-0,033	-0,072	-0,151	-0,052	-0,080	-0,088	-0,344	0,104	-0,015	-0,159	-0,237	0,081	-0,061
Q.13.7.2*	-0,039	-0,250	0,095	-0,156	0,022	-0,084	-0,019	0,091	-0,110	-0,064	-0,091	-0,040	-0,260	0,069	0,005	-0,025	-0,237	0,075	-0,057

* Supplementary variable.

Table 3 – CATPCA results: component loadings for regulation PC.

Bold values in light shading represent component loadings (correlations between variables and components) above 0.5

Principal component 1 | *Deposit insurance*

<i>Variables</i>	<i>Component Loadings</i>			
	<i>PC 1</i>	<i>PC 2</i>	<i>PC 3</i>	<i>PC 4</i>
<i>8.1 Is there an explicit deposit insurance protection system for commercial banks?</i>	0,861	-0,061	0,058	-0,007
<i>8.4 Does the deposit insurance agency/fund administrator have the following powers as part of its mandate? c. Bank intervention authority.</i>	0,921	-0,086	0,043	0,074
<i>8.4.1 Does the deposit insurance authority by itself have the legal power to cancel or revoke deposit insurance for any participating bank?</i>	0,921	-0,078	0,058	0,077
<i>8.4.2 Can the deposit insurance agency/fund take legal action for violations against laws, regulations, and bylaws (of the deposit insurance agency) against bank directors or other bank officials?</i>	0,919	-0,068	0,063	0,086
<i>8.4.3 Has the deposit insurance agency/fund ever taken legal action for violations against laws, regulations, and bylaws (of the deposit insurance agency) against bank directors or other bank officials?</i>	0,866	-0,055	0,074	0,095
<i>8.5 Is participation in the deposit insurance system compulsory for the following banking entities?</i>	0,939	-0,089	0,046	0,049
<i>8.6 Are the following types of deposits excluded from deposit insurance coverage?</i>	0,940	-0,070	0,069	0,107
<i>8.7 The deposit insurance coverage type is: a. Per depositor account; b. Per depositor; c. Per depositor per institution; d. Other (please explain).</i>	0,937	-0,076	0,025	0,102

Principal component 1 | *Deposit insurance*

<i>Variables</i>	<i>Component Loadings</i>			
	<i>PC 1</i>	<i>PC 2</i>	<i>PC 3</i>	<i>PC 4</i>
<i>8.10 Is there formal coinsurance, i.e. are ALL depositors explicitly insured for less than 100% of their deposits?</i>	0,907	-0,083	0,022	-0,031
<i>8.11 What percentage of the total deposits of participating commercial banks was actually covered by the scheme as of end of 2010?</i>	-0,603	-0,009	-0,133	0,039
<i>8.12 Is there an ex ante fund/reserve to cover deposit insurance claims in the event of the failure of a member bank?</i>	0,906	-0,051	0,018	0,051
<i>8.13 Funding is provided by: a. Government; b. Banks; c. Combination/Other (please explain).</i>	0,895	-0,081	0,009	0,043
<i>8.14 Do deposit insurance fees/premiums charged to banks vary based on some assessment of risk?</i>	0,927	-0,085	0,021	0,043
<i>8.17.2 Were insured depositors wholly compensated (to the extent of legal protection) the last time a bank failed?</i>	0,672	-0,048	-0,042	-0,004
<i>8.17.3 Were any deposits not explicitly covered by the deposit insurance scheme at the time of failure compensated the last time a bank failed (excluding funds later paid out in liquidation procedures)?</i>	0,706	-0,069	-0,016	0,177

Table 4 – Principal components composition and labels, regulation

Bold values represent component loadings above 0.5 (in absolute value). Variables with higher correlations in each PC determined its label (Marôco, 2018).

Principal component 2 | Requirements on banking licensing, liquidity diversification, and credit

Variables	Component Loadings			
	PC 1	PC 2	PC 3	PC 4
<i>1.1 What body/agency grants commercial banking licenses? Please include the name of licensing agency. If more than one, please describe their respective licensing roles.</i>	-0,080	0,556	-0,021	-0,012
<i>1.4.2 Are the sources of funds to be used as capital verified by the regulatory/supervisory authorities?</i>	0,225	0,684	-0,108	-0,040
<i>1.6 Which of the following are legally required to be submitted before issuance of the banking license?</i>	0,115	0,718	-0,092	0,012
<i>7.2 Are there any regulatory rules or supervisory guidelines regarding asset diversification?</i>	0,233	0,910	-0,119	0,032
<i>7.2.2 Are banks prohibited from making loans abroad?</i>	0,239	0,910	-0,122	0,027
<i>7.4 Are the following requirements in place in your jurisdiction? b. Central Bank reserve and/or deposit requirements.</i>	0,070	0,678	-0,128	0,066
<i>7.4.1 Are banks required to hold reserves in foreign currencies or other foreign-denominated instruments in order to fulfill the requirements listed above?</i>	0,046	0,678	-0,156	-0,098
<i>9.2 Which criteria are taken into account to classify loans and advances as non-performing ...?:</i>	0,240	0,922	-0,170	-0,036
<i>10.7 Are commercial banks required by supervisors to have external credit ratings?</i>	0,143	0,771	-0,150	-0,198

Principal component 3 | Capital ownership and complementary banking activities

<i>Variables</i>	<i>Component Loadings</i>			
	<i>PC 1</i>	<i>PC 2</i>	<i>PC 3</i>	<i>PC 4</i>
<i>2.5.1 Can related parties own capital in a bank?</i>	-0,106	0,104	0,766	-0,015
<i>4.1 What are the conditions under which banks can engage in securities activities?</i>	-0,057	0,132	0,952	-0,090
<i>4.2 What are the conditions under which banks can engage in insurance activities?</i>	-0,099	0,134	0,943	-0,074
<i>4.3 What are the conditions under which banks can engage in real estate activities?</i>	-0,100	0,129	0,943	-0,073

Principal component 4 | Entry into banking denied applications and information disclosure

<i>Variables</i>	<i>Component Loadings</i>			
	<i>PC 1</i>	<i>PC 2</i>	<i>PC 3</i>	<i>PC 4</i>
<i>1.13 What were the primary reasons for denial of the applications in questions 1.7, 1.10, 1.11 and 1.12?</i>	-0,196	0,076	0,019	0,619
<i>10.5.1 Do banks disclose to the public ...? b. Off-balance sheet items; c. Governance and risk management framework</i>	0,269	-0,146	-0,064	-0,634

3. RESULTS AND DISCUSSION

World Finance Conference 2021, August 3-6

- Banking regulatory practices that best describe the global regulatory framework (representing the most relevant proxy candidates to measure banking regulation):
 - Deposit insurance (Cull *et al.*, 2002; Demirguç-Kunt and Kane, 2002; and Cihak *et al.*, 2012, *e.g.*);
 - Liquidity and diversification requirements;
 - Complementary banking activities;
 - Market discipline (Lane, 1993; Barth *et al.* (2004); Ushida and Satake (2009); Swamy, 2018; and Anginer *et al.*, 2019, *e.g.*);
 - Capital (with less expression) (Moosa, 2010; Aiyar *et al.* 2015; and Jacques, 2017).

