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IRB Model Regulatory Arbitrage and Profitability at European Banks

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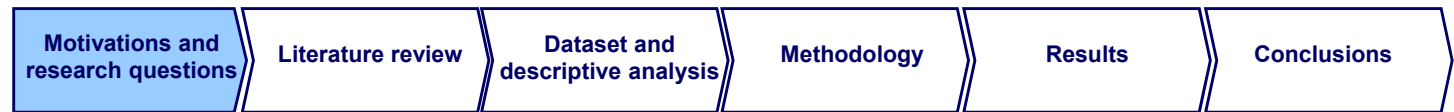*** Lumsa University (Rome) & MoFIR**   **** Sapienza University (Rome)**

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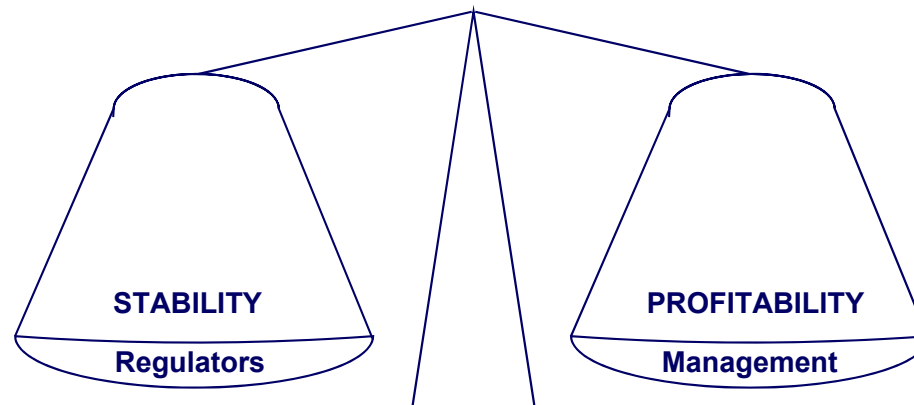
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| Motivations and research questions | Literature review | Dataset and descriptive analysis | Methodology | Results | Conclusions |

– *Motivations and research questions* –

❑ A well established view in economic banking literature asserts that "**higher capital-asset ratio** (CAR) is associated with a **lower after-tax return on equity** (ROE)" (Berger, 1995)

❑ The arguments in favor of that hypothesized negative relationship between capital and earnings have intuitive appeal and are consistent with "**standard one-period models** of **perfect capital markets** with **symmetric information** between a bank and its investors". A higher capital ratio tends to "reduce the risk on equity" and therefore "lowers the equilibrium expected return on equity required by investors". In addition, a higher CAR lowers after-tax earnings by reducing the tax shield provided by the deductibility of interest payments

❑ Despite these arguments, empirical evidence and economic literature during the time have found suggestions also for the **opposite view**: by this perspective, there are a number of potential explanations for the **positive capital-earnings relationship**, **once the assumptions of the one-period model of perfect market with symmetric information are relaxed**. Relaxation of the one-period assumption allows "an increase in earnings to raise the capital ratio, provided that marginal earnings are not fully paid out in dividends". Relaxation of the perfect capital markets assumption allows "an increase in capital to raise expected earnings by reducing the expected costs of financial distress including bankruptcy". Finally, relaxation of the symmetric information assumption allows for "a signaling equilibrium in which banks that expect to have better performance credibly transmit this information through higher capital" (Berger, 1995)

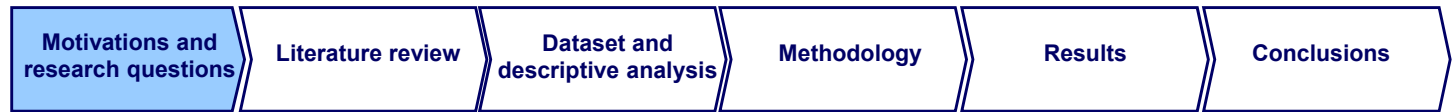| Motivations and research questions | Literature review | Dataset and descriptive analysis | Methodology | Results | Conclusions |

– Motivations and research questions –

❑ From a different perspective, the level of capital of banks is an argument of particular relevance for **prudential regulation**, which considers an **adequate level of capital** as a fundamental – even if no longer a sufficient per sé – condition to pursuit the **financial stability** of a single bank and the whole banking system

❑ However, the debate about the possibility to determine an **adequate threshold** of capital necessary to ensure the **soundness and stability** of the international banking system – by realizing a correct measure of risk **without mortifying banking profitability** – remains almost an **unresolved issue**

❑ From this perspective, because the level of capital necessary to accomplish to the regulatory framework can hinder the **profitability** of banks – by enlarging (exogenously) the denominator of their Return on Equity ratio (ROE) – supervisors had always been engaged, since the first version of the 1988 Accord, to **attenuate** the effects that regulatory requirements can determine hampering banks profitability

STABILITY
Regulators

PROFITABILITY
Management

Motivations and research questions	Literature review	Dataset and descriptive analysis	Methodology	Results	Conclusions

– *Motivations and research questions* –

☐ **Supervisors** by the time have considered different tools in order to achieve that optimal threshold

☐ Nevertheless, unlike the **"unrealistic"** hypothesis that supervised banks may had considered as being nearly **optimal** the regulatory framework preceding the Basel III framework, this latter has been already largely commented, and eventually **criticized**, among other factors, because of its potential effects of **reduction of credit** available to the economy by the banking system, which is on average required to achieve the new regulatory framework by a higher amount of capital

☐ In particular, a **concern** (too shy in reality, especially from academicians!!!) has emerged because of the relevant effort that must be put in place by the more sophisticated banks – which were in general the ones utilizing most the further sources of funding other than common base – so that could be asked them to completely review their profitability profile

☐ Because of its relevant effects on the banks behavior, the Basel III has been considered like a possible further spur to ameliorate their **capital profile**, eventually acting by a more **discretionary** use of regulatory framework in order to achieve further reduction of **capital absorption**

☐ The **potential bias**, arising from that perspective, is that the discretionary use of regulatory framework can move from a **"fair use"** of the possibilities proposed by regulators to a further **"enforcing interpretation"** of regulatory discretionary – which, in their extensions – may become interpretable as a suspected evidence of **"regulatory arbitrage"**

– *Motivations and research questions* –

☐ The possible ways of **regulatory capital optimization** vs **regulatory arbitrage**

