

1 Commercial Banking Stability Determinants in European 2 Countries

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5 *Received: 14 December 2019 Accepted: 2 January 2020 Published: 15 January 2020*

6

7 **Abstract**

8 The purpose of this paper was to investigate the determinants of banking stability in
9 European countries. This study used a sample of 280 commercial banks in 26 European Banks
10 from 2002-2019. The bank stability most common measure is the insolvency risk (Z-Score).
11 We used the GMM estimator technique described by Arellano and Bover (1995) to estimate
12 the impact of bank specific and macroeconomic variables on European bank stability across
13 different European regions by subdividing the original sample into five subsamples. We find
14 significant differences in the determinants of stability between banks from East, South, North,
15 South and Central European countries, respectively. We show that the impact of bank specific
16 factors on bank stability differs across different European regions.

17

18 **Index terms**— bank stability, financial crisis, GMM estimation

19 **1 Introduction**

20 uring the past two decades, many countries have experienced significant episodes of systemic banking crises. The
21 financial crises experienced in recent decades prompted efforts to develop models that could help identify the
22 possible factors underlying the bank risk excess. Indeed, the global financial crisis of 2007-2008, followed by
23 the European sovereign debt crisis late in 2009, provides a natural experiment that allows us to investigate the
24 determinants of bank stability. Banking stability is defined as the absence of banking crises, achieved through
25 the stability of all banks in the banking system or sector (Brunnermeier et al., 2009). In fact, the role and
26 development of commercial banks has always attracted the attention of academic research. In fact, commercial
27 banks are known to play an important role in the economic development of a country, and that an efficient and
28 profitable banking system is a crucial condition for economic growth. In addition, the recent global financial crisis
29 has emphasized the importance of an early identification of riskier banks, as this allows for solving the problems
30 at a lower cost (Baselga-Pascual et al. 2015). Laeven and Levine (2009); ??arrellet al. (2010); Ozili (2018)
31 and Albaity et al. (2019) found that bank stability is closely tied to several microeconomic and macroeconomic
32 factors. Furthermore, Salas and Saurina (2002) combined macroeconomic as well as microeconomic variables
33 to explain nonperforming loans of Spanish Commercial and Savings banks from 1985 to1997. They found that
34 bank-specific factors may serve as early warning indicators for future changes in bank stability.

35 According to this study, various economic and institutional features differ amongst different European regions.
36 In this paper, we investigated why commercial banks stability varies across these groups of countries and whether
37 bank stability determinants depend on the bank specific characteristics and their macroeconomic environment.
38 Our study sought to shed light on the determinants of bank stability and how the subdivision of the sample
39 affected these determinants. The role of banks remains central in the financing of the economic activity in
40 general, and in different segments of the market in particular (Athanasoglou et al. 2008). The banks' stability
41 helps to predict financial crises because a profitable banking sector has a better ability to withstand negative
42 shocks.

43 For this purpose, we used a sample of over 280 commercial banks from 26 European countries 1 1 The
44 sample includes 280 listed Commercial banks from Germany, Austria, Belgium, Bulgaria, Cyprus, Denmark,

4 A) SPECIFIC BANKS FACTORS

45 Spain, Estonia, France, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland,
46 Portugal, Czech Republic, Romania, United Kingdom, Slovakia, Slovenia, Sweden and Finland. over the time
47 period spanning from 2002 to 2019. We analyzed which external and internal environmental factors that have
48 an impact on bank stability and whether the determinants vary amongst banks operating in different regions of
49 European countries. We investigated the effect of bank-specific (e.g., capital ratio, bank size) and macroeconomic
50 determinants (e.g. Inflation and GDP growth) on bank stability. The global sample was divided into five
51 sub-samples (Eastern Europe; Western Europe; Northern Europe; Southern Europe and Central Europe). By
52 separately considering these groups, we were able to analyze how the relevant determinants affect bank stability
53 and how these effects differ between the different regions categories. Through this paper, we wanted to investigate
54 the determinants of bank stability and whether the various economic and institutional features across groups of
55 European countries have an impact on these determinants. By applying a dynamic GMM technique, we were able
56 to account for stability persistence and potential endogeneity problems. The existing literature on bank stability
57 is quite large and provides a comprehensive examination of the effects of bank-specific and macroeconomic
58 determinants on bank stability.