Acknowledgements:



CIÊNCIA, TECNOLOGIA
E ENSINO SUPERIOR



SFRH/BPD/108826/2015

Cristina Pereira Pedro

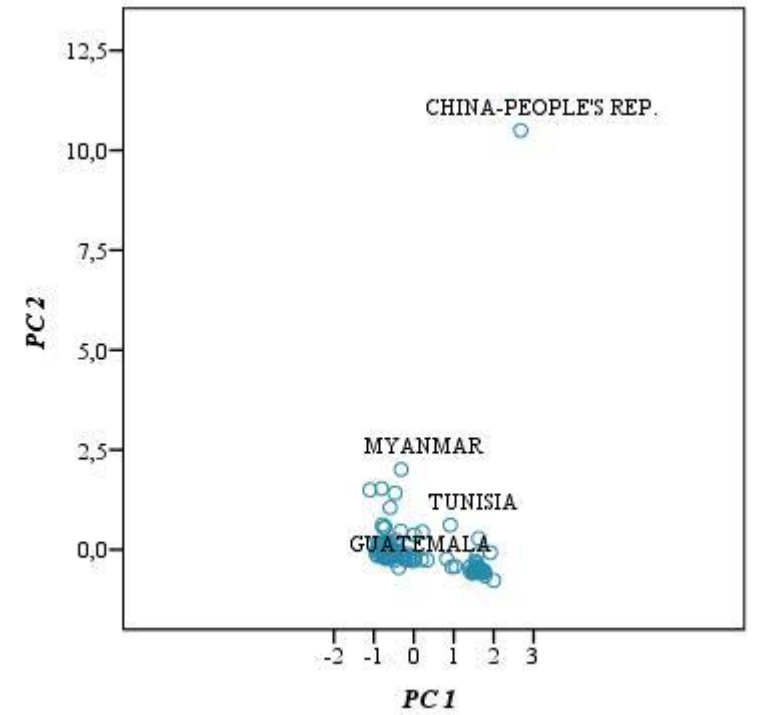
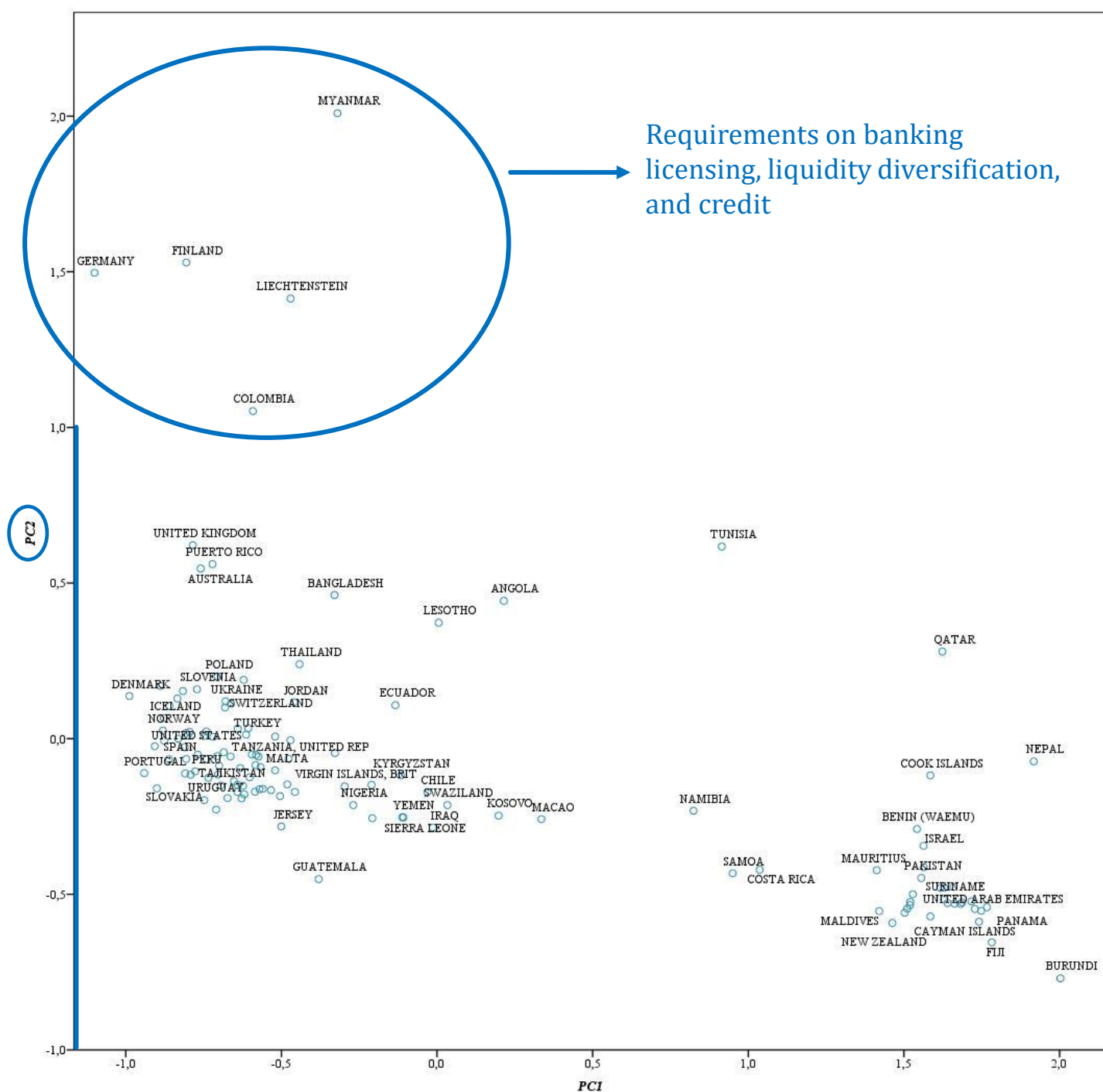


Fig. 3 Object points labeled by country, regulation.
Source: Authors' calculations.

Country scores from CATPCA on 82 variables, (30 as analysis variables and 52 supplementary variables).

The points represent the coordinates of each country in each principal component with, approximately, zero mean and unit standard deviation.

