

The Effect of Possible EU Diversification Requirements on the Risk of Banks' Sovereign Bond Portfolios

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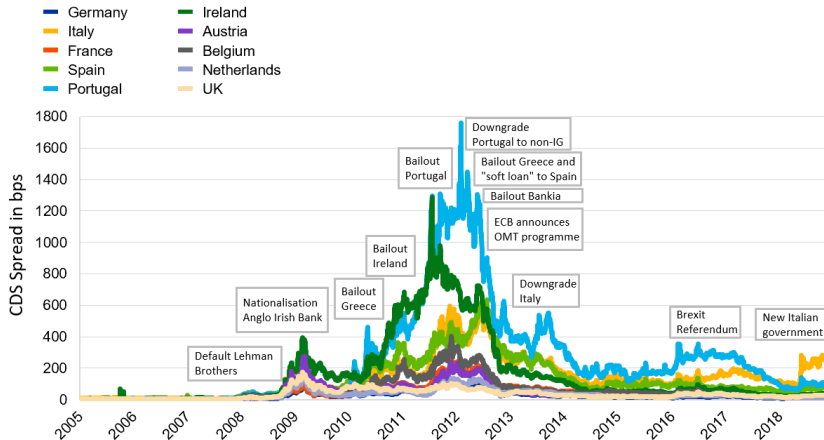
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Assessment of potential changes in regulation

- 1 Estimate the current risk and diversification of banks' sovereign bond portfolios
 - ⇒ EBA stress test and transparency exercise data on European banks
- 2 Evaluate the impact of limits on large exposures
 - ⇒ Would the increased diversification reduