THE IMPACT OF THE IRB APPROACH ON THE RISK WEIGHTS OF EUROPEAN BANKS

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BANKING DEVELOPMENT, STABILITY AND SUSTAINABILITY

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The opinions expressed in this presentation are those of the authors and they do not necessarily represent the views of the Bank of Spain or the Eurosystem.

- ✓ **Measuring the relation of bank and portfolio variables with the use of IRB, and the relation of these same variables with RWA Density:**

  Use of IRB = (IRB exposure) / (Total exposure)

  Density of RWA = (Total RWA) / (Total exposure)

- ✓ **Studying whether there is a relation between IRB use and RWA density**

- ✓ **Analyzing the relation between RWAs and market perception of risk**

INTRODUCTION:

Background on Bank Capital Regulation

Basel I
1988

- ➤ **Homogenization: International system of capital requirements.**

Basel II
2006

- ➤ **Focus on internal models to compute the RWAs and limiting the possibilities for regulatory arbitrage.**
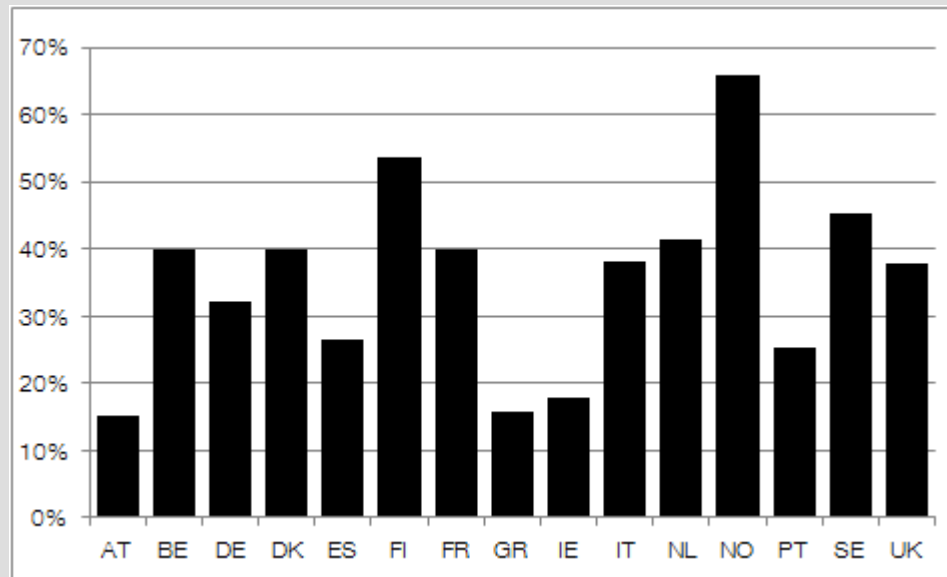
Basel III
2013

- ➤ **Increase the required amount of capital (CET 1, different buffers, etc.) for a given size of RWAs. There are no significant modifications of the methodology to calculate the RWAs.**

INTRODUCTION:

Differences in RWA density between IRB and SA
Private Sector Portfolio

SA RWA Density
–
IRB RWA Density

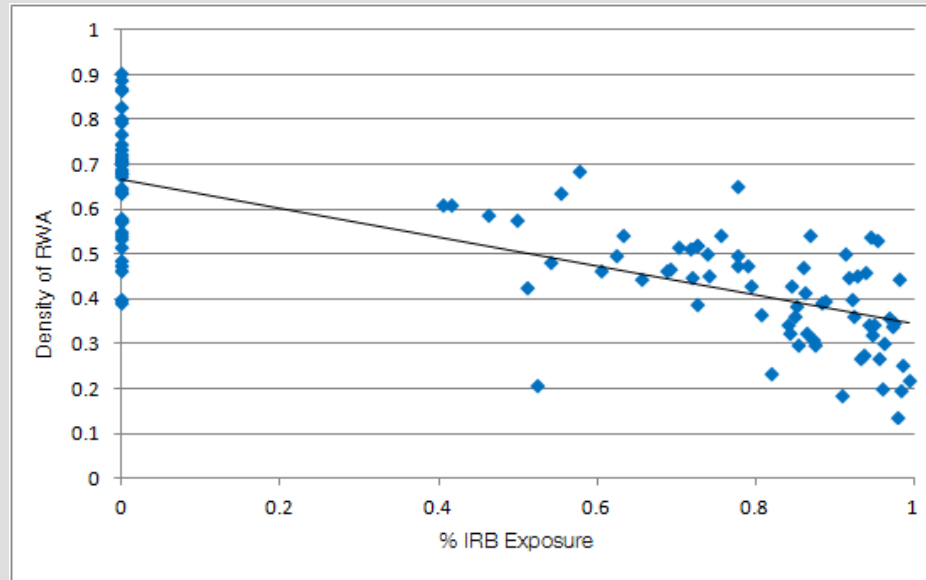✓ The difference in RWA density between the SA and IRB approaches varies across countries.