Stability ... *Profitability*

$$\frac{\text{Regulatory Capital}}{\text{RWA}_{CRE} + (MR + OR)*12.5} \geq 8\%$$

$$\frac{\text{Return}}{\text{Equity}} = RoE$$

Portfolio mix optimization and risk reduction

Switch to Less Capital Consuming Methodologies

Switch to Less Capital Consuming Assets

Retail ...
Mortgage
Corporate

$$\frac{\text{EAD}_{STD}}{\text{EAD}_{CRE}} \qquad \frac{\text{EAD}_{IRB}}{\text{EAD}_{CRE}}$$

$$\frac{\text{EAD}_{CRE}}{\text{Total Assets}} \quad + \quad \left\{ \text{Other Control Variables} \right\} \quad \rightarrow \quad \frac{\text{RWA}_{CRE}}{\text{EAD}_{CRE}}$$

Fair use of regulatory options

Regulatory Arbitrage

Motivations and research questions	Literature review	Dataset and descriptive analysis	Methodology	Results	Conclusions
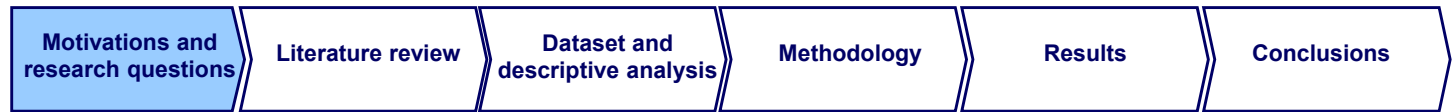
– *Motivations and research questions* –

❑ Therefore, for a more comprehensive view, our analysis becomes as follows:

Return

e.g.

$$RoE = \frac{Return}{Equity}$$

Risk

e.g.

$$RWA\ density = \frac{RWA}{EAD}$$

Capital

e.g.

$$CAR = \frac{Equity}{Total\ Asset}$$

Motivations and research questions	Literature review	Dataset and descriptive analysis	Methodology	Results	Conclusions
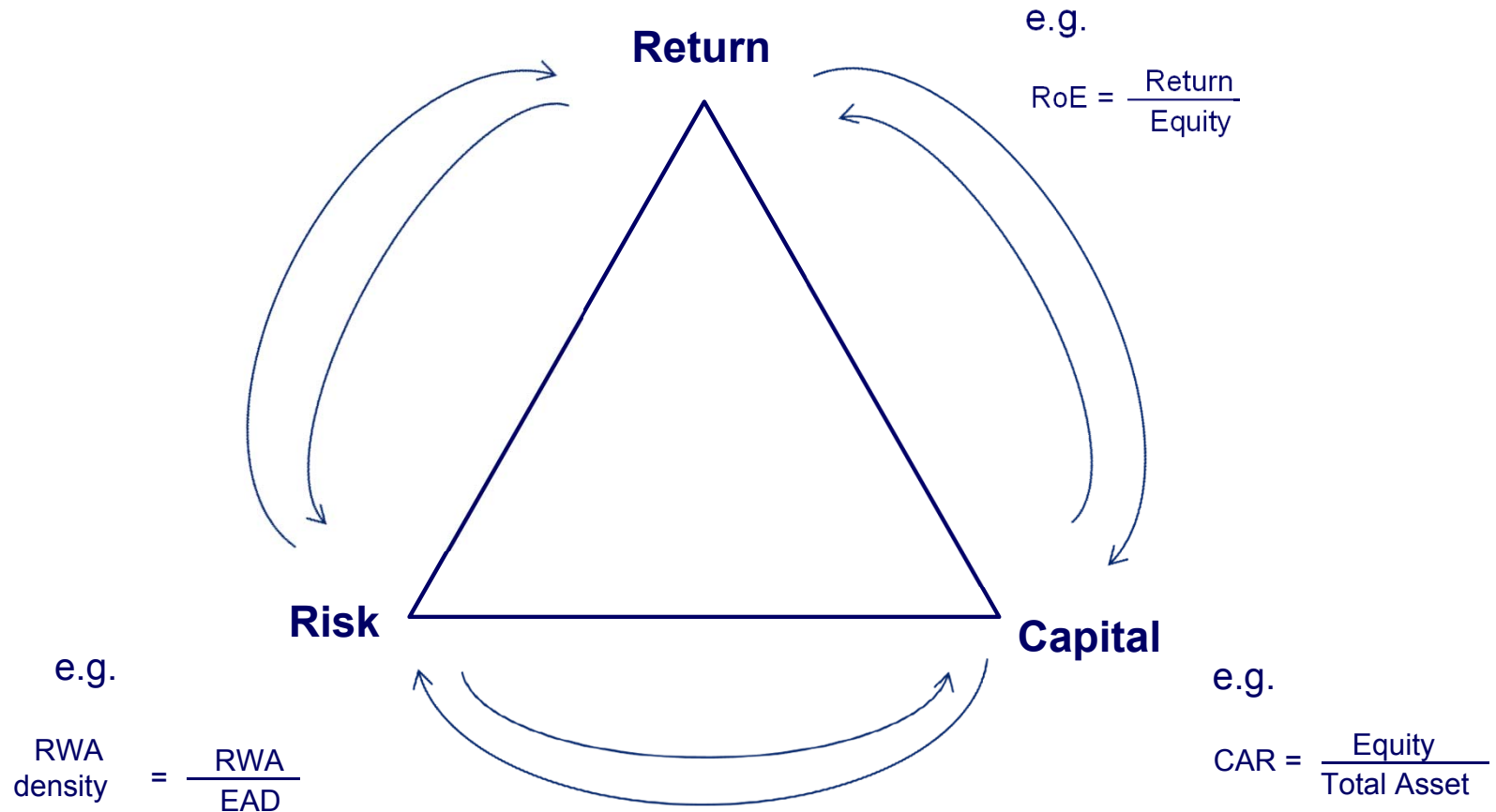
– *Literature Review* –

❑ Our paper deals within two fundamental streams of economic banking literature: the **first one**, more recent, considers the **potential bias characterizing regulatory metrics (RWA dispersion) because of regulatory arbitrage**; the **second one**, more established, although with still significant gaps of knowledge, investigates the **determinants of profitability** and **optimal capital structure**