59 Most of the papers, however, study this topic within a single-country setup or a small group of countries
60 from either developed or developing countries. A wide range of results from these studies strongly suggests that
61 microeconomic and macroeconomic factors have an important impact on bank stability. Only a few papers,
62 however, have dealt with bank stability for a larger sample of countries and opted to sample subdivision.

63 This research study is thought to contribute to the existing literature in important ways. First, to the
64 best of our knowledge, this is one of the pioneering studies for European countries to examine the bank stability
65 determinants between different European sub-samples. Most studies that have focused on this aspect are primarily
66 based on US economy or on other developed countries ??Heid et al. 2004; ??ime, 2001and Stolz, 2007) and
67 emerging markets (Ghosh et al. 2003 andGodlewski, 2005). Second, it is the first paper among empirical banking
68 studies to combine bank-specific and macroeconomic variables to test their impact on European bank stability.
69 Third, to control for unobserved heterogeneity as well as endogeneity issues, we relied on the generalized method
70 of moments (GMM) estimators, also referred to as the difference-GMM and system-GMM estimators, developed
71 by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998) for dynamic panel data
72 models.

73 This dynamic panel GMM technique aims to address problems of endogeneity, heteroscedasticity, autocorrelation
74 (Doytch and Uctum, 2011) and to monitor individual and time specific effects. The use of the dynamic
75 approach allows for the persistence of stability estimation.

76 The remainder of the paper is structured as follows. Section 2 surveyed the relevant literature. Section 3
77 detailed our model, as well as the dependent and independent variables used in our analyses. Section 4 described
78 and discussed the results of our empirical analysis and Section 5 provided the relevant conclusions drawn from
79 this study.

80 2 II.

81 3 Literature Review

82 Undoubtedly, bank stability has been extensively studied. The respective empirical studies have focused their
83 analyses either on cross-country evidence or on the banking system of individual countries. According to the
84 related literature, (De Nicolo, 2000; Konishi and Yasuda (2004)

85 4 a) Specific banks factors

86 In general, banks with high capital ratios are considered safer (than their counterparts). The conventional risk-
87 return hypothesis would thus imply a negative relationship between the equity to assets ratio and bank stability.
88 Furthermore, banks with higher equity-to-assets ratios normally have a reduced need for external funding, which
89 has again a positive effect on their stability. Given that we have effects pointing in opposite directions, the overall
90 effect of this variable is indeterminate from a theoretical point of view. Delis et al. (2011) argued that bank
91 capitalization is negatively related to bank risk-taking. This finding seems to be intuitive since a higher equity
92 capital, as a consequence of stricter capital requirements, implies a more prudent bank behavior. Low bank
93 capitalization leads to an increase in bank risk taking bases on the moral hazard theory. Berger and De Young
94 (1997) argued that bank managers increase their loan portfolio risk if banks are less capitalized. We referred to
95 the capital ratio, the cost-to-income ratio and bank size as internal determinants of bank stability. In line with
96 previous research of Athanasoglou et al. (2008) and Iannotta et al. (2007), among others, the ratio of equity to
97 assets (capital ratio) was used as a measure of capital strength.

98 Bank size is often considered an important determinant of its stability. As in most studies in banking (e.g.,
99 ??athanasoglou et al.2008; Demirguc-Kunt and Huizinga, 1999), we used total assets of the bank as a proxy for its
100 size. Larger banks are more likely to have economies of scale advantages than smaller banks. We thus expected
101 a positive effect of size on bank stability, (Pasiouras and Kosmidou, 2007; ??mirlock, 1985). However, Stiroh
102 and Rumble (2006), Berger et al. (1987) and Pasiouras and Kosmidou (2007) have shown that banks that have
103 become extremely large exhibit a negative relationship between size and stability due to bureaucratic and other
104 size-related reasons. Accordingly, the overall effect needs to be investigated empirically.