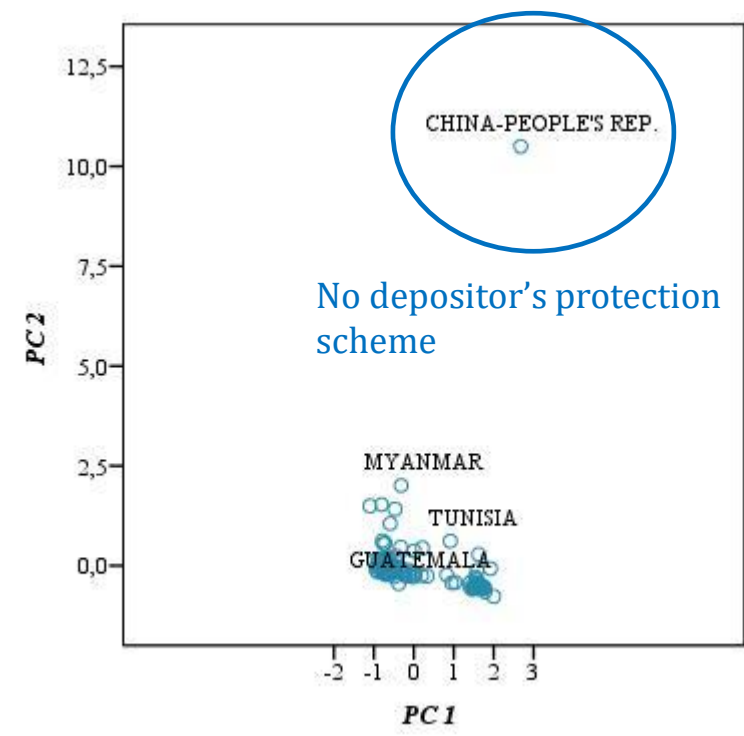
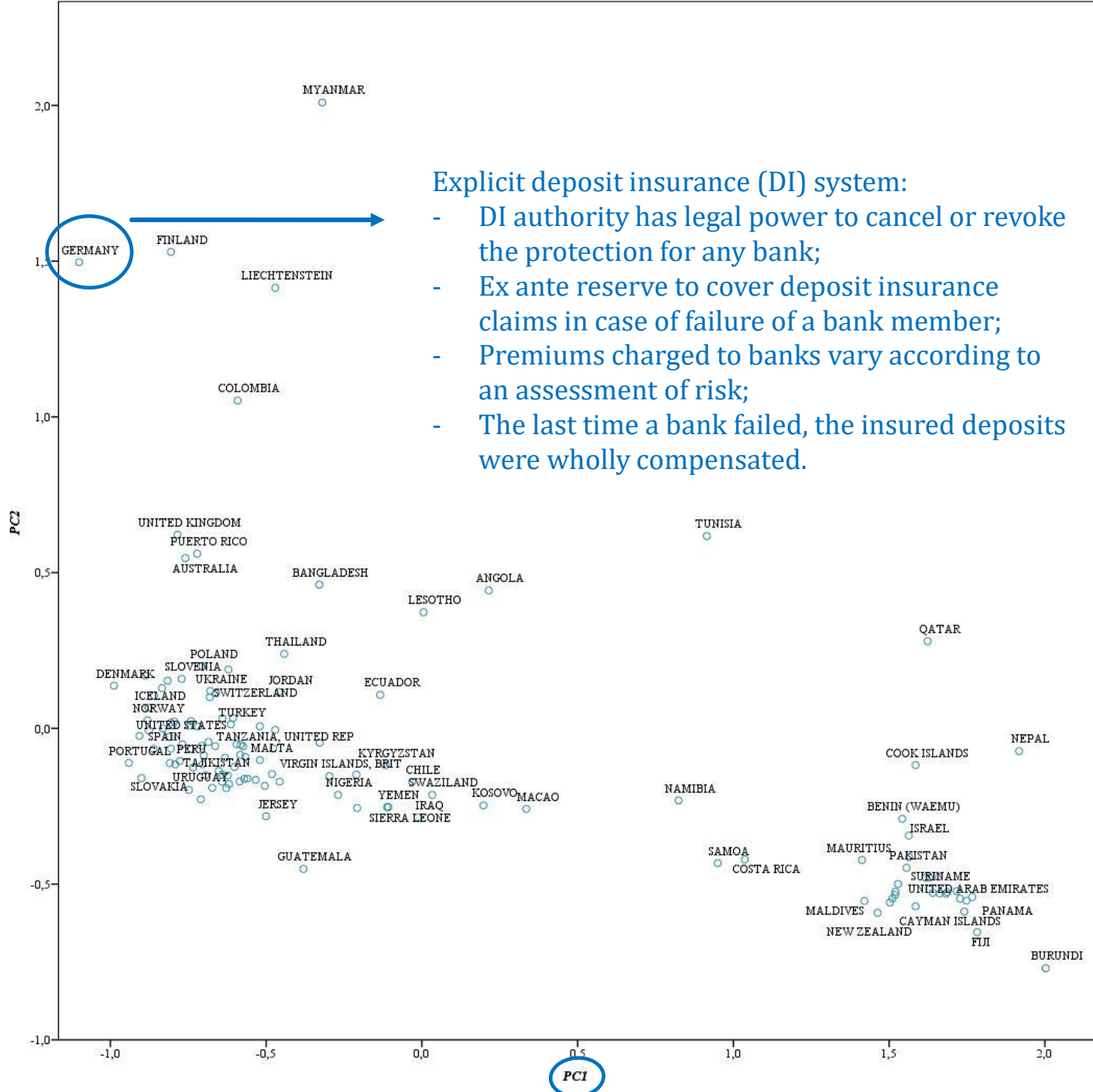


Fig. 3 Object points labeled by country, regulation.
Source: Authors' calculations.

Country scores from CATPCA on 82 variables, (30 as analysis variables and 52 supplementary variables).

The points represent the coordinates of each country in each principal component with, approximately, zero mean and unit standard deviation.

