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Appendix A: Abbreviations Used in the Thesis

Abbreviation	Meaning
AIC	Akaike Information Criterion
AMA	Advanced Measurement Approach (for operational risk capital calculation)
BCBS	Basel Committee of Banking Supervision
BIA	Basic Indicator Approach (for operational risk capital calculation)
BPS	Business Process Simulation
BPM	Business Process Management
CDF	Cumulative Density Function
CVaR	Conditional Value at Risk
GAAP	Generally Accepted Accounting Principles
GAMLSS	Generalized Additive Model for Location Scale and Shape
GARCH	Generalized Autoregressive Conditional Heteroscedasticity
LDA	Loss Distribution Approach (for operational risk capital calculation)
OpRK	Operational Risk Capital
$OpRK_c$	Operational risk capital estimated by the scaling technique
$OpRK_B$	Operational risk capital estimated by the Bayesian technique
$OpRK_C$	Operational risk capital estimated by the covariate-based technique
$OpRK_{true}$	True operational risk capital
ORX	Operational Riskdata eXchange Association
PDF	Probability Density Function
SM	Standardized Method (for operational risk capital calculation)
SDS	System Dynamics Simulation
TVaR	Tail Value at Risk
VaR	Value at Risk

Appendix B: Country Codes and Bank Codes

No.	Bank Code	Bank Name	Country	Country Code
1	AUS.CBA	Commonwealth Bank of Australia	Australia	AUS
2	AUS.NAB	National Australia Bank	Australia	AUS
3	AUS.WBC	Westpac Banking Corporation	Australia	AUS
4	AUT.BAC	Bank Austria – Creditanstalt	Austria	AUT
5	AUT.EGB	Erste Group Bank AG	Austria	AUT
6	BEL.FTS	Fortis	Belgium	BEL
7	BRA.BSC	Banco Bradesco S/A	Brazil	BRA
8	CAN.BNS	Bank of Nova Scotia	Canada	CAN
9	CAN.BMO	Bank of Montreal	Canada	CAN
10	CAN.RBC	Royal Bank of Canada (RBC)	Canada	CAN
11	CAN.TDB	Toronto Dominion Bank Group	Canada	CAN
12	DNK.DBA	Danske Bank A/S	Denmark	DNK
13	FRA.BNP	BNP Paribas	France	FRA
14	FRA.CAS	Credit Agricole SA	France	FRA
15	FRA.SGL	Société Générale	France	FRA
16	DEU.CBA	Commerzbank AG	Germany	DEU
17	DEU.DBA	Deutsche Bank AG	Germany	DEU
18	DEU.DPB	Deutsche Postbank AG	Germany	DEU
19	IRL.BIG	Bank of Ireland Group	Ireland	IRL
20	ITA.ISP	Intesa SanPaolo	Italy	ITA
21	NLD.ABN	ABN AMRO	Netherlands	NLD
22	NLD.ING	ING Group	Netherlands	NLD
23	NLD.RBN	Rabobank Nederland	Netherlands	NLD
24	PRT.BPN	Banco Portugues de Negocios	Portugal	PRT
25	ZAF.FRD	First Rand	South Africa	ZAF
26	KOR.HBK	Hana Bank	South Korea	KOR
27	ESP.BSB	Banc Sabadell	Spain	ESP
28	ESP.BBV	Banco Bilbao Vizcaya Argentaria	Spain	ESP
29	ESP.BPS	Banco Pastor	Spain	ESP
30	ESP.BPO	Banco Popular	Spain	ESP

31	ESP.BST	Banco Santander	Spain	ESP
32	ESP.BNS	Banesto	Spain	ESP
33	ESP.CCT	Caixa Catalunya	Spain	ESP
34	ESP.CNV	Caixanova	Spain	ESP
35	ESP.CLB	Caja Laboral	Spain	ESP
36	ESP.CMR	Cajamar	Spain	ESP
37	SWE.SEB	Skandinaviska Enskilda Banken	Sweden	SWE
38	GBR.STA	Standard Chartered Bank	UK	GBR
39	GBR.BLB	Barclays Bank	UK	GBR
40	GBR.HBO	HBOS PLC	UK	GBR
41	GBR.HSB	HSBC Holdings plc	UK	GBR
42	GBR.LBG	Lloyds Banking Group	UK	GBR
43	GBR.RBS	Royal Bank of Scotland Group	UK	GBR
44	USA.BOA	Bank of America	USA	USA
45	USA.COF	Capital One	USA	USA
46	USA.JPM	JPMorgan Chase & Co.	USA	USA
47	USA.NAT	National City	USA	USA
48	USA.PNC	PNC Bank	USA	USA
49	USA.USB	US Bancorp	USA	USA
50	USA.WCR	Wachovia Corporation	USA	USA
51	USA.WAM	Washington Mutual	USA	USA
52	USA.WFC	Wells Fargo & Co	USA	USA

Appendix C: Data Sources

Table C-1

Data Sources about Macro Variables

Key	Variable name	Data source
country_name	Country Name	
country_code	Country Code	
year	Year 2006-2010	
gdp_growth	GDP growth (annual %)	World Development Indicators
gover_effective	Government Effectiveness	The Worldwide Governance Indicators
reg_quality	Regulatory Quality	The Worldwide Governance Indicators
rule_law	Rule of Law	The Worldwide Governance Indicators
cont_corrup	Control of Corruption	The Worldwide Governance Indicators
enforce_act	Enforcement actions taken over the past 5 years (2006-2010)	Bank Regulation and Supervision
sp_rem_bd	Remuneration of the board directors as part of the supervisory process of risk-taking	Bank Regulation and Supervision
sp_rem_sbm	Remuneration of senior bank management as part of the supervisory process of risk-taking	Bank Regulation and Supervision
sp_rem_bs	Remuneration of other bank staff as part of the supervisory process of risk-taking	Bank Regulation and Supervision
reg_act	Authority of the supervisory agency to take regulatory action when it considers that the remuneration or compensation is excessive	Bank Regulation and Supervision
cpi	Corruption Perceptions Index (CPI) score (2006-2010)	Transparency International

Appendix D: Data

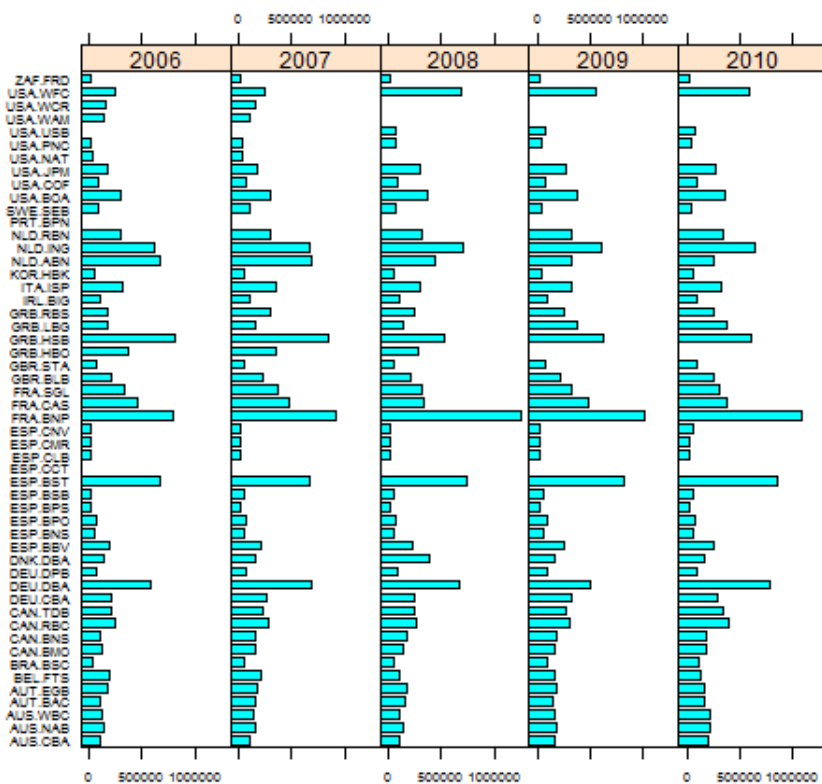


Figure D1. Banks by retail assets.

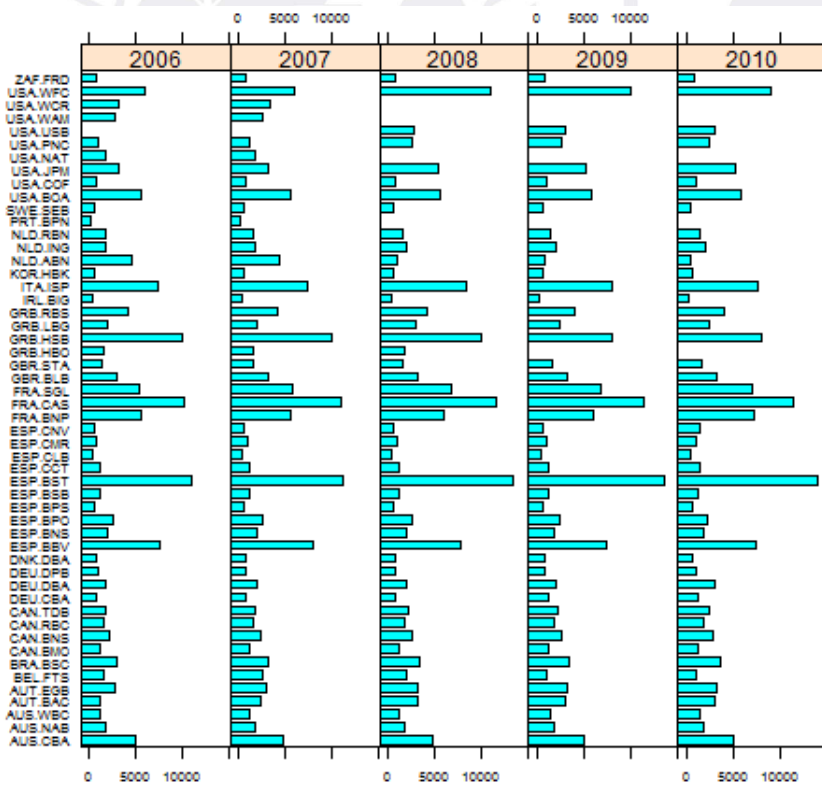


Figure D2. Banks by number of branches.

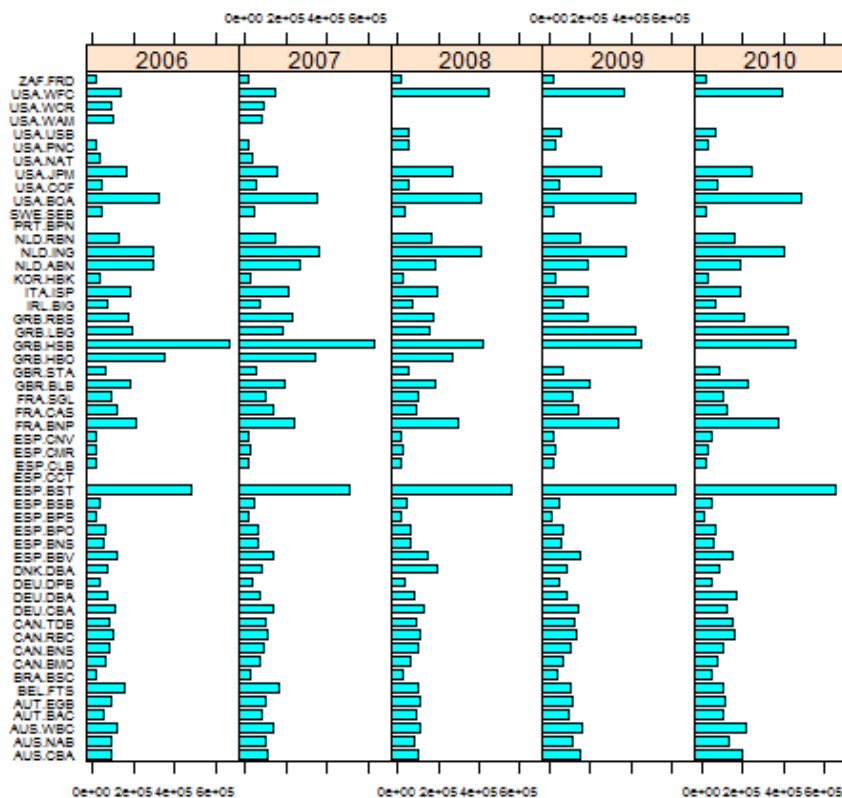


Figure D3. Banks by retail loans.

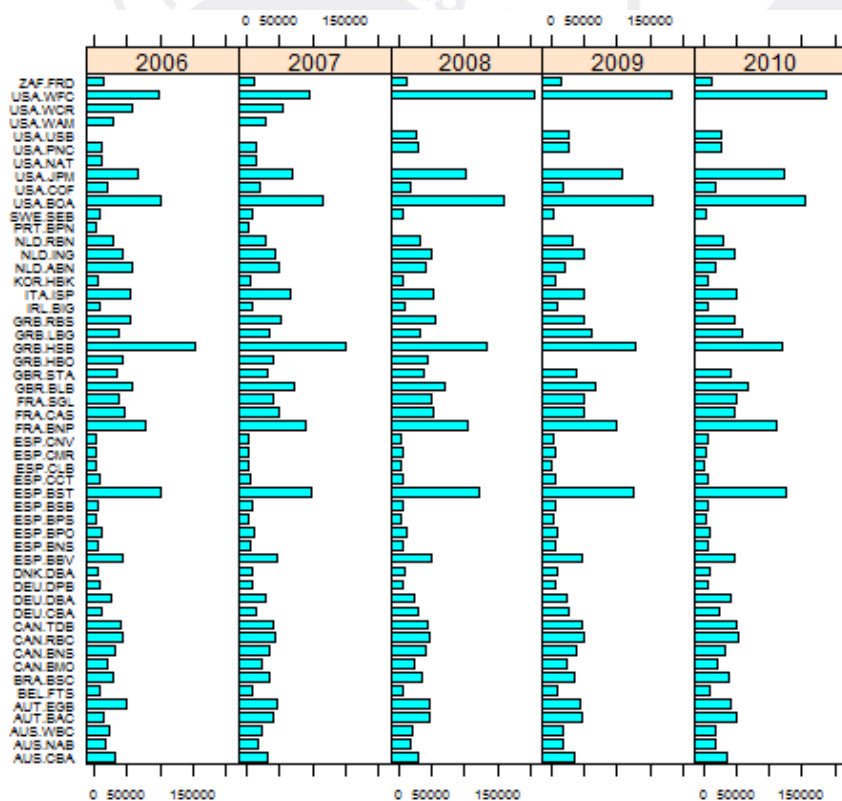


Figure D4. Banks by retail staff.