105 5 b) Macroeconomic factors

106 The macroeconomic environment plays an important role in banking sector stability. We chose two macro
107 variables. First, we used the real GDP growth rate where we expected a higher growth reflects better conditions
108 for financial stability. However, in countries where credit and real economy cycles are highly correlated the
109 opposite might occur.

110 Next, we used the inflation rate and assumed that price stability contributes to the stability of the banking
111 sector. Furthermore, an important element of the macroeconomic analysis is the study of the link between
112 business cycle fluctuations and a banking sector stability. Indeed, Männasoo and Mayes (2009) argued that
113 during favorable macroeconomic conditions, the GDP growth and bank stability are significantly and negatively
114 related. Bad economic conditions can worsen the quality of the loan portfolio generating credit losses, which
115 eventually reduces a bank stability. Furthermore, banks stability might be procyclical because GDP growth also
116 influences net interest income via the lending activity as demand for lending increases (decreases) in cyclical
117 upswings (downswings). We thus expected a positive impact on a bank stability, according to the literature
118 on the association between economic growth and financial sector stability (e.g., Demirguc-Kunt and Huizinga,
119 1999; The effect of inflation on bank stability depends on whether wages and other operating expenses increase
120 at a faster rate than the inflation. Most studies (e.g., Bourke, 1989; Molyneux and Thornton, 1992) found a
121 positive relationship between inflation and stability. However, if inflation is not anticipated and banks do not
122 adjust their interest rates correctly, there is a possibility that costs may increase faster than revenues and hence
123 affect bank stability adversely. Demirguc-Kunt and Detragiache (2005) showed that inflation is highly significant
124 in increasing the probability of bank risk of developed and developing countries over the period running from
125 1980 to 1995 using a multivariate Logit model. Jimenez et al. ??2008) found that a strict monetary policy is
126 associated with a higher bank stability in the Spanish context. Ioannidou et al. (2009) found similar results
127 using the monetary policy decision as an exogenous variable for the Bolivian banking industry.

128 6 III.

129 7 Data and Methodology

130 This section identified the sources of our data, presented the data and described the regression model we used to
131 investigate the effects of internal and external factors on bank stability.

132 8 a) Data

133 Our main data source for the bank-specific characteristics is the Fitch-IBCA Bank scope (BSC) database, which
134 provides annual financial information on banks in 26 countries around the world.

135 The macroeconomic factors, namely inflation and GDP growth were collected from the IMF World Economic
136 Outlook database. The Demirguc-Kunt et al. ??2008) database was used for the deposit insurance variable. The
137 most common bank stability measure is the insolvency risk (Z-Score).

138 9 b) Methodology

139 We empirically investigated the internal and external factors effects on bank stability using a dynamic linear
140 model given by:?????????????????? ??,?? = ?? 0 + ?? 1 ??????????????????? ??,??1 + ?? 2 ?? ??,?? + ?? 3 ??
141 ?? + ?? ?? + ?? ??,?? ???, ??(1)

142 Where Logzscore i,t represents the stability of bank i at time t , with $i = 1, \dots, N$, $t = 1, \dots, T$,? 0 is a
143 constant term, ? 1 is the bank persistence coefficients for stability. ?? ??,?? denotes the bank-specific explanatory
144 variables; ?? ?? denotes the macroeconomic explanatory variables; ?? ?? represents the individual random effects
145 and ?? ??,?? denotes the error terms. As a consequence, we specified a dynamic model by including a lagged
146 dependent variable within the regression, i.e., Logz score $i,t - 1$ is the one-period lagged profitability????????????
147 ??,?? = (?????? ??,?? + ?????? ??,??)/?? ?? ??????? ??,?? ?(2)