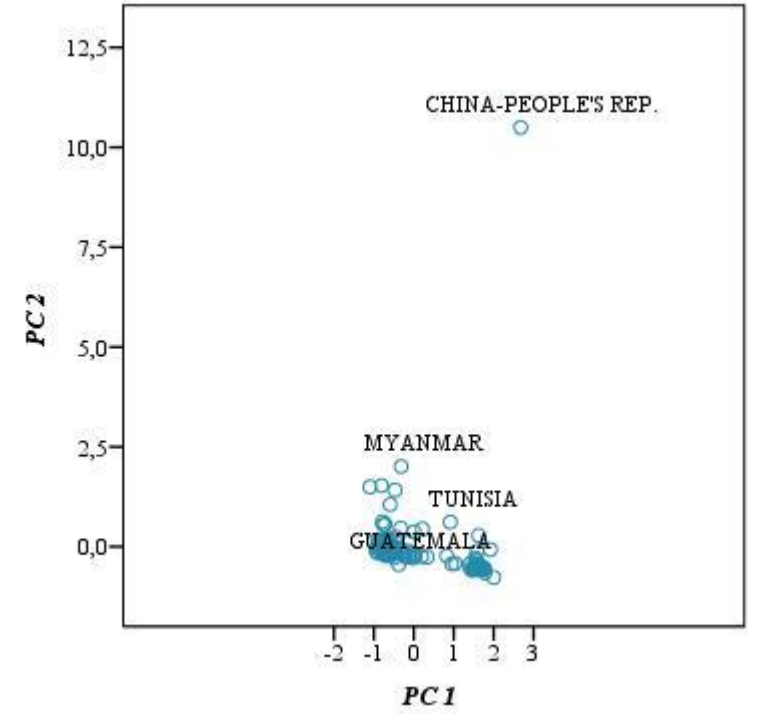
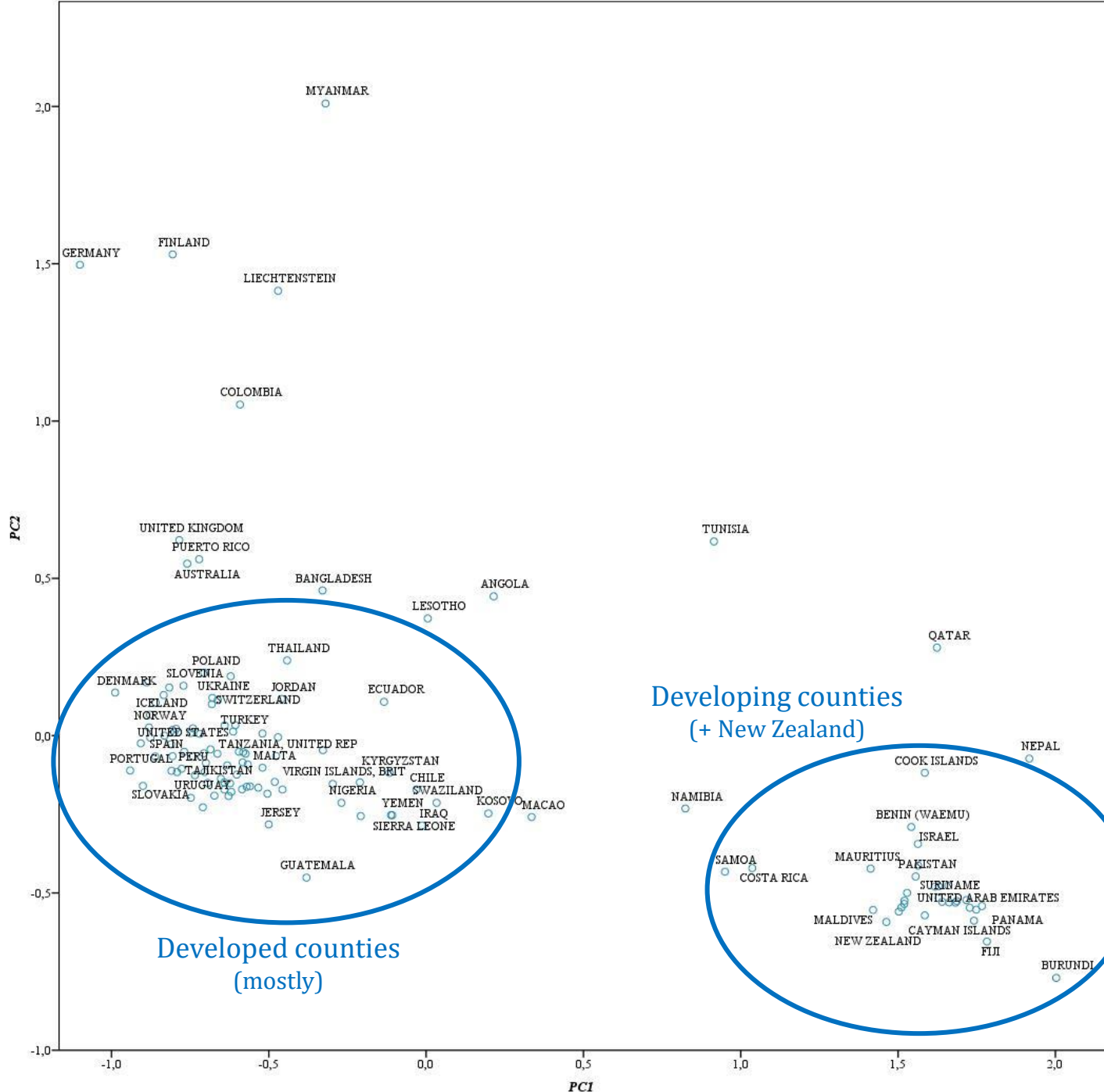


Fig. 3 Object points labeled by country, regulation.
Source: Authors' calculations.

Country scores from CATPCA on 82 variables, (30 as analysis variables and 52 supplementary variables).

The points represent the coordinates of each country in each principal component with, approximately, zero mean and unit standard deviation.