Appendix E: Distribution of idiosyncratic parameters

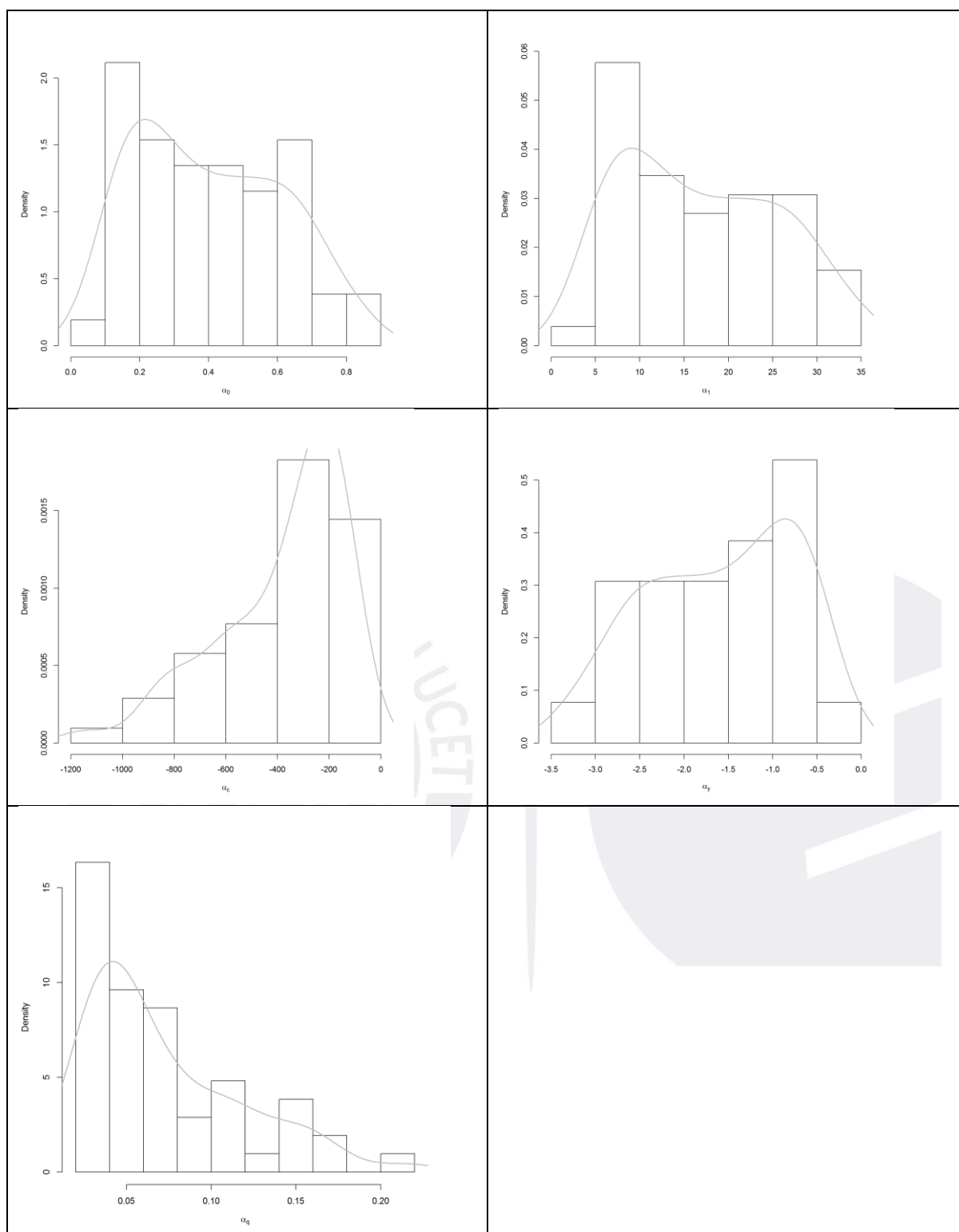


Figure E1. Distribution of parameters of the ramp function that defines the outbreak of operational losses in each bank.