Source: EBA, December 2013.

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INTRODUCTION:

Correlation between IRB Use and RWA Density
Private Sector Portfolio

✓ There is a clear negative relation between the use of IRB approach and lower RWA density.

Source: EBA, December 2013.

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DATA DESCRIPTION:

The study of the RWAs of banks has been **historically difficult**:

✓ Lack of publicly available data

✓ Low level of granularity and lack of homogeneity

Data from the 2014 EBA Stress Test Exercise

Data published by the **EBA** as result of the **stress test exercise** in 2014 at European level:

- ✓ **Published information:** 123 bank groups from 22 countries, with strict methodological requirements to ensure comparability. The dataset informs of credit exposure, RWA and provisions as of Dec 2013, broken down by sector, by approach to RWA computation, by default status and country of the exposure.

- ✓ **Sample in our article:** 106 banks from 15 countries in Western Europe.

http://www.eba.europa.eu/risk-analysis-and-data/eu-wide-stress-testing/2014/results

Accounting and Market Data

The SNL database provides data on financial statements and market prices for an extensive sample of international banks:

- ✓ **Balance sheet and P&L** data for year 2013 for a sample of 103 European banks.

- ✓ **Stock market prices and CDS quotes** for years 2013 and 2014 for the subsample of banks for which this information is available.

https://www.snl.com/

LITERATURE REVIEW:

✓ **Capital Structure:** Flannery and Rangan (2006), Gropp and Heider (2010), Berger et al. (2008), Brewer et al. (2008), Jimenez et al. (2012), Behn et al. (2013), Aiyar et al. (2014).

✓ **RWAs Structure:** Basel Committee and Banking Supervision (2013a), Basilea III, EBA studies (2013a, 2013b, 2013c), Le Leslé and Avramova (2012), Ledo (2011), FSA (2010), Arroyo et al. (2013), BDE (2015).

✓ **Econometric studies of RWA density and IRB use (panel data):** Bruno et al. (2015), Mariathasan and Merrouche (2014), Beltratti and Paladino (2013), Behn et al. (2014).

✓ **Regulatory RW and market measures of risk:** Demirgüç-Kunt et al. (2013), Das and Sy (2012), Vallascas and Hagendorff (2013), Avery and Berger (1991), Jackson et al. (1999).

INDEX FOR METHODOLOGY AND RESULTS SECTION:

1. **Use of IRB and RWA Density**
   - ✓ Methodology for bank level analysis
   - ✓ Methodology for bank-country level analysis
   - ✓ Results for IRB use model
   - ✓ Results for RWA density model
2. **Correlation between the errors of IRB use and RWA density models**
3. **CDS prices and Stock Return**
   - ✓ Methodology
   - ✓ Results for model with 2013 CDS data
   - ✓ Results for Stock Returns model
   - ✓ Results for models with 2014 CDS and Stock Returns data
4. **Final considerations**

Estimation Methodology (bank level characteristics)

1. Linear specifications

(1) $$IRB_{ij} = \alpha_{IRB} + X_{i,IRB} \cdot \beta_{IRB} + P_{ij,IRB} \cdot \gamma_{IRB} + \varepsilon_{ij,IRB}$$

(2) $$DENS_{ij} = \alpha_{DENS} + X_{i,DENS} \cdot \beta_{DENS} + P_{ij,DENS} \cdot \gamma_{DENS} + \varepsilon_{ij,DENS}$$

IRB_{ij} = % of IRB exposure over total credit exposure

$DENS_{ij}$ = total credit RWA over total exposure

$X_{i,IRB}$ and $X_{i,DENS}$ = vector of bank level characteristic (e.g., total assets, ROA, solvency ratio, etc.)