→ (Informal) clusters

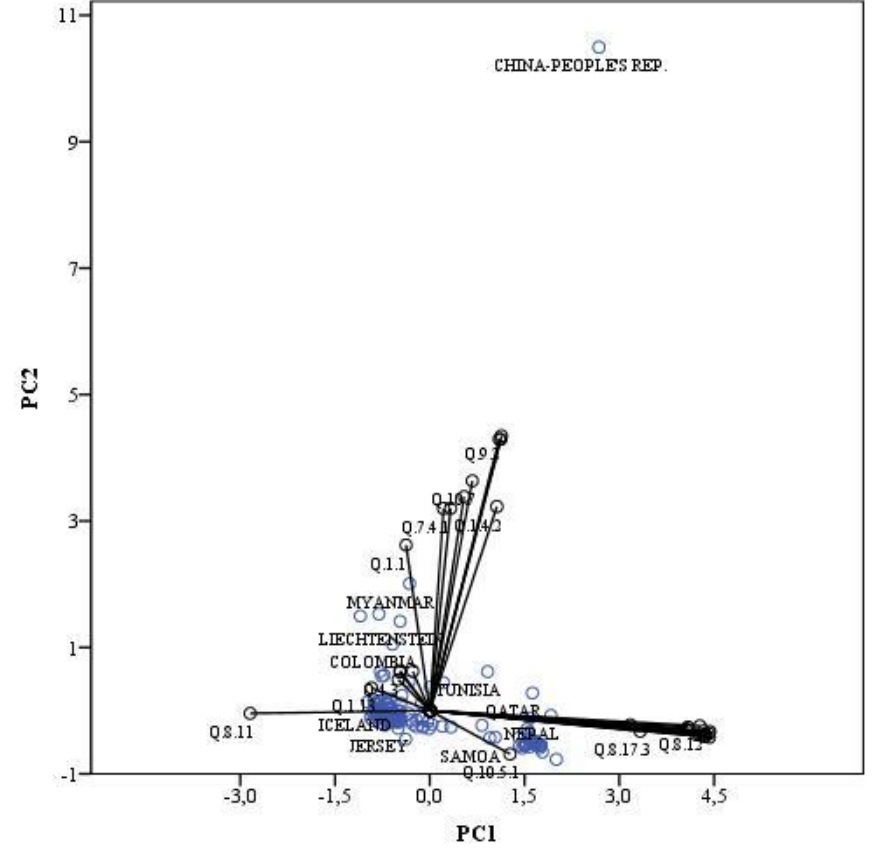
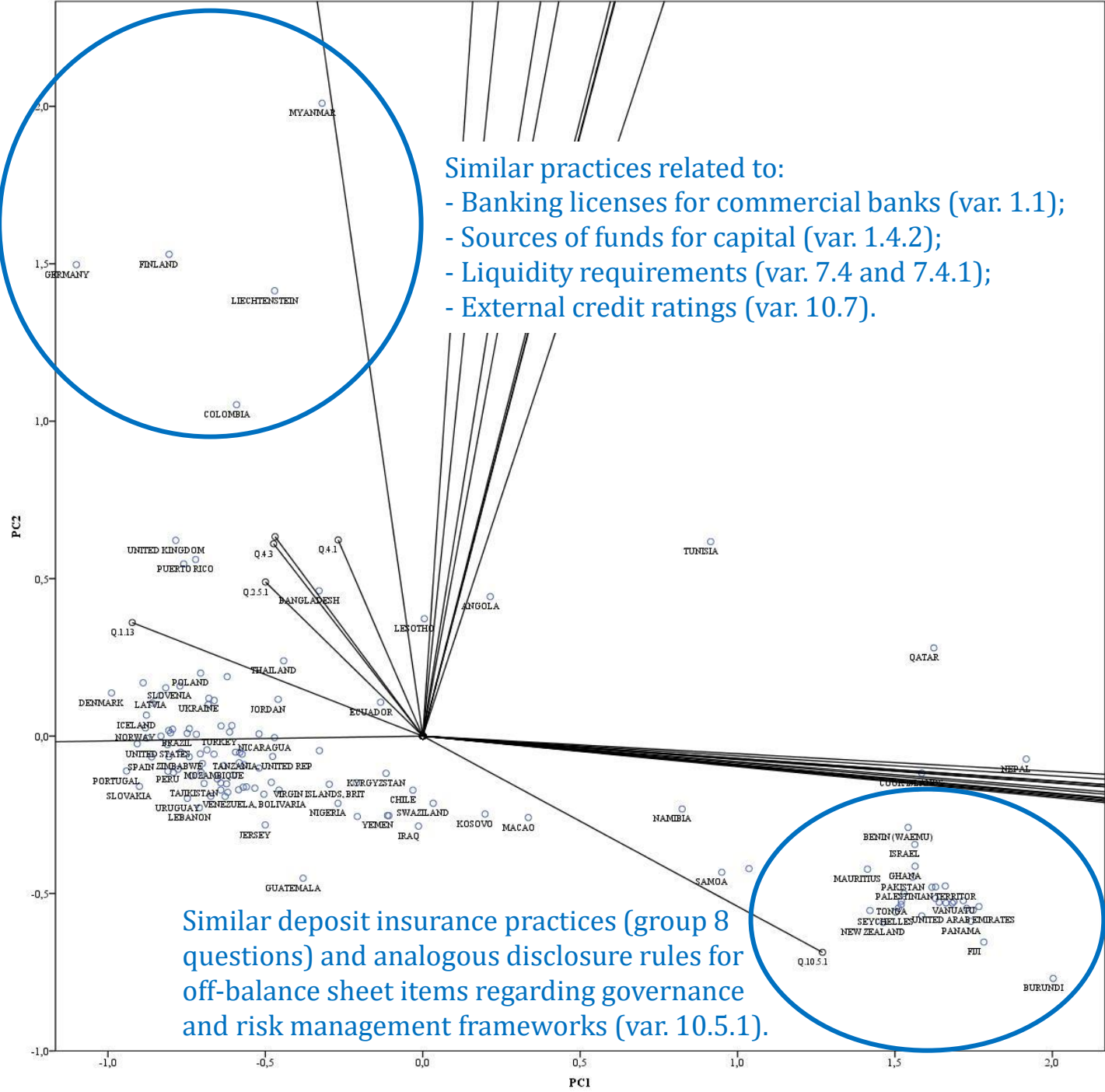


Fig. 4 Biplot of objects and component loadings, regulation.
Source: Authors' calculations.

Plot of country scores (the points) and component loadings (the vectors) from CATPCA on the relevant variables to determine regulation.

The square of the original length ([-1, 1]) of the vectors from the origin up to the component loading point represents the variable's total variance accounted for.

Shorter vectors are those of the variables determining PC3 and PC4 not represented in this two-dimensional plot.

Principal component 1 | *Supervision institutional structure and mandate*

<i>Variables</i>	<i>Component loadings</i>		
	PC1	PC2	PC3
<i>12.1 What body/agency supervises commercial banks for prudential purposes?</i>	0,707	-0,263	0,075
<i>12.3.2 Can the supervisory authority force a bank to change its internal organizational structure?</i>	0,904	-0,290	0,056
<i>12.4 To whom is the supervisory agency legally responsible or accountable?</i>	0,589	-0,227	0,108
<i>12.5 How is the head of the supervisory agency appointed?</i>	0,910	-0,279	0,048
<i>12.6 Does the head of the supervisory agency have a fixed term?</i>	0,860	0,161	-0,120
<i>12.7 Can the head of the supervisory agency be removed by ...</i>	0,866	0,189	-0,127
<i>12.9 Can individual supervisory staff be held personally liable for damages to a bank caused by their actions or omissions committed in the good faith exercise of their duties?</i>	0,733	-0,074	-0,010
<i>12.12 If an infraction of any prudential regulation is found in the course of supervision, must it be reported?</i>	0,535	-0,278	0,091
<i>12.12.1 Are there mandatory actions that the supervisor must take in these cases?</i>	0,620	-0,245	0,076

Table 6 – Principal components composition, supervision

Bold values represent component loadings above 0.5. Variables with higher correlations in each PC determine its label.

Source: Authors' calculations.

Principal component 2 | Discipline: enforcement and resolution

<i>Variables</i>	<i>Component loadings</i>		
	PC1	PC2	PC3
<i>11.1 Please indicate whether the following enforcement powers are available to the supervisory agency: a. Cease and desist-type orders for imprudent bank practices; f. Require banks to constitute provisions to cover actual or potential losses; j. Require banks to reduce or suspend dividends to shareholders; k. Require banks to reduce or suspend bonuses and other remuneration to bank directors and managers</i>	0,220	0,686	-0,268
<i>11.5a. Which authority has the powers to perform the following problem bank resolution activities? a. Declare insolvency</i>	0,318	0,823	-0,317
<i>11.5b. Which authority has the powers to perform the following problem bank resolution activities? b. Supersede shareholders' rights</i>	0,207	0,776	-0,226
<i>11.5c. Which authority has the powers to perform the following problem bank resolution activities? c. Remove and replace bank senior management and directors</i>	0,198	0,793	-0,261

Table 6 – Principal components composition, supervision

Bold values represent component loadings above 0.5. Variables with higher correlations in each PC determine its label.

Source: Authors' calculations.

Principal component 3 | *Exit: insolvency*

<i>Variables</i>	<i>Component loadings</i>		
	PC1	PC2	PC3
<i>11.4 Is there a separate bank insolvency framework that is distinct from that of non-financial firms?</i>	0,072	0,282	0,631
<i>11.5 Which authority has the powers to perform the following problem bank resolution activities? e. Appoint and oversee a bank liquidator/receiver</i>	0,049	0,286	0,885
<i>11.6 Is court approval required for the following bank resolution activities? b. Supersede shareholders' rights; c. Remove and replace bank senior management and directors; e. Appoint and oversee a bank liquidator/receiver</i>	0,068	0,321	0,810
<i>11.7 Can the bank shareholders appeal to the court against a resolution decision of the banking supervisor?</i>	-0,050	-0,314	-0,870

Table 6 – Principal components composition, supervision

Bold values represent component loadings above 0.5. Variables with higher correlations in each PC determine its label.