148 Where ?????? ??,?? represents the rate of return on assets of bank ?? at year ??; ?????? ??,?? represents
149 the ratio of equity capital to total assets for the bank ?? at year ??; ?? ?? (?????? ??,??) is the estimate
150 of the standard deviation of the return on assets rate of bank ?? at year ???. While several authors used the
151 Z-Score variable as indicated above Laeven and Levine (2009), among others applied the natural logarithm of
152 the Z-score as the insolvency bank risk (log Zscore). Roy (1952) and Boyd et al. (1993) argued that Z-score
153 represents a measure of a bank's distance from insolvency, which is defined as a situation in which losses exceed
154 equity. A higher Z-Score level indicates that the bank is more stable. Following Roy (1952), Boyd et al. (1993)
155 and Laeven and Levine (2009), we examined the impact of internal and external factors on bank stability in
156 terms of bank specific and macroeconomic variables. The variable definitions and the data sources are described
157 in table (1). (Hansen, 1982). It is worth noting that the system GMM estimator also controls for unobserved
158 heterogeneity and for the persistence of the dependent variable. Overall, this estimator has been found to yield
159 consistent estimations of the parameters (see e.g., Delis and Kouretas, 2011). Given the focus of our study, we
160 reported the estimation results for the full sample. In addition, we separately estimated the model for each of
161 the five sub-samples as defined above. Finally, because the simultaneous inclusion of certain variables could raise

162 concerns of multicollinearity, we computed several tests to make sure that multicollinearity issues do not affect
163 our results.

164 The descriptive statistics on the different variables used in this analysis are reported in Table 2. It should be
165 noted that the stability variables high standard deviations indicate the existence of substantial cross-sectional
166 variation in the bank stability levels of the European commercial banks.

167 10 c) Empirical results

168 The bank stability determinants for the European sampled institutions were examined and then the different
169 sub-panels were checked separately (Eastern Europe; Western Europe; Northern Europe; Southern Europe and
170 Central Europe). Furthermore, the impact of bank specific and macroeconomic variables on European bank
171 stability across different European regions was investigated by separating the full sample into five sub-samples.
172 We thought it would be interesting to briefly highlight a few observations. The bank stability proxy high
173 standard deviations suggest that there is a substantial cross-sectional variation in the bank stability level. As
174 expected, there is a large heterogeneity across the country categories. The stability among banks tends to vary,
175 which is explained by a higher homogeneity of institutions. The capitalization of banks also differs considerably
176 between country categories. In fact, banks in East and West European countries are better capitalized than
177 those in Northern and Southern Europe countries. These observations can be partly explained by regulatory
178 interventions, which also differ between countries indifferent economic development stages. Finally, we considered
179 the macroeconomic factors included as explanatory variables in our analyses. The inflation rates are on average
180 higher in North and Central European countries. This is partly related to an often inflationary monetary policy
181 and a less stable macroeconomic environment, in general.

182 Table ?? reports the regression results for our main stability measure. We provided separate estimations for
183 five sub-sample categories. The first column of the table displays the results when the banks from all countries
184 are simultaneously considered, whereas columns two through six show the estimation results by region. Our
185 estimation results have stable coefficients. The Wald-test indicates fine goodness of fit for the estimated model and
186 the Saran test shows no evidence of over-identifying restrictions. The equation indicates the existence of negative
187 first-order autocorrelations. However, this does not imply that the estimates are inconsistent. Inconsistency
188 would be implied if there was a second-order auto-correlation (Arellano and Bond, 1991). The test value of
189 the secondorder autocorrelation (AR 2 errors), however, implies that the moment conditions of the model are
190 valid. The significance of the coefficient on our lagged dependent variable across all models confirms the use of
191 a dynamic model. We remarked that our stability measure reveals a high persistence degree proving the validity
192 of our GMM model. The results for the determinants of our stability measure provide further insights that
193 are worth emphasizing. The positive and significant coefficient of the size variable for the whole sample as for
194 Eastern European, Western European and Northern European samples in our bank stability regressions confirms
195 some empirical support for the economies of scale marketpower hypothesis (Diamond, 1984). Larger banks might
196 achieve efficiency gains that are reflected in higher earnings because they do not operate in very competitive
197 markets. Therefore, the theoretical basis of the linkage between size and bank stability is mixed.

198 11 GMM System Estimation Results

199 12 Variable

200 On the one hand, there are arguments in favor of a negative relationship between size and bank stability (see
201 ??anders et al.1990). The existence of a negative relationship between size and risk is related to the justification
202 for the existence of banks. The argument is the diversification by size. Indeed, larger banks of ten have a greater
203 diversification capacity which implies a higher risk compared to smaller banks.