❑ Since the dispersion among RWAs has become evident even across banks operating in the same region and with similar business specialization, supervisors have recently started to investigates about **regulatory arbitrage taking place at banks via RWA calculations** [EBA (2013a, 2013b, 2013c, 2014); BCBS (2013a, 2013b, 2013c); Banco de Espana (2010, 2011, 2012); Banca d'Italia (2012); National Bank of Belgium (2014); IMF (2012a, 2012b, 2015)]

❑ More recently, Mariathasane & Merrouche (2014) and Ferri & Pesic (2016) investigate the determinants of RWA dispersion by focusing attention about the effect that the adoption of **IRB methodologies** can play in reducing capital absorption, via risk-weights manipulation. They both conclude that **regulatory arbitrage** is likely to materialize with the adoption of IRB, especially among **weakly capitalized banks**. However, although Mariathasane & Merrouche (2014) examine the relationship between banks' approval for the internal ratings-based (IRB) approaches of Basel II and the ratio of risk-weighted assets to total assets, Ferri & Pesic (2016) focus attention on RWA/EAD, so that they are able to clean the risk weighted density from the roll-out effect generated by banks portfolio shift from Standard to IRB

| Motivations and research questions | Literature review | Dataset and descriptive analysis | Methodology | Results | Conclusions |

– *Literature Review* –

❑ From another perspective, over the time significant efforts have been dedicated to investigate both for the **determinants of banks profitability**, on one side (Berger et al., 1995a; Albertazzi & Gambacorta, 2009; DeYoung & Rice, 2004; Fiordelisi & Molyneux, 2010), together with the decisions for the **optimization of capital** level, on a second side (Berger et al., 1995b; Blum, 1999; Estrella, 2004). More in particular, the interest on the determinants of banks profitability relates to the most recent economic literature on **bank business model**, which has by the time investigated **balance sheets characteristics** (Altunbas et al., 2011), **income and funding diversification** (Demirgüc-Kunt and Huizinga, 2010; Köhler 2016), classification of financial institutions on the base of their **asset and liability combination via cluster analysis** (Ayadi et al., 2011)

❑ The difficulty at looking together to those elements is caused by the **reciprocal nexus of causation** between those two variables (Berger, 1995; Berger & DeYoung, 1997), especially when the **prudential regulation** exogenously impact the capital structure decision (Kim & Santomero, 1988; Repullo, 2004)

❑ Moving from that standpoint, in this paper we aim to investigate about **profitability** distortions due to IRB model regulatory arbitrage among European banks, so to verify if potential savings of capital absorption generated by IRB model calibration significantly affects reported profits at European banks. Therefore, by considering the relation between **capital**, **profitability** and **risk**, we aim to add a new contribution about the **causal relation between risk and profitability** in bank organizations

| Motivations and research questions | Literature review | Dataset and descriptive analysis | Methodology | Results | Conclusions |

– *Dataset and descriptive analysis* –

❑ Our main contributions largely owe to the data we compiled. Namely, besides introducing other control variables, we augment BankScope data with information painstakingly gathered from **individual banks' statements** and **Pillar Three reports**.

❑ This gives us for each bank:

i) its Risk Weighted Assets (RWAs) and Exposures At Default (EADs)

ii) its percentage of EADs referred to, respectively, the Standard model, the Foundation IRB (F-IRB) model, and the Advanced-IRB (A-IRB) model

STATS	ROE	RWA/EAD	STD	FIRB	AIRB	SIZE	INT INC	IMPAIR	LOANS	SECURITIES	DEPOSIT	EQUITY	TCRATIO	REQ CREP	REQ MARP	REQ OPEP	ASSETS GROWTH
mean	0.03	46.30	63.56	16.79	19.69	17.43	63.17	21.19	56.32	23.70	41.57	7.01	15.12	83.95	4.52	10.34	3.86
p90	0.15	73.00	100.00	80.00	83.00	19.91	93.00	50.00	82.00	48.00	74.00	12.00	21.27	95.32	11.75	14.97	18.51
p75	0.10	59.00	100.00	0.00	38.00	18.76	78.00	27.00	72.00	33.00	60.00	9.00	16.70	91.76	5.63	11.08	7.85
p50	0.05	46.00	100.00	0.00	0.00	17.31	66.00	15.00	60.00	20.00	44.00	6.00	13.32	88.05	1.85	8.02	0.96
p25	0.01	33.00	24.00	0.00	0.00	16.12	54.00	5.00	42.00	11.00	25.00	4.00	10.90	80.41	0.30	6.03	-4.43
p10	-0.17	18.00	0.00	0.00	0.00	15.25	32.00	1.00	24.00	3.00	3.00	2.00	9.20	67.16	0.00	4.04	-11.82
sd	0.13	20.83	40.22	32.58	34.65	1.86	124.55	22.22	21.97	18.00	24.05	6.84	13.44	15.50	7.93	10.99	20.87
N	1339	1345	1345	1345	1345	1341	1338	1281	1343	1341	1325	1341	1231	1329	1329	1329	1309

MEAN (by BANKS)	ROE	RWA/EAD	STD	FIRB	AIRB	SIZE	INT INC	IMPAIR	LOANS	SECURITIES	DEPOSIT	EQUITY	TCRATIO	REQ CREP	REQ MARP	REQ OPEP	ASSETS GROWTH
STD	0.03	52.34	100.00	0.00	0.00	16.46	58.49	22.32	58.61	19.37	48.10	8.35	15.09	85.15	3.89	11.26	5.76
FIRB	0.04	38.31	25.89	74.20	0.00	17.96	64.91	19.67	54.36	25.22	34.81	5.88	14.37	82.45	4.71	9.91	4.13
AIRB	0.02	41.31	24.58	1.11	74.40	18.84	70.78	20.37	53.53	30.77	34.86	5.38	15.77	82.91	5.57	8.96	0.06

Motivations and research questions	Literature review	Dataset and descriptive analysis	Methodology	Results	Conclusions

– *Methodology* –

❑ The main contributions of our econometric analysis are grounded in some features of the data we compiled. To test whether and the extent to which there was "regulatory arbitrage" and whether it intensified under lower level of capital and profitability, we focus on three fundamental variables, respectfully measuring **profitability**, **capital adequacy** and **risk**

❑ Since those variables are characterized by a not easily to disentangle problem of reciprocal causation, we decided to approach it (in line with some previous analysis) via a **Granger causality approach**