Source: Authors' calculations.

3. RESULTS AND DISCUSSION

World Finance Conference 2021, August 3-6

- These conclusions corroborate previous studies defending similar practices as major concerns of supervision structures, such as:
 - the importance of independent* (Eichengreen and Dincer, 2001) or supranational (Beck and Wagner, 2016) supervisors;
 - the extend of information included in supervisory reports (Neyapti and Dincer, 2005);
 - The head of supervisory contract terms and supervisory agency powers (Barth *et al.* 2013b).

*From governmental bodies.

Acknowledgements:



CIÊNCIA, TECNOLOGIA
E ENSINO SUPERIOR



SFRH/BPD/108826/2015

Cristina Pereira Pedro

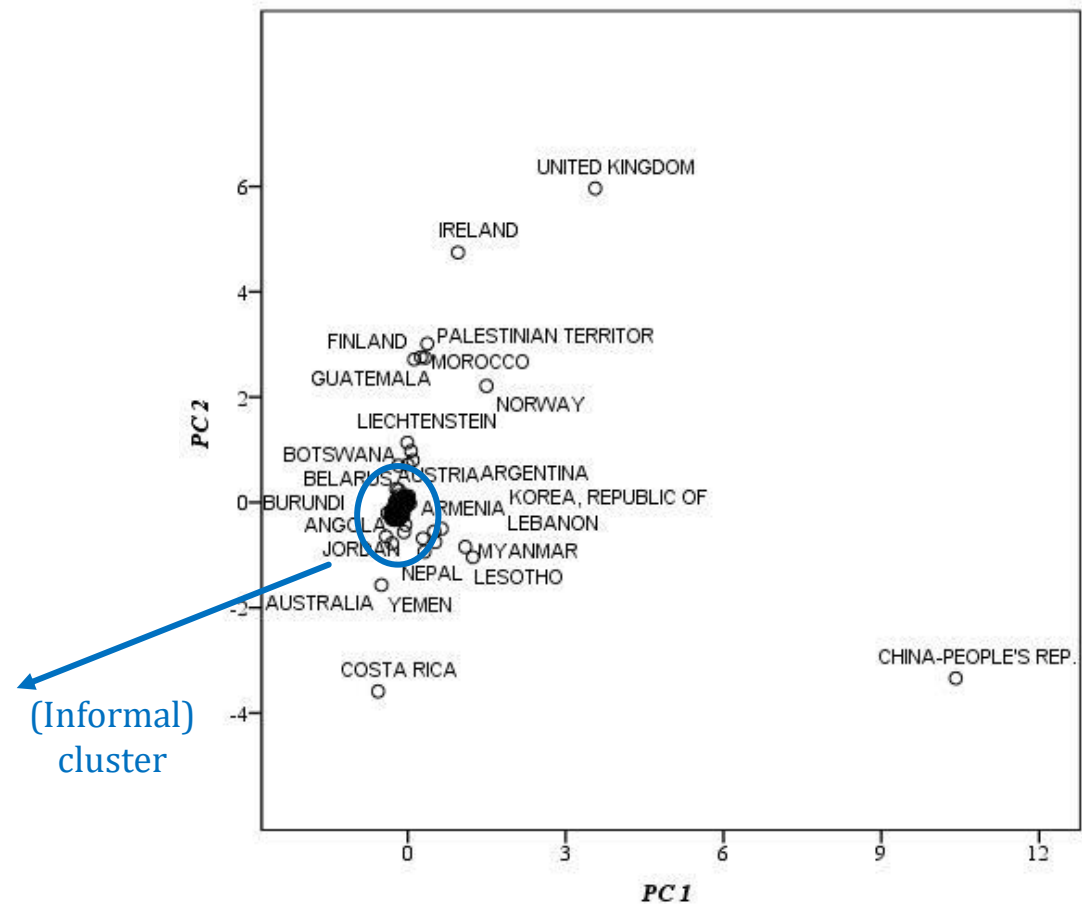
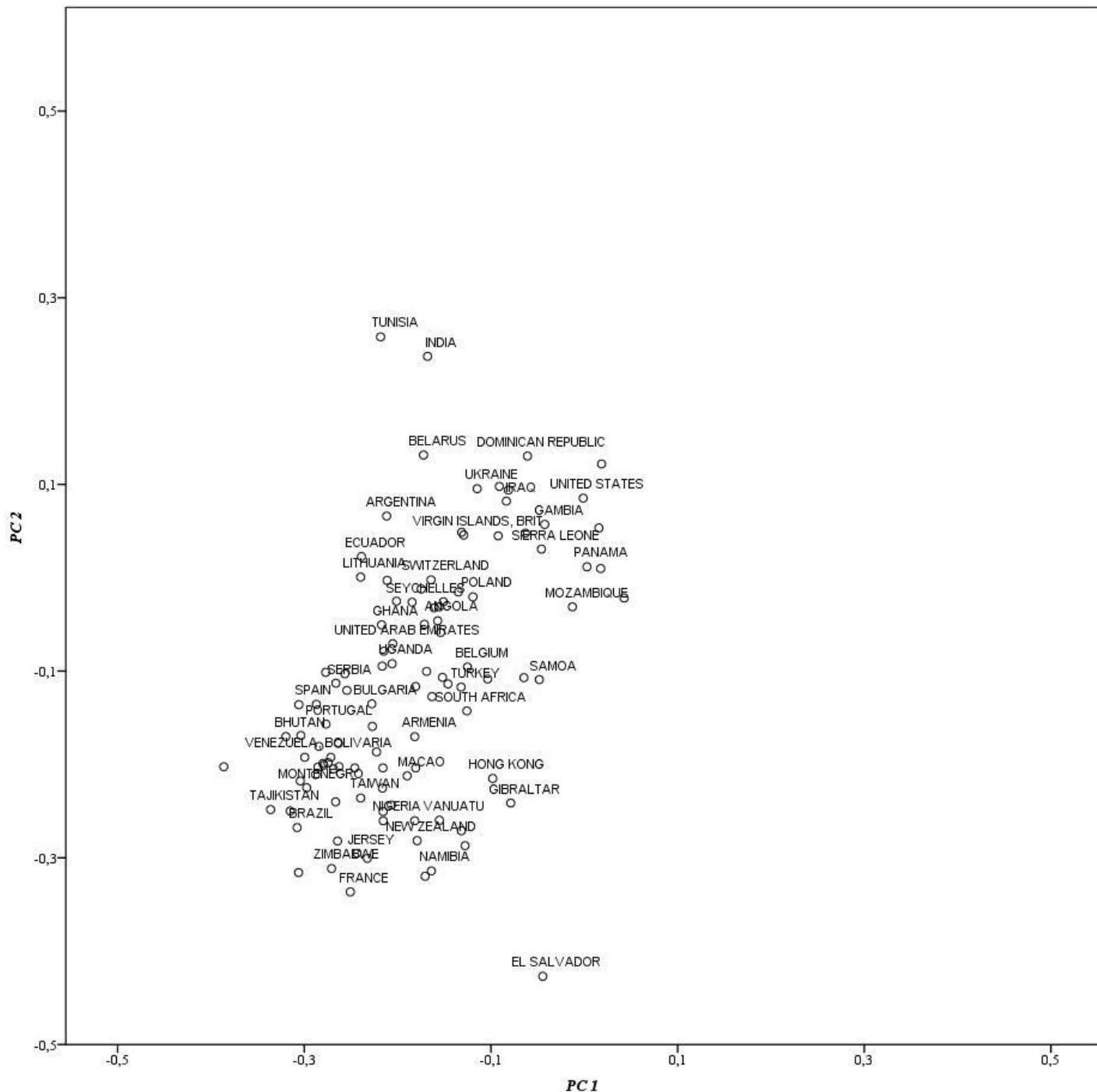