$P_{ij,IRB}$ and $P_{ij,DENS}$ = vector of credit portfolio characteristics (e.g. composition of the credit portfolio, default rate, etc.)

2. Tobit specifications for IRB choice

- ✓ Only for equation (1).
- ✓ The variable IRB_{ij} is naturally distributed in the [0, 1] interval. Some banks rely exclusively on SA approach in some portfolios: $IRB_{ij} = 0.$

METHODOLOGY:
USE OF IRB AND RWA DENSITY

Estimation Methodology (bank-country level characteristics)

1. Linear specifications

(3) $$IRB_{ijl} = \alpha_{IRB,l} + X_{i,IRB} \cdot \beta_{IRB} + P_{ijl,IRB} \cdot \gamma_{IRB} + \varepsilon_{ijl,IRB}$$

(4) $$DENS_{ijl} = \alpha_{DENS,l} + X_{i,DENS} \cdot \beta_{DENS} + P_{ijl,DENS} \cdot \gamma_{DENS} + \varepsilon_{ijl,DENS}$$

IRB_{ijl} = % of IRB exposure over total credit exposure

$DENS_{ijl}$ = total credit RWA over total exposure

$X_{i,IRB}$ and **$X_{i,DENS}$** = vector of bank level characteristic (e.g., total assets, ROA, solvency ratio, etc.)

$P_{ijl,IRB}$ and **$P_{ijl,DENS}$** = vector of country-credit portfolio characteristics (e.g. composition of the credit portfolio in country l, default rate in country l, etc.)

2. Tobit specifications for IRB choice

- ✓ Only for equation (3).
- ✓ The variable IRB_{ij} is naturally distributed in the [0, 1] interval. Some banks rely exclusively on SA approach in some portfolios: $IRB_{ij} = 0$.

Regional fixed effects have been included ($\alpha_{IRB,l}$, $\alpha_{DENS,l}$) to test if geographical location explains IRB use and RWA density.

RESULTS:
DEPENDENT VARIABLE - USE OF IRB

Results (bank-country level characteristics)

Tobit – P&B*	Total	Private Sector	Corporates	Retail
Exposure	+	+	+	+
Weight - Public & Banking	-			
Weight – Corporate	+	+		
Weight – Retail	-			
Default Rate	-	-	-	-
Total Assets	+	+	+	+
ROA	+	+	+	+
Book Equity / Total Assets	-	-	-	-
Deposits / Total Debt	-	-	-	-
Cash and Cash Equivalents / Total Assets	-	-	-	-
Securities / Total Assets	+	+	+	-

  * Similar results for linear model

 ** The shaded cells indicate statistically significant coefficients

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✓ **Bank level**: there is a negative relation between **default rate** and use of IRB. The ratio ***Book Equity / Total Assets*** is strongly negatively related to IRB use, as banks with stronger equity base use IRB less. The **total assets** of the bank have a significant positive effect, although of moderate size.

✓ **Bank-country level**: conclusions in this case are similar. The effect of ***Exposure*** is positive, indicating that a larger exposure in a given country is more likely to be subject to the IRB approach. Larges banks (higher ***Total assets***) tend to use more the IRB approach overall. The ratios ***Deposits / Total Debt*** and ***Cash and Cash Equivalents / Total Assets*** have negative and significant effects. **Fixed effects** are highly significant but not enough to make insignificant the above mentioned variables (portfolio and bank characteristics).

Results (bank-country level characteristics)

Lin – P&B	Total	Private Sector	Corporates	Retail
Exposure	-	-	-	-
Weight - Public & Banking	-			
Weight – Corporate	+	+		
Weight – Retail	-			
Default Rate	+	+	+	+
Total Assets	-	-	-	+
ROA	-	-	-	-
Book Equity / Total Assets	+	+	+	+
Deposits / Total Debt	-	-	+	+
Cash and Cash Equivalents / Total Assets	+	+	+	-
Securities / Total Assets	-	-	-	-

** The shaded cells indicate statistically significant coefficients

RESULTS:
DEPENDENT VARIABLE – RWA DENSITY

✓ **Bank level**: banks with better past profit performance (**ROA**, **Default Rate**) are more likely to have a credit portfolio of higher quality, which implies lower density of RWAs. The ratio **Book Equity / Total Assets** is clearly positively correlated with RWA density. Banks with a retail business profile and more conservative management of their liquidity (higher *Deposits / total Debt* and *Cash and Cash Equivalents / Total Assets*) are associated to higher RWA density.