❑ In a Granger causality contest we know that "if lagged values of X help predict current values of Y in forecast formed lagged values of both X and Y, then X is said to Granger cause Y" … in such a way throughout this approach we aim to investigate about this kind of "chickens and eggs" dilemma upon the following variables:

- Risk = RWA/EAD

- Profitability = Ratio of Net Income/Equity

- Capitalization = Ratio of Equity/Total Asset

IRB Model Regulatory Arbitrage and Profitability at European Banks

– Results (ROE, RWA/EAD, EQUITY) –

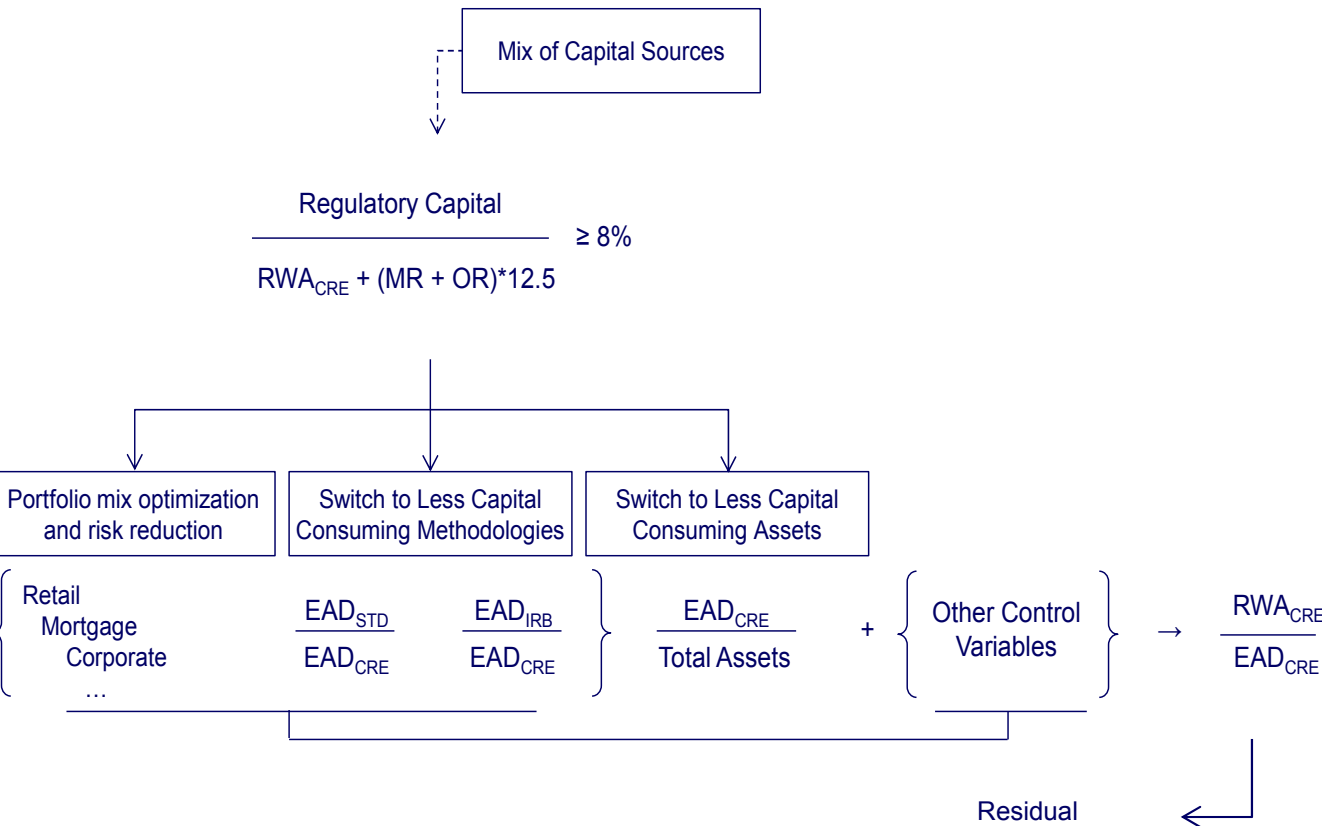|	Total Sample			STD Banks			FIRB Banks			AIRB Banks		
	ROE	RWA/EAD	EQUITY	ROE	RWA/EAD	EQUITY	ROE	RWA/EAD	EQUITY	ROE	RWA/EAD	EQUITY
L.ROE	0.4902***	0.6799	-2.8462	0.3325**	-0.7109	-2.1905	0.0128	17.3347***	-4.2784*	0.1015	31.1615**	-2.9073*
	0.135	10.186	2.476	0.157	8.755	1.734	0.193	6.426	2.245	0.126	12.352	1.525
L2.ROE	0.0779	-1.8416	-1.7035	0.1925	10.4932*	-0.3542	0.1985	-11.4854*	-4.1932*	0.1614	-9.4591	0.9949
	0.089	4.223	1.662	0.118	5.887	2.433	0.124	5.899	2.228	0.118	7.854	0.936
ROE Total	0.5681***	-1.1617	-4.5497	0.525*	9.7823	-2.5447	0.2113	-5.8493***	-8.4716**	0.2629	21.7024**	-1.9124
	0.288	8.667	9.967	1.456	7.939	9.462	6.763	7.939	9.462	6.763	0.992	3.252
L.RWA/EAD	0.0018	0.9191***	0.086	0.0044	1.0319***	0.0867	0.0007	0.9172***	0.1039**	-0.0029	0.6525***	-0.0184
	0.004	0.219	0.102	0.003	0.162	0.123	0.002	0.159	0.047	0.002	0.220	0.023
L2.RWA/EAD	-0.0011	0.1212	-0.0881	-0.0043	-0.0556	-0.0909	0.0001	-0.0167	-0.0940**	0.0037*	0.0981	0.0522**
	0.003	0.196	0.090	0.003	0.148	0.116	0.002	0.196	0.045	0.002	0.166	0.024
RWA/EAD Total	0.0007	1.0403***	-0.0021	0.0001	0.9763***	-0.0042	0.0008	0.9005***	0.0099*	0.0008	0.7506***	0.0338*
	9.958	0.288	14.384	8.929	0.200	9.981	5.284	0.200	9.981	5.284	0.152	4.232
L.EQUITY	0.0037	0.7678*	1.1654***	0.0047	0.236	0.8643***	-0.014	-0.6522	0.9870***	0.0301*	0.5495	0.5161***
	0.008	0.414	0.166	0.006	0.305	0.303	0.013	0.398	0.267	0.017	0.879	0.169
L2.EQUITY	-0.0072	-0.8510**	-0.2245	-0.0056	-0.6330**	-0.0465	0.0072	0.6533	-0.1092	-0.0262*	-0.9235	0.3556***
	0.005	0.346	0.154	0.005	0.271	0.234	0.009	0.411	0.210	0.014	0.706	0.113
EQUITY Total	-0.0035	-0.0832	0.9409***	-0.0009	0.397**	0.8178***	-0.0068	0.0011	0.8778***	0.0039	-0.374	0.8717***
	9.471	6.175	0.288	9.982	2.500	0.200	7.483	2.500	0.200	7.483	6.187	0.152
CONSTANT	0.0026	-2.5697	0.9361	0.0048	3.918	1.9464**	0.0321	1.9457	1.1122	-0.0444	10.2463*	-0.4542
	0.061	4.234	0.843	0.074	5.086	0.832	0.072	2.758	0.991	0.091	5.585	1.150
N	828	828	828	402	402	402	230	230	230	227	227	227
N(g)	236	236	236	122	122	122	66	66	66	73	73	73