Fig. 6 Object points labeled by country, supervision.
Source: Authors' calculations.

Country scores from CATPCA on 35 variables, (23 as analysis variables and 12 supplementary variables).

The points represent the coordinates of each country in each principal component with, approximately, zero mean and unit standard deviation.

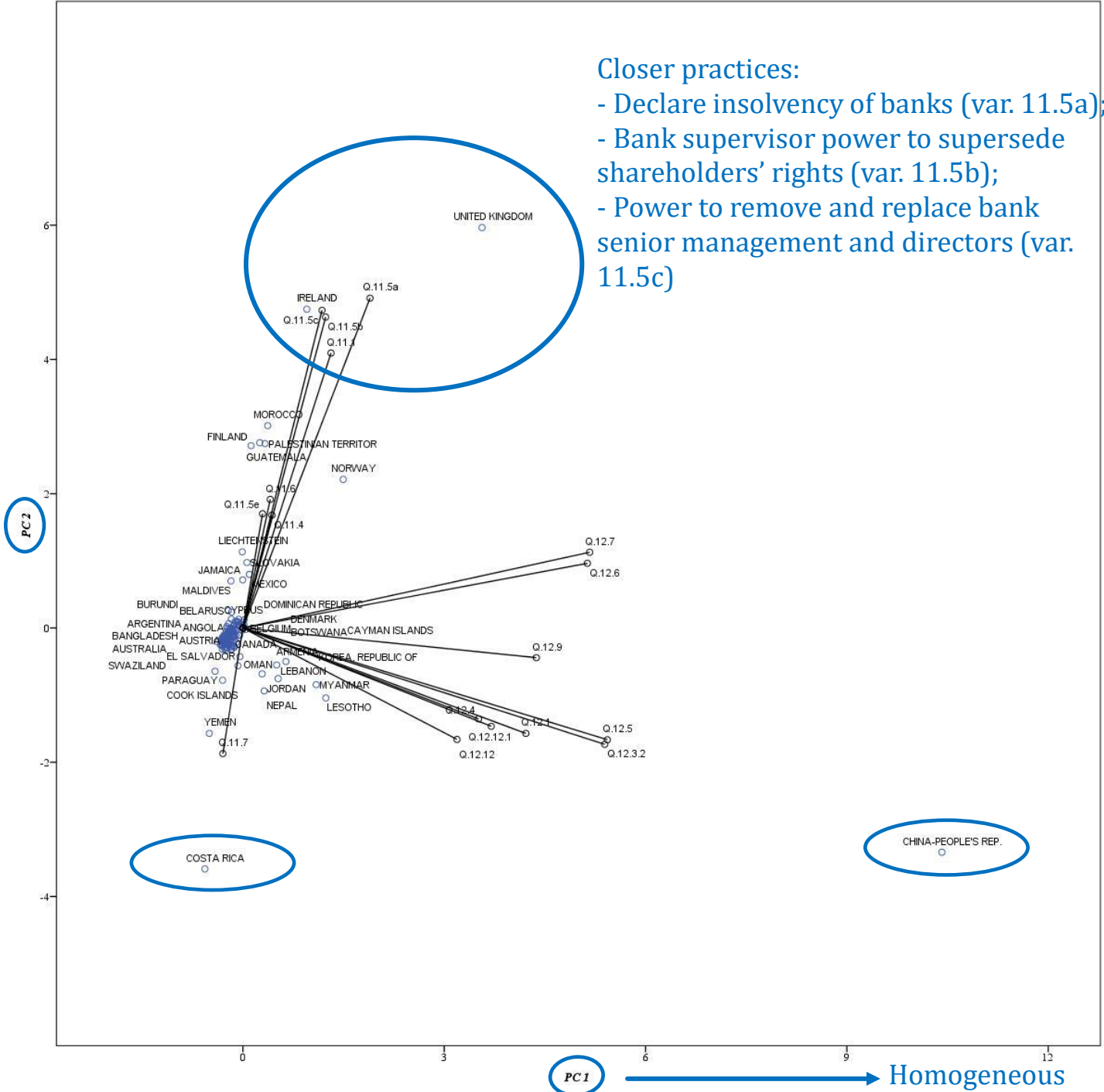


Fig. 7 Biplot of objects and component loadings, supervision.
Source: Authors' calculations.

Plot of country scores (the points) and component loadings (the vectors) from CATPCA on the relevant variables to determine regulation.

The square of the original length ([-1, 1]) of the vectors from the origin up to the component loading point represents the variable's total variance accounted for.

Shorter vectors are those of the variables determining PC3 not represented in this two-dimensional plot.

3. RESULTS AND DISCUSSION

World Finance Conference 2021, August 3-6

- Robustness checks:
 - Test results strength;
 - Capture the (potential) influence of countries' economic development;
 - Differences induced by the legal frameworks of offshore countries.

	<i>All sample</i>	<i>OECD</i>	<i>Non offshore</i>	<i>Offshore</i>
<i>Number of sampled countries</i>	141	31	118	23

Acknowledgements:



CIÊNCIA, TECNOLOGIA
E ENSINO SUPERIOR



SFRH/BPD/108826/2015

Cristina Pereira Pedro

3. RESULTS AND DISCUSSION

- Robustness checks

<i>Variables - regulation</i>	<i>All sample</i>	<i>OECD</i>	<i>Non offshore</i>	<i>Offshore</i>
<i>Deposit insurance variables (8.1 to 8.17.2)</i>	PC1	PC1	PC1	PC1
<i>9.2 Which criteria are taken into account to classify loans and advances as non-performing ...?:</i>	PC2	PC2	PC2	PC2

Table 7 – RS variables by sub-sample and PC. *Source:* Authors’ calculations.

Robustness checks, confirming the variables that best characterize RS practices around the world, regardless of the sample composition.

The 1st component explains most data variability (and highest internal consistency) → evidence that depositor’s protection schemes are key regulatory practices regardless countries development level or legal framework differences.