✓ **Bank-country level**: conclusions in this case are similar. Additionally, a moderated negative relation between the size of the exposure in a given country (*Exposure*) and the density of RWAs has been identified.
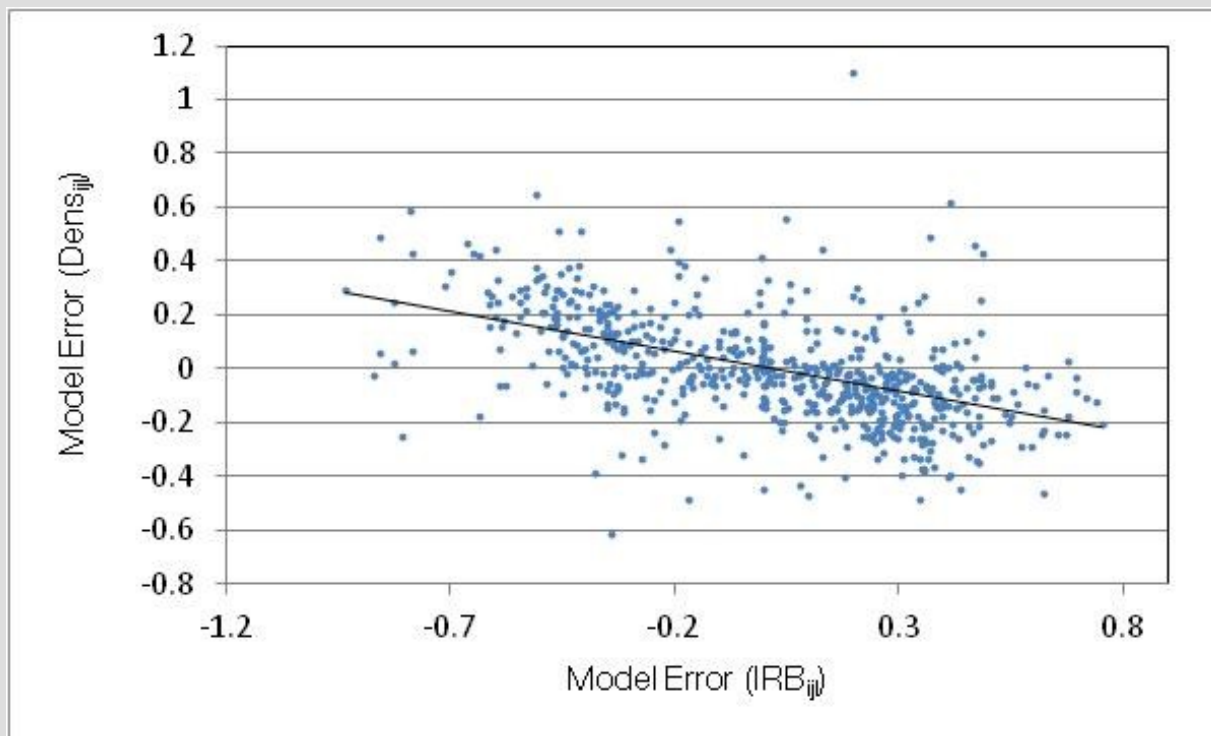
RESULTS:
ERROR CORRELATION: IRB USE & RWA DENSITY MODELS

Error analysis

✓ Description of the relation between the portions of the density of RWAs and the use of the IRB approach that are not explained by the bank and portfolio variables.

✓ There is a clear negative relation between the unexplained portions of DENS and IRB.

Estimation Methodology (bank level)

1. **Market Risk Measure (2013)**   **Use of IRB and RWA Density (2013)**

$$(5) \quad IRB_i = \alpha_{IRB} + CDS_{i,DENS} \cdot \rho_{DENS} + Vol.CDS_{i,DENS} \cdot \beta_{DENS} + \varepsilon_{i,IRB}$$

$$(6) \ DENS_i = \alpha_{DENS} + CDS_{i,DENS} \cdot \rho_{DENS} + Vol.CDS_{i,DENS} \cdot \beta_{DENS} + \varepsilon_{i,DENS}$$

✓ We also use these models substituting CDS with Stock Return data.