The variables ROE$_{Total}$, RWA/EAD$_{Total}$, EQUITY$_{Total}$ are the estimated coefficients for the test that the sum of lagged terms is equal to zero. A significance level lower than 10% enables to reject the null hypothesis of no causality from the x to the y. A coefficient greater than zero show a positive causation from the x to the y; a coefficient smaller than zero show a negative causation from the x to the y.

| Motivations and research questions | Literature review | Dataset and descriptive analysis | Methodology | Results | Conclusions |

– *Results* –

❑ Ancillary regression controlling for RWA dispersion

Mix of Capital Sources

$$\frac{\text{Regulatory Capital}}{RWA_{CRE} + (MR + OR)*12.5} \geq 8\%$$

Portfolio mix optimization and risk reduction | Switch to Less Capital Consuming Methodologies | Switch to Less Capital Consuming Assets

Retail
Mortgage
Corporate
…

$$\frac{EAD_{STD}}{EAD_{CRE}} \quad \frac{EAD_{IRB}}{EAD_{CRE}} \quad \bigg\} \quad \frac{EAD_{CRE}}{\text{Total Assets}} + \Bigg\{ \begin{matrix}\text{Other Control}\\\text{Variables}\end{matrix} \Bigg\} \rightarrow \frac{RWA_{CRE}}{EAD_{CRE}}$$

Residual

	RWA/EAD		
L.RWA/EAD	0.9200***	Tau2009	-0.5945
	0.063		2.598
F-IRB	-0.1326***	Tau2010	-0.1227
	0.039		2.636
F-IRB SQ	0.0011***	Tau2011	0.542
	0.000		2.661
A-IRB	-0.1493**	Tau2012	-1.4346
	0.058		2.611
A-IRB SQ	0.0013**	Tau2013	-1.3677
	0.001		2.656
ASSETS GROWTH	-0.0695***	CONSTANT	5.2556
	0.022		8.377
LOANS/LIABILITIES	-0.0005	N	970
	0.002	N(g)	225
SIZE	0.0178	AR2-p	0.254
	0.330	J	43
Z-SCORE	-0.0001	Hansen df	23
	0.000	Hansen-p	0.2831
OFF/TA	-0.0118	R2	0.9012
	0.013		
OTHER/TA	-0.0189**		
	0.009		
LISTED	0.0919		
	0.752		
STATE AID	-0.5184		
	0.773		
STRESS TEST	0.9951		
	0.666		

IRB Model Regulatory Arbitrage and Profitability at European Banks

– Results (ROE, RESIDUAL, EQUITY)–

	Total Sample			STD Banks			FIRB Banks			AIRB Banks		
	ROE	RESIDUAL	EQUITY	ROE	RESIDUAL	EQUITY	ROE	RESIDUAL	EQUITY	ROE	RESIDUAL	EQUITY
L.ROE	0.5977***	0.0945	0.0035	0.1598	0.0747	-0.0049	0.1353	0.1088	-0.0435	0.1972	0.1224	-0.0224
	0.155	0.113	0.031	0.185	0.076	0.021	0.218	0.082	0.033	0.140	0.119	0.016
L2.ROE	0.0879	-0.0065	-0.0240	0.3542**	0.0498	-0.0285*	0.2478**	-0.0131	-0.0343	0.2561**	0.0248	0.0019
	0.094	0.059	0.016	0.152	0.066	0.016	0.108	0.053	0.025	0.130	0.061	0.009
ROE Total	0.6856	0.0880	-0.0205	0.5140**	0.1245	-0.0334	0.3831*	0.0957	-0.0778	0.4533**	0.1472	-0.0205
	0.230	11.322	9.146	2.630	7.419	5.478	3.088	6.076	4.686	1.770	6.203	6.003
L.RESIDUAL	0.3876	-0.4772	0.0368	0.7053**	-0.0704	0.0585	-0.2932	-0.3215	0.0365	-0.4274*	-0.5877***	-0.0077
	0.418	0.295	0.086	0.341	0.215	0.058	0.432	0.313	0.059	0.231	0.187	0.017
L2.RESIDUAL	0.2558**	0.0128	0.0149	0.2304*	0.0802	0.0244	0.2541	-0.0243	0.0176	0.1089	0.0020	-0.0067
	0.100	0.068	0.013	0.132	0.079	0.022	0.162	0.105	0.016	0.113	0.113	0.018
RESIDUAL Total	0.6434**	-0.4644	0.0517	0.9357**	0.0098	0.0829	-0.0391	-0.3458	0.0541	-0.3185*	-0.5857***	-0.0144
	4.176	9.861	11.503	3.859	7.677	7.776	5.475	6.110	6.093	3.524	0.467	3.888
L.EQUITY	-0.2060	1.0505	0.5716	-0.2733	0.4255	0.3664*	-2.3098*	-0.1900	0.6894***	-0.3641	-0.3308	0.4917**
	0.870	0.708	0.380	0.588	0.298	0.206	1.192	0.522	0.221	1.099	1.479	0.220
L2.EQUITY	-0.1637	-0.7941	0.3994	0.2959	-0.2846	0.5976***	1.8482	0.6410	0.2425*	0.3621	-0.2527	0.4034***
	0.734	0.762	0.373	0.462	0.323	0.217	1.139	0.672	0.144	0.994	1.322	0.154
EQUITY Total	-0.3697	0.2564	0.9710***	0.0226	0.1409	0.9640***	-0.4616	0.4510	0.9319***	-0.0020	-0.5835	0.8951***
	11.436	8.795	0.230	6.089	6.886	0.156	4.307	6.157	0.124	3.061	5.878	0.125
CONSTANT	2.2593	-2.0399	0.5089**	-0.9150	-1.8792	0.4498	4.3048	-2.3747	1.1089	0.5003	3.6081	0.9626
	2.417	1.535	0.238	3.248	1.242	0.293	4.738	2.375	0.697	2.965	2.196	0.661
N	531	531	531	244	244	244	154	154	154	156	156	156
N(g)	198	198	198	98	98	98	56	56	56	65	65	65