Acknowledgements:



CIÊNCIA, TECNOLOGIA E ENSINO SUPERIOR



3. RESULTS AND DISCUSSION

- Robustness checks:

<i>Variables - supervision</i>	<i>All sample</i>	<i>OECD</i>	<i>Non offshore</i>	<i>Offshore</i>
<i>11.5e. Which authority has the powers to perform the following problem bank resolution activities? e. Appoint and oversee a bank liquidator/receiver</i>	PC3	PC1	PC2	PC1
<i>12.6 Does the head of the supervisory agency have a fixed term?</i>	PC1	PC1	PC1	PC2
<i>12.7 Can the head of the supervisory agency be removed by ...</i>	PC1	PC1	PC1	PC2
<i>12.12 If an infraction of any prudential regulation is found in the course of supervision, must it be reported?</i>	PC1	PC3	PC1	PC4

Less robust results towards a specific PC, but reliable to support the relevance of 4 variables measuring supervision.

Table 7 – RS variables by sub-sample and PC. *Source:* Authors’ calculations.

Robustness checks, confirming the variables that best characterize RS practices around the world, regardless of the sample composition.

Acknowledgements:



4. CONCLUSION

World Finance Conference 2021, August 3-6

- Main conclusions:
 - Results weakened the role of capital requirements (due to little robustness when comparing different sample compositions);
 - Deposit insurance is on the top of relevant variables to measure banking regulation;
 - Supervisory agencies resolution powers, the characteristics of head of supervisory agency mandate, and the report of prudential regulation infractions are the most relevant proxies to measure supervision;
 - The observance of similar RS practices between countries is not related to its development levels or its inclusion in a political group.

Acknowledgements:



CIÊNCIA, TECNOLOGIA
E ENSINO SUPERIOR



SFRH/BPD/108826/2015

Cristina Pereira Pedro

4. CONCLUSION

World Finance Conference 2021, August 3-6

- Contributions:
 - Compile and summarize the quantitative and qualitative information available on RS for 141 countries;
 - Identify the most reliable banking RS variables to measure RS practices around the world;
 - Identify similitudes and discrepancies between the observed countries;
 - Find robust results regardless of countries development levels or the legal framework of each jurisdiction;
 - **Provide composite data by country (object scores by PC), useful for constructing proxies for RS to be used as explanatory variables in future regression models.**

Acknowledgements:



CEFAGE
centro de estudos e formação avançada em gestão e economia



Fundação
para a Ciência
e a Tecnologia



REPÚBLICA
PORTUGUESA

CIÊNCIA, TECNOLOGIA
E ENSINO SUPERIOR



European Union
European Social Fund

SFRH/BPD/108826/2015

Cristina Pereira Pedro

<i>Country</i>	<i>PC 1</i>	<i>Country</i>	<i>PC 2</i>	<i>Country</i>	<i>PC 3</i>	<i>Country</i>	<i>PC 4</i>
Germany	-1.100	Burundi	-0.770	China	-1.396	Myanmar	-3.557
Denmark	-0.989	Fiji	-0.654	Myanmar	-1.023	Burundi	-3.503
Portugal	-0.941	New Zealand	-0.592	Liechtenstein	-0.665	Tajikistan	-3.354
Romania	-0.907	Panama	-0.588	Finland	-0.481	Yemen	-3.149
Slovakia	-0.900	Cayman Islands	-0.571	Lebanon	-0.477	Guatemala	-2.475
Hungary	-0.888	Seychelles	-0.559	Uganda	-0.414	Bosnia and Herzegovina	-1.964
Norway	-0.881	Maldives	-0.554	Tunisia	-0.395	Fiji	-1.765
Iceland	-0.878	United Arab Emirates	-0.553	Denmark	-0.391	Angola	-1.704
Isle of Man	-0.877	Belize	-0.547	Portugal	-0.373	Iraq	-1.659
Spain	-0.861	Syrian Arab Republic	-0.546	Armenia	-0.365	Puerto Rico	-1.554
Canada	-0.860	Madagascar	-0.542	Oman	-0.354	Paraguay	-1.415
Latvia	-0.834	Kuwait	-0.535	Cyprus	-0.349	Sierra Leone	-1.303
Lithuania	-0.832	Gambia	-0.531	Ireland	-0.348	Venezuela	-1.300
Luxembourg	-0.816	Bhutan	-0.530	Moldova	-0.346	Virgin Islands, British	-1.162
United States	-0.811	Guyana	-0.528	Slovakia	-0.338	El Salvador	-1.139
Mexico	-0.809	Malawi	-0.526	Mozambique	-0.337	Tunisia	-1.018
Italy	-0.807	Tonga	-0.525	Bahrain	-0.334	Ethiopia	-0.980
Belgium	-0.806	Vanuatu	-0.523	Guatemala	-0.328	Panama	-0.898
Finland	-0.806	Suriname	-0.516	Swaziland	-0.298	Suriname	-0.873
Bulgaria	-0.801	South Africa	-0.500	El Salvador	-0.298	Kyrgyzstan	-0.827
Netherlands	-0.795	Botswana	-0.480	Macao	-0.297	Germany	-0.798
Greece	-0.792	Palestinian Territory	-0.479	Kosovo	-0.247	Honduras	-0.772
United Kingdom	-0.785	Egypt	-0.476	Greece	-0.247	Kosovo	-0.749
Peru	-0.777	Guatemala	-0.451	Estonia	-0.246	Guernsey	-0.740
Slovenia	-0.771	Pakistan	-0.448	Trinidad and Tobago	-0.244	Madagascar	-0.723
Taiwan	-0.769	Samoa	-0.433	Montenegro	-0.243	Dominican Republic	-0.705
Australia	-0.759	Mauritius	-0.423	Switzerland	-0.242	Belize	-0.616
Brazil	-0.748	Costa Rica	-0.421	Ukraine	-0.233	Gambia	-0.585

Table 8 - Object scores of each country, by PC, regulation (Example: incomplete table!)

Sorted list of countries in ascending order of object scores, by PC. The object scores are the coordinates of each country in each PC.

How to measure banking regulation and supervision

Cristina Pereira Pedro* (cristinap@uevora.pt), Joaquim J. S. Ramalho** (jjsro@iscte.pt), Jacinto Vidigal da Silva* (jsilva@uevora.pt)

* Center for Advanced Studies in Management and Economics, Universidade de Évora (CEFAGE-UE)

** Department of Economics & Business Research Unit (BRU-IUL), Instituto Universitário de Lisboa (ISCTE-IUL)

Cristina Pereira Pedro (Grant SFRH/BPD/108826/2015), Joaquim J. S. Ramalho (Grant UIDB/00315/2020) and Jacinto Vidigal da Silva (Grant UIDB/04007/2020) are pleased to acknowledge financial support from Fundação para a Ciência e a Tecnologia.

Acknowledgements:



CEPAGE
centro de estudos e formação avançada em gestão e economia



Fundação
para a Ciência
e a Tecnologia



REPÚBLICA
PORTUGUESA

CIÊNCIA, TECNOLOGIA
E ENSINO SUPERIOR



European Union
European Social Fund

SFRH/BPD/108826/2015

Cristina Pereira Pedro