204 The capital ratio, which is defined as equity over total assets, has a positive and significant effect on bank
205 stability for Eastern and Western Europe commercial banks only. It is negatively related to bank stability for
206 Northern, Southern and Central Europe banks. The negative coefficients show that bearing more capital has a
207 negative impact on the bank stability. This observation reflects the fact that banks with relatively more equity
208 are automatically less stable. As outlined above, the capital ratio is a measure of bank risk and may have an a
209 priori ambiguous effect on bank stability. Indeed, bettercapitalized banks are safer compared to those with lower
210 capital ratios and may face lower costs of funding due to lower prospective bankruptcy costs. In concrete terms,
211 an increase of the capital ratio by 1% leads to an increase of the bank stability of 0.026% for the whole sample.
212 This result confirms the empirical evidence of Bourke (1989), Demirguc-Kunt and Huizinga (1999), as well as
213 Berger and Bouwman (2013).

214 Considering the external factors related to the macroeconomic environment of the countries in which the
215 banks are operating, we found that the inflation rate has a positive and significant effect on bank stability in
216 East and North European countries. Bank management in these countries seems to forecast future inflation
217 satisfactorily, which, in turn, implies that interest rates Focusing on columns (2) and (3) related to Eastern and
218 Western European banks, we achieved the same findings for the whole sample. We remarked a significant impact
219 of macroeconomic variables on bank stability. This result can be explained by the emergence of financial crisis
220 which influenced the banking stability and generated a high bank risk level of financial institutions in the world
221 and especially in the European banking industry. The regression results for Central European banks are reported

222 in column (6). We notice that the bank stability variable is negatively related to bank specific factors; however,
223 it is positively related to the GDP growth rate. By subdividing the whole sample of commercial banks into five
224 sub-samples, we remarked important differences in the bank stability behavior.

225 **13 IV.**

226 **14 Conclusion**

227 Different determinants of the banks' stability have been investigated in the literature. While most of the papers
228 focus on the individual banks and developed markets, only a few were achieved dealing with the banking sector
229 stability in European commercial banks. Furthermore, banking stability around the world differs widely as
230 commercial banks have to cope with different macroeconomic environments and different institutional realities.
231 Applying the GMM estimator technique described by Arellano and Bover (1995) on a crosscountry data set of
232 commercial banks across 26 European countries over the period 2002 to 2019, this paper analyzed the main
233 determinants of bank stability. We subdivided the whole sample of 280 banks across the 26 European countries
234 cited above into five subsamples (East, West, North, South and Central European countries) to show the stability
235 determinants differences across different regions. We used the zscore for measuring the bank stability and reached
236 sound findings. The results show that the bank capitalization influences the banks' stability.

237 Consequently, a positive relationship is noticeable meaning that a well-capitalized banking sector is also a
238 stable one. Therefore, banks with a higher equity to assets ratio are relatively more stable. This result seems
239 very interesting and of great importance, to in light of the current discussions concerning the capital adequacy
240 ratios (Basel III). We also revealed remarkable results with respect to bank size. We pointed out that, bank
241 size has negative and significant effects on bank stability. Significant differences were noted in the determinants
242 of stability between banks from East, Year 2020 () C South, North, South and Central European countries,
243 respectively. We observed differences between different sub-samples with respect to significance, sign as well
244 as of coefficients. We showed that the impact of bank specific factors on bank stability differs across different
245 European regions. This may be explained by differences in bank regulation, size of the economy, institutional
246 environment. However, we found the same relationship between bank stability, bank-specific and macroeconomic
247 factors for the whole sample, for East and West European banks. Specifically, the estimation results indicate
248 that the macroeconomic variables coefficients are fairly stable across different regions. We showed that the
249 macroeconomic variables, especially the real GDP growth rate and inflation rate, have a strong effect on the
250 bank stability (See, e.g. Laeven and Levine 2009; Barrell et al. 2010). Therefore, an increase in the GDP growth
251 rate generates an increase in the bank stability.