The variables ROE$_{Total}$, RESIDUAL$_{Total}$, EQUITY$_{Total}$ are the estimated coefficients for the test that the sum of lagged terms is equal to zero. A significance level lower than 10% enables to reject the null hypothesis of no causality from the x to the y. A coefficient greater than zero show a positive causation from the x to the y; a coefficient smaller than zero show a negative causation from the x to the y.

– Robustness (ROE, DIF_RWA, EQUITY) –

	Total Sample			STD Banks			FIRB Banks			AIRB Banks		
	ROE	DIF_RWA	EQUITY	ROE	DIF_RWA	EQUITY	ROE	DIF_RWA	EQUITY	ROE	DIF_RWA	EQUITY
L.ROE	0.4940***	-8.8469	-2.8378	0.2883	-5.3315	-3.4757	0.0856	15.1512**	-3.9419*	0.0068	17.7516	-1.0068
	0.143	8.856	2.209	0.186	9.285	2.326	0.212	7.670	2.278	0.164	11.849	1.964
L2.ROE	0.0873	1.0011	-1.3783	0.2342*	11.6576**	0.7498	0.1578	-9.4557	-4.0924*	0.2102*	-7.1727	0.1346
	0.085	3.960	1.938	0.135	5.627	3.130	0.122	5.882	2.307	0.110	6.915	0.903
ROE Total	0.5813***	-7.8458	-4.2161**	0.5225***	6.3261	-2.7259	0.2434	5.6955**	-8.0343*	0.217	10.5789	-0.8722
	0.288	14.075	5.953	1.400	6.353	7.235	7.369	6.353	7.235	4.614	7.044	4.939
L.DIF_RWA	0.0048	0.7120**	0.1598	0.0065**	1.0394***	0.1251	0.0006	0.8717***	0.1240**	-0.0039**	0.6418***	0.0084
	0.004	0.325	0.158	0.003	0.160	0.135	0.003	0.211	0.057	0.002	0.200	0.031
L2.DIF_RWA	-0.0043	0.2433	-0.1298	-0.0065**	-0.0695	-0.1193	-0.0003	0.0316	-0.1046*	0.0027	0.0811	0.0560**
	0.004	0.281	0.136	0.003	0.146	0.128	0.003	0.253	0.055	0.002	0.143	0.027
DIF_RWA Total	0.0005	0.9553***	0.03	0.0002*	0.9699***	0.0058	0.0003	0.9033***	0.0194*	-0.0012*	0.7229***	0.0644*
	14.361	0.288	14.280	5.464	0.200	9.581	2.436	0.200	9.581	3.451	0.213	4.398
L.EQUITY	-0.0009	1.1432**	1.0574***	0.0013	0.2714	0.8397***	-0.0108	-0.3542	0.9641***	0.0224*	1.3523	0.4558***
	0.010	0.518	0.219	0.006	0.274	0.297	0.013	0.367	0.253	0.012	1.076	0.169
L2.EQUITY	-0.0017	-1.0955***	-0.1305	-0.0018	-0.6163**	-0.0021	0.004	0.3026	-0.0966	-0.0158	-1.4097	0.3520***
	0.006	0.408	0.191	0.005	0.278	0.240	0.009	0.384	0.184	0.010	0.947	0.099
EQUITY Total	-0.0026	0.0477**	0.9269***	-0.0005	-0.3449*	0.8376***	-0.0068	-0.0516	0.8675***	0.0066	-0.0574	0.8078***
	11.236	4.571	0.288	4.802	4.444	0.200	6.910	4.444	0.200	5.976	6.872	0.150
Constant	0.0238	0.0572	0.7935	-0.0043	3.7085*	1.3689**	0.0678	-1.1337	1.5531*	-0.0207	-1.4356	1.6292*
	0.039	1.802	0.485	0.037	2.018	0.604	0.046	2.280	0.849	0.041	2.540	0.850
N	828	828	828	402	402	402	230	230	230	226	226	226
N(g)	236	236	236	122	122	122	66	66	66	73	73	73

The variables ROE$_{Total}$, DIF_RWA$_{Total}$, EQUITY$_{Total}$ are the estimated coefficients for the test that the sum of lagged terms is equal to zero. A significance level lower than 10% enables to reject the null hypothesis of no causality from the x to the y. A coefficient greater than zero show a positive causation from the x to the y; a coefficient smaller than zero show a negative causation from the x to the y.