2. **Use of IRB and RWA Density (2013)** ⟶ **Market Risk Measure (2014)**

$$(7) \quad CDS_{i,FORWARD} = \delta_0 + IRB_i \cdot \delta_1 + DENS_i \cdot \delta_2 + \omega_i$$

✓ We also use these models substituting CDS with Stock Return Volatility. (7)
Results

RESULTS:
MODEL WITH 2013 CDS DATA

Model CDS Price Measures (2013) (2013)   **Use of IRB and RWA Density**

Dependent variables	Use of IRB			Density of RWAs		
	TOBIT 1m	**TOBIT 3m**	**TOBIT 12m**	**LIN 1m**	**LIN 3m**	**LIN 12m**
CDS 2013 1m	-			-		
CDS 2013 3m		-			-	
CDS 2013 12m			-			+
CDS Volatility 2013 1m	-			+		
CDS Volatility 2013 3m		-			+	
CDS Volatility 2013 12m			-			+

** The shaded cells indicate statistically significant coefficients

Model Stock Return Measures (2013)   **Use of IRB and RWA Density**
(2013)

Dependent variables →	Use of IRB			Density of RWAs		
	TOBIT 1m	**TOBIT 3m**	**TOBIT 12m**	**LIN 1m**	**LIN 3m**	**LIN 12m**
Price to Book 2013	+	+	-	-	-	-
Dividend Yield 2013	+	+	+	-	+	-
Stock Return 2013 1m	+			-		
Stock Return 2013 3m		-			-	
Stock Return 2013 12m			+			-
Volatility Stock Return 2013 1m	-			-		
Volatility Stock Return 2013 3m		-			+	
Volatility Stock Return 2013 12m			-			-

** The shaded cells indicate statistically significant coefficients

Use of IRB and RWA Density (~~2013~~)   **CDS and Vol.Returns (2014)**

Dependent variables →	CDS		
	CDS 2014 1m	**CDS 2014 3m**	**CDS 2014 12m**
IRBi	-	-	-
DENSi	-	-	-

Dependent variables →	Vol. Returns		
	Vol. Return 2014 1m	**Vol. Return 2014 3m**	**Vol. Return 2014 12m**
IRBi	-	-	-
DENSi	-	-	-