252 Our results are relevant from several points of view. First, the variables included in our analyses confirm and
253 complement findings from former studies on bank stability. Second, we provided evidence relying on contemporary
254 data, including the latest financial crisis. Third, the analysis of a large sample of banks from 26 countries
255 grouped into five sub-samples allowed us to better understand how the determinants of bank stability depend
256 on a European country subdivision. Future research could focus on the impacts of the governmental and legal
257 environment on bank stability. This issue will be addressed in a future work.

258 **15 Global Journal of Management and Business Research**

259 Volume XX Issue V Version I Year 2020 () ¹

; Cihak and Hesse, 2006; Machler et al., 2007; Garcia-Marco and Robles-Fernandez (2008); Laeven and Levine, 2009; Houston et al., 2010; Turk Ariss (2010); Angkinand Wiilborg (2010); Forssbaeck (2011); Agoraki et al. (2011); Delis et al. (2012); Beck et al., 2013; Lepetit and Strobel, 2013; Fernández et al., 2016 and Ahamed and Mallick (2017); Kabir and Worthington (2017); Ozili, 2018 and Albaity et al. (2019)), bank stability has always been measured by z-score. The employed measure is based on Roy (1952) and is expressed as a function of internal and external determinants. The internal determinants include bank-specific variables whereas the external ones reflect the environmental variables, that are generally expected to affect the stability of financial institutions. In most studies, variables such as bank size and capital ratio serve as internal determinants of banking stability (e. g., Bourke, 1989; Demirguc-Kunt and Huizinga, 1999; Goddard et al. 2004; Pasiouras and Kosmidou, 2007; Javaid et al. 2011; Jokipii and Monnin, 2013; Boateng et al., 2015; Tan and Anchor, 2017 and Ozili, 2018). The external determinants of bank stability, as presented in the literature, include factors such as the inflation rate and GDP growth rate. Most studies (Athanasoglou et al. 2008; Demirguc-Kunt and Huizinga, 1999; Jokipi and Monnin, 2013;

Figure 1:

Figure 2:

1

Variable	Descriptions
Bank stability proxy	
Log Zscore	It is defined as the inverse of the probability of insolvency and return on assets plus the capital asset ratio divided by the standard deviation of asset returns. The z-score measures the distance from insolvency to the mean and follows the normal distribution. A higher z-score indicates that the bank is more stable
Bank specific variables	
LnTA	Bank size : The natural logarithm of total assets
BC	Bank capitalization ratio (%)
Macroeconomic variables	
INF	The inflation rate
GDP	Indicators The GDP growth rate

We adopted a two-step dynamic panel data methodology as proposed by Arellano & Bond (1991); Blundell & Bond (1998). The GMM technique was used to address the issues of heteroscedasticity, autocorrelation in the data and to monitor individual and time specific effects. The number of lags was determined by the autocorrelation test and test for over identification

of endogeneity,
by Arellano-
Bond

[Note: Notes: Bank-level variables include bank capital and bank size. Macroeconomic variables include GDP growth rate and inflation rate. Domestic credit to private sector and real interest rate. The Bureau Van Dijk Bank scope data baseis the main source of the financial statements. The macroeconomic data are obtained from WDI.]

Figure 3: Table 1 :

2

Variable	Correlation	Mean	Std.dev	Mean	Std.dev	Mean	Std.dev	Mean	Std.dev	Mean	Std.dev	Mean
LogZs core												
2.574	1.019	2.129		1.812			2.022	1.892		1.248	2.847	1.111
		0.781								2.125	0.56	
Ln TA												
7.614	1.134	6.119		7.325			1.523	6.159		1.714	7.432	1.548
		2.116								8.456	1.36	
BC												
6.977	4.784	7.325		6.546			5.638	0.285		0.293	0.113	0.197
		2.238								6.824	2.21	
GDP												
2.132	2.124	1.835		0.547			1.814	1.145		2.695	0.645	1.256
		4.258								1.213	3.78	
INF												
1.795	1.823	0.625		1.194			1.017	2.136		3.281	1.109	1.456
		1.877								2.122	1.69	

[Note: Notes: Dependent variable is bank stability; LogZscore. Independent variables are bank size (LnTA); bank capitalization (BC); (GDP) growth rate and inflation rate (INF).]

Figure 4: Table 2 :

7

Figure 5: Table 7 :

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