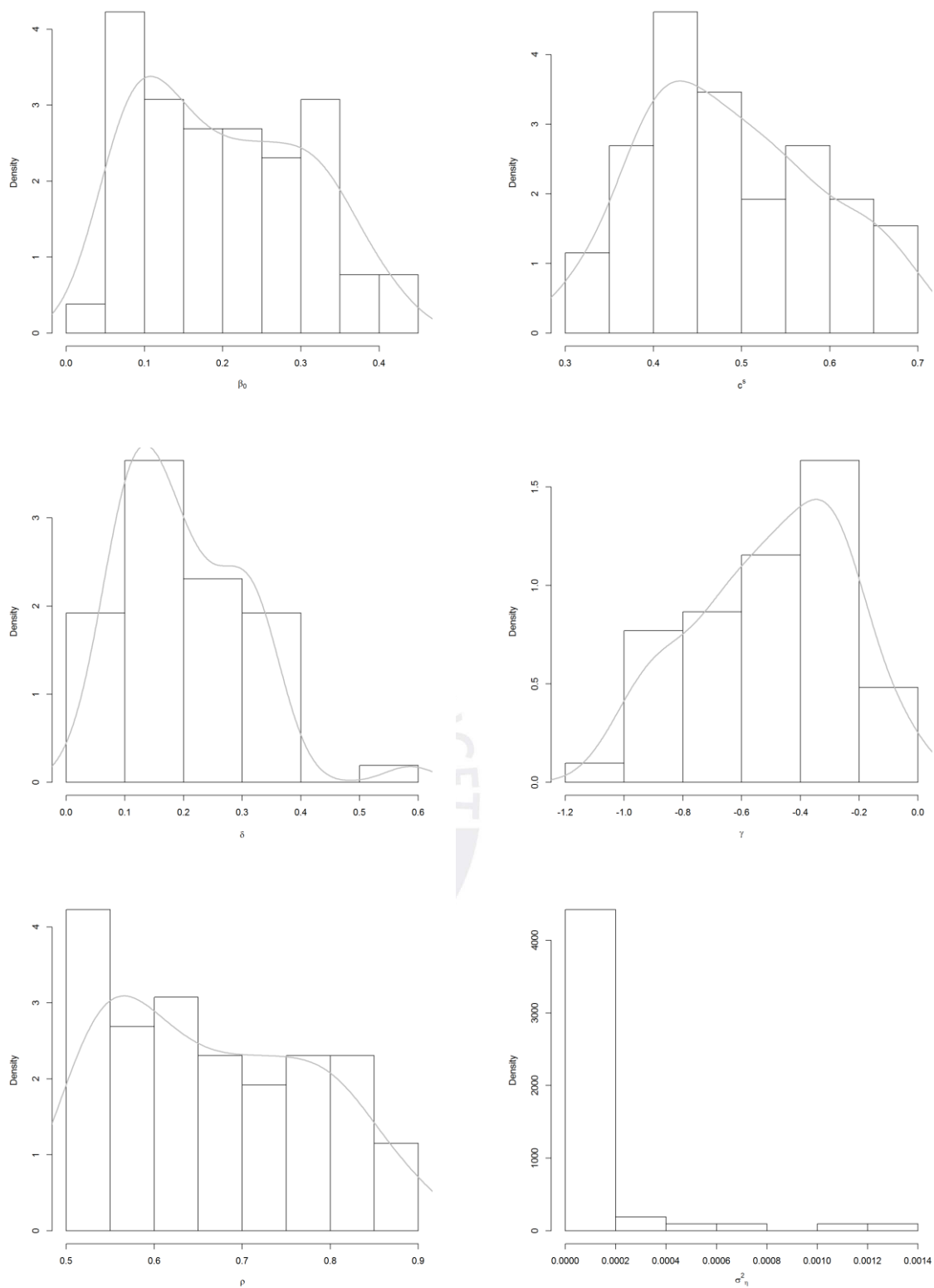


Figure E2. Distribution of other idiosyncratic parameters in the operational loss model.