** The shaded cells indicate statistically significant coefficients
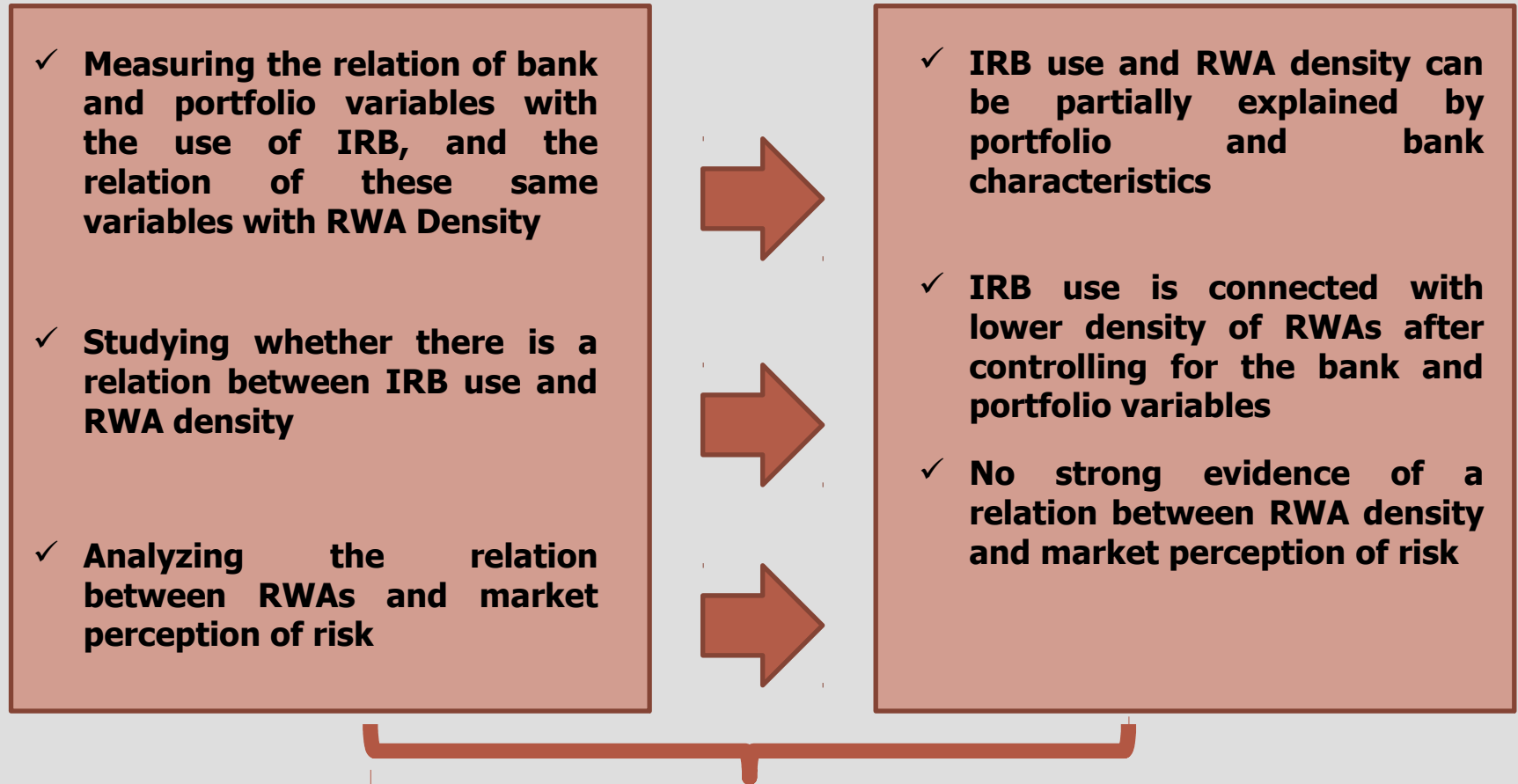
Eq. (7)

RESULTS:
MODELS WITH CDS PRICES AND STOCK RETURNS

✓ **2013 CDS prices**: we **don't find a strong relation** between the percentage of use of IRB for computing of RWAs in 2013 and CDS data. Banks with higher associated risk in CDS prices use the IRB approach less often. There is **no significant relation** between CDS price level and the density of RWAs.

✓ **2013 Stock data**: the variables **Price to Book 2013** and **Dividend Yield 2013** are **not significant**. There is **no evidence** that stock market data is correlated with the density of RWAs.

✓ **2014 Market Prices**: the results show us that the RWA density at the end of 2013 is **unrelated** to CDS price level and stock return volatilities in 2014. Intensity of IRB use is **more informative** of future value of CDS and stock return volatility than RWA density.

FINAL CONSIDERATIONS:

- ✓ **Measuring the relation of bank and portfolio variables with the use of IRB, and the relation of these same variables with RWA Density**

- ✓ **Studying whether there is a relation between IRB use and RWA density**

- ✓ **Analyzing the relation between RWAs and market perception of risk**

- ✓ **IRB use and RWA density can be partially explained by portfolio and bank characteristics**

- ✓ **IRB use is connected with lower density of RWAs after controlling for the bank and portfolio variables**

- ✓ **No strong evidence of a relation between RWA density and market perception of risk**

Are RWAs effectively measuring the risk that they are designed to capture?

Are some banks making strategic use of RWA regulatory framework to reduce capital requirements?

THANKS FOR YOUR ATTENTION

ANNEX:

FINANTIAL PROFILE OF THE BANKS FROM SNL DATA

Total Assets	The total assets figure reported in the balance sheet.
ROA	The ratio (in percentage) of net profit over average balance sheet assets.
Book Equity/Total Assets	Total equity in the balance sheet over total balance sheet assets.
Deposits/Total Debt	Customer deposit liabilities to debt instrument liabilities.
Cash&Cash Equivalents/ Total Assets	The ratio of cash and cash equivalents over total balance sheet assets.
Securities/Total Assets	Total financial securities on the asset side of the balance sheet over total balance sheet assets.