– Robustness (ROE, RESIDUAL, EQUITY – More Capitalized) –

	Total Sample			STD Banks			FIRB Banks			AIRB Banks		
	ROE	RESIDUAL	EQUITY	ROE	RESIDUAL	EQUITY	ROE	RESIDUAL	EQUITY	ROE	RESIDUAL	EQUITY
L.ROE	-0.0146	-0.1334	0.0711	-0.1782	0.1703	0.0022	0.4547***	-0.0257	0.1131***	0.0672	0.1280	0.0018
	0.150	0.145	0.073	0.202	0.142	0.026	0.159	0.141	0.040	0.158	0.170	0.034
L2.ROE	0.1022	0.1074	-0.0885**	0.1065	-0.1755	-0.0586**	-0.0164	0.1205	-0.1189**	0.2170	0.0243	-0.0282*
	0.167	0.071	0.044	0.308	0.144	0.029	0.217	0.076	0.054	0.135	0.148	0.017
ROE Total	0.0876	-0.0260	-0.0174**	-0.0717	-0.0052	-0.0564**	0.4383***	0.0948	-0.0058**	0.2842	0.1523	-0.0264*
	6.909	7.592	3.024	5.534	5.551	1.565	0.093	3.511	1.263	2.581	3.746	2.293
L.RESIDUAL	-0.2167	-0.2940**	-0.0126	-0.0299	0.0655	0.1170	-0.1068	-0.5462***	0.0501	-0.2666*	-0.5187***	0.0234
	0.287	0.120	0.067	0.431	0.217	0.072	0.182	0.120	0.067	0.151	0.117	0.021
L2.RESIDUAL	-0.0272	-0.0625	0.0071	0.0797	-0.0191	0.0118	-0.1640	-0.0292	-0.0544*	-0.0639	-0.0068	0.0064
	0.093	0.053	0.021	0.154	0.078	0.017	0.128	0.136	0.032	0.121	0.072	0.021
RESIDUAL Total	-0.2439	-0.3565**	-0.0055	0.0498	0.0464	0.1288	-0.2708	-0.5754***	-0.0043**	-0.3305	-0.5255***	0.0298
	7.106	2.639	3.736	3.811	4.522	4.448	4.407	0.093	1.996	3.445	0.085	4.268
L.EQUITY	0.7983	0.0534	0.5227	0.3319	0.5170**	0.2626**	-0.0908	-1.2245**	1.1380***	0.4840	0.1711	0.4676***
	0.784	0.372	0.393	0.382	0.223	0.107	1.102	0.572	0.187	0.919	0.937	0.139
L2.EQUITY	-0.3698	0.1771	0.5215	0.1965	-0.2461	0.7344***	0.2119	1.6526	-0.2194	-0.4676	-0.2684	0.4218***
	0.790	0.363	0.369	0.374	0.286	0.115	1.598	1.051	0.335	0.747	0.899	0.128
EQUITY Total	0.4285	0.2305	1.0442***	0.5284	0.2709	0.9970***	0.1211	0.4281*	0.9186***	0.0164	-0.0973	0.8894***
	3.445	0.085	4.268	4.589	1.067	0.112	2.121	2.230	0.093	3.373	2.348	0.085
CONSTANT	2.0453	-1.9496	0.0234	1.8994	-3.6070**	0.5741	2.2398	-2.1927	0.9212	3.6321	0.2613	1.1166
	1.981	1.501	0.394	3.585	1.692	0.354	3.425	3.218	0.802	2.262	2.379	0.685
N	270	270	270	125	125	125	86	86	86	73	73	73
N(g)	101	101	101	50	50	50	32	32	32	32	32	32

The variables ROE_{Total}, $RESIDUAL_{Total}$, $EQUITY_{Total}$ are the estimated coefficients for the test that the sum of lagged terms is equal to zero. A significance level lower than 10% enables to reject the null hypothesis of no causality from the x to the y. A coefficient greater than zero show a positive causation from the x to the y; a coefficient smaller than zero show a negative causation from the x to the y.

– *Robustness (ROE, RESIDUAL, EQUITY – Less Capitalized)* –

	Total Sample			STD Banks			FIRB Banks			AIRB Banks		
	ROE	RESIDUAL	EQUITY	ROE	RESIDUAL	EQUITY	ROE	RESIDUAL	EQUITY	ROE	RESIDUAL	EQUITY
L.ROE	0.6434***	0.0240	-0.0164	0.4054***	0.0465	-0.0203	0.2124*	0.0954	-0.0266**	0.3399**	0.1810*	-0.0194*
	0.153	0.088	0.023	0.138	0.091	0.019	0.118	0.098	0.011	0.144	0.104	0.012
L2.ROE	0.1662	0.0298	-0.0023	0.3102**	0.0515	-0.0158	0.3507**	-0.1243	-0.0045	0.1978	0.0673	0.0114
	0.107	0.061	0.016	0.154	0.064	0.017	0.137	0.086	0.017	0.169	0.075	0.009
ROE Total	0.8096***	0.0538	-0.0187	0.7156***	0.0980	-0.0361	0.5631***	-0.0289	-0.0311*	0.5377	0.2483	-0.008*
	0.161	6.516	8.024	0.169	5.440	5.164	0.202	3.942	1.938	2.736	3.995	2.445
L.RESIDUAL	0.1540	-0.1557	0.0308	0.2733	0.0209	0.0642	-0.3387	0.1058	-0.0351	0.1061	-0.5896***	0.0206
	0.303	0.262	0.068	0.237	0.128	0.056	0.469	0.303	0.033	0.239	0.185	0.027
L2.RESIDUAL	0.4428***	0.2159*	0.0246	0.3737**	0.3517***	0.0470	0.4133	0.0231	0.0244	0.4636*	-0.0854	0.0152
	0.154	0.112	0.022	0.174	0.147	0.038	0.275	0.128	0.017	0.264	0.186	0.020
RESIDUAL Total	0.5968***	0.0602	0.0554	0.6470*	0.3726**	0.1112	0.0746	0.1289	-0.0107*	0.5697	-0.675***	0.0358
	1.523	5.220	8.075	3.165	0.362	5.404	3.827	2.023	2.093	3.652	0.091	4.551
L.EQUITY	-4.3118***	1.2033	0.7485***	-2.0350	-0.5499	0.6891***	-3.6309*	0.3499	0.2434*	0.4283	-1.9568	1.1997***
	1.661	1.194	0.257	1.737	1.039	0.242	2.027	0.739	0.143	3.750	2.264	0.215
L2.EQUITY	0.4279	-0.8006	-0.0701	-0.8613	0.6421	-0.0373	1.1090	0.4123	0.1975	-1.2951	-1.5587	-0.3336
	1.152	0.877	0.211	1.031	0.817	0.255	1.471	0.707	0.136	4.233	2.550	0.266
EQUITY Total	-3.8839***	0.4027	0.6784***	-2.8963	0.0922	0.6518***	-2.5219	0.7622	0.4409	-0.8668	-3.5155	0.8661***
	1.497	8.027	0.162	3.736	4.885	0.154	3.195	3.830	3.351	3.574	2.504	0.091
CONSTANT	18.9479***	-2.1155	1.9114***	15.0095	-0.3516	2.2236**	9.3140	-3.0952	2.6355***	1.8092	17.9586***	0.8666
	6.602	5.215	0.656	9.495	3.855	1.106	7.035	3.547	0.985	7.400	6.305	0.627
N	261	261	261	119	119	119	68	68	68	83	83	83
N(g)	97	97	97	48	48	48	24	24	24	33	33	33