Appendix F: Covariate-based technique regressions

Table F1

Severity regressions with GAMLSS

Mean regression	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Intercept	-2.80 (***)	-2.78 (***)	-2.43 (***)	-2.65 (***)	-2.47 (***)	-2.59 (***)
GDP growth	0.01 (*)		0.01 (*)	0.01 (*)	0.01 (*)	0.01 (*)
Crisis		-0.08 (**)				
CPI	-0.05 (***)	-0.05 (***)	-0.17 (***)	-0.12 (***)	-0.16 (***)	-0.10 (.)
Government Effectiveness			0.33 (***)			
Regulatory Quality				0.21 (*)		
Rule of Law					0.29 (***)	
Control of Corruption						0.10
Control	-0.40 (*)	-0.63 (***)	-0.26	-0.44 (*)	-0.42 (*)	-0.42 (*)
Employees per branch	0.13 (***)	0.14 (***)	0.13 (***)	0.14 (***)	0.14 (***)	0.13 (***)
Assets per employee	-0.01 (.)	-0.01 (*)	-0.01 (*)	-0.00	-0.00	-0.01 (***)
Scale regression						
Intercept	0.73 (***)	0.56 (***)	1.12 (***)	0.83 (***)	1.12 (***)	0.92 (***)
GDP growth	0.01 (*)	-0.02				
CPI	-0.07 (***)	-0.02 (.)	-0.20 (***)	-0.15 (***)	-0.21 (***)	-0.11 (***)
Employees per branch	-0.01 (***)	-0.01 (***)	-0.02 (***)	-0.02 (***)	-0.02 (***)	-0.01 (***)
Diagnostics						
Global Deviance	-6657.35	-6633.58	-6677.04	-6718.08	-6732.36	-6658.17
AIC	-6581.01	-6553.02	-6598.11	-6610.79	-6624.83	-6577.47
SBC	-6344.62	-6303.55	-6353.68	-6278.53	-6291.84	-6327.55

Notes:

- 1) All models include additional repressors that are defined in terms of smoothed terms. They are not reported here because they are used as additional controls. Smoothing is performed with p-splines.
- 2) Significance codes are 0 = ***, 0.001='***', 0.01='*', 0.05='.', 0.1=' '.

Table F2

Frequency regressions with GAMLSS

Mean regression	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Intercept	4.33 (***)	4.32 (***)	4.28 (***)	4.23 (***)	4.22 (***)	4.24 (***)	4.40 (***)
GDP growth	0.13 (***)	0.13 (***)	0.13 (***)	0.13 (***)	0.14 (***)	0.14 (***)	0.12 (***)
Dummy for crisis		0.04					
CPI			0.02				
Gov. effectiveness				0.12			
Regulatory Quality					0.13		
Rule of Law						0.17	
Control of Corruption							0.00
Control	-3.50 (***)	-3.51 (***)	-3.68 (***)	-3.70 (***)	-3.69 (***)	-3.83 (***)	-3.69 (***)
Assets per employee	-0.03 (.)	-0.03 (*)	-0.03 (*)	-0.03 (*)	-0.03 (*)	-0.04 (*)	-0.04 (*)
Scale regression							
Intercept	-0.14	-0.14	-0.11	-0.10	-0.07	-0.07	-0.47
Employees per branch	0.05 (**)	0.05 (**)	0.05 (**)	0.05 (**)	0.05 (**)	0.05 (**)	0.05 (**)
Diagnostics							
Global Deviance	1581.63	1581.58	1570.44	1581.11	1570.75	1562.64	1535.25
AIC	1611.76	1613.72	1606.82	1612.27	1609.40	1604.36	1584.57
SBC	1663.01	1668.40	1668.74	1665.30	1675.15	1675.34	1668.48

Notes:

- 1) All models include additional repressors that are defined in terms of smoothed terms. They are not reported here because they are used as additional controls. Smoothing is performed with p-splines.
- 2) Significance codes are 0 = ***, 0.001='***', 0.01='**', 0.05='*', 0.1='.'.