The variables ROE$_{Total}$, RESIDUAL$_{Total}$, EQUITY$_{Total}$ are the estimated coefficients for the test that the sum of lagged terms is equal to zero. A significance level lower than 10% enables to reject the null hypothesis of no causality from the x to the y. A coefficient greater than zero show a positive causation from the x to the y; a coefficient smaller than zero show a negative causation from the x to the y.

| Motivations and research questions | Literature review | Dataset and descriptive analysis | Methodology | Results | Conclusions |

– Robustness (ROA, SD(ROA), EQUITY) –

	Total Sample			STD Banks			FIRB Banks			AIRB Banks		
	ROA	SD(ROA)	EQUITY	ROA	SD(ROA)	EQUITY	ROA	SD(ROA)	EQUITY	ROA	SD(ROA)	EQUITY
L.ROA	0.6290***	-0.1438	-0.1489	0.5321***	0.5765	-0.3345	0.3858*	-0.2115*	0.7200	0.2873*	-0.0173	0.0620
	0.119	0.328	0.464	0.165	0.561	0.612	0.218	0.115	0.553	0.161	0.227	0.519
L2.ROA	-0.0283	-1.1895*	-0.2311	0.0757	-2.2809*	-0.0557	0.2000	0.1095	-0.2036	0.2022	0.0512	0.0884
	0.095	0.624	0.316	0.153	1.209	0.498	0.180	0.155	0.459	0.142	0.091	0.294
ROA Total	0.6007***	-1.3333	-0.3800	0.6078***	-1.7044	-0.3902	0.5858***	-0.1020	0.5164	0.4895***	0.0339	0.1504
	0.288	10.592	14.352	0.200	7.404	9.537	0.625	5.635	6.800	0.368	6.963	6.621
L.SD(ROA)	-0.0881	0.0357	-0.0872	-0.0479	0.0427	-0.0559	0.1332	0.1876***	1.4914***	0.3474***	0.2130***	0.7296***
	0.097	0.612	0.374	0.172	0.692	0.505	0.129	0.042	0.200	0.123	0.066	0.275
L2.SD(ROA)	-0.0124	-0.3222	0.2079	-0.0586	-0.2094	0.1505	0.1885***	0.3074**	0.9709***	0.1689*	0.3530***	0.3835***
	0.084	0.291	0.343	0.126	0.234	0.356	0.058	0.127	0.331	0.095	0.047	0.145
SD(ROA) Total	-0.1005*	-0.2865	0.1207	-0.1065**	-0.1667	0.0946	0.3217***	0.4950***	2.4623***	0.5163***	0.5660***	1.1131***
	8.272	13.225	14.373	3.044	9.716	7.772	1.059	0.214	0.752	0.150	0.150	0.151
L.EQUITY	0.0744*	0.0974	1.2725***	0.0333**	-0.0074	1.1355***	0.0042	0.0383	0.5929***	0.0815	0.0285	0.6245***
	0.038	0.126	0.160	0.016	0.115	0.169	0.030	0.072	0.176	0.089	0.058	0.174
L2.EQUITY	-0.0354*	-0.0248	-0.3167***	-0.0197	0.0095	-0.2102**	0.0207	-0.0108	0.0044	-0.0793	-0.0111	0.2916***
	0.020	0.051	0.084	0.016	0.078	0.097	0.036	0.050	0.179	0.075	0.053	0.104
EQUITY Total	0.0390	0.0726	0.9558***	0.0136**	0.0021	0.9253***	0.0249	0.0275	0.5973***	0.0022	0.0174	0.9161***
	9.762	12.773	0.288	3.867	1.707	0.200	7.567	6.599	0.752	7.508	7.471	0.151
CONSTANT	-0.1399	0.5847*	0.5086	-0.0127	1.5670**	0.7516	-0.1489	0.0168	1.4877***	-0.0678	-0.0065	0.3901
	0.162	0.351	0.577	0.084	0.695	0.731	0.113	0.177	0.457	0.148	0.069	0.606
N	828	828	829	402	402	402	230	230	230	226	226	227
N(g)	236	236	236	122	122	122	66	66	66	73	73	73

The variables ROA_{Total}, SD_ROA_{Total}, $EQUITY_{Total}$ are the estimated coefficients for the test that the sum of lagged terms is equal to zero. A significance level lower than 10% enables to reject the null hypothesis of no causality from the x to the y. A coefficient greater than zero show a positive causation from the x to the y; a coefficient smaller than zero show a negative causation from the x to the y.

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– *Conclusions* –

- ❑ In this paper, we started observing that **RWAs dispersion** across similar banks raises the concern of regulatory arbitrage via IRB models maneuvering, so that a bank might appear more solid than it effectively is, in such a way to report **higher returns on equity** than what would be appropriate

- ❑ Then, we focused on profitability distortions due to IRB model regulatory arbitrage for 239 European banks over 2007-2013. Via **Granger causality analysis** we showed that a significant link between lower RWAs and higher RoE emerges only within AIRB models. More in particular, splitting RWAs between a systematic component depending from its basic determinants and its **orthogonal component** we find that only the latter affects RoE levels. Thus, we may conclude that **regulatory arbitrage via IRB model calibration significantly affects reported profits at European banks**

- ❑ The policy prescriptions deriving from our analysis are rather simple. It is not advisable for regulators and supervisors to apply a **"hands off"** approach and let banks large degrees of freedom in operating their IRB models. Otherwise, the results could prove very costly to those investors lured in buying bank shares by overrated profitability and still have problems of bank stability. These concerns have already led to somewhat downplay the role of the RWA approach – e.g., think of the growing importance of alternative approaches such as Stress Testing and Assets Quality Evaluation. If, nevertheless, regulators and supervisors wish to keep the RWA approach, we can envisage that they will need to **become much more proactive in terms of aggressive verification of the IRB models** and, more generally, adopting a "hands on" approach to banking supervision

Thank You for Attention !!!

Critics, Questions and Suggestions

are warmly welcomed!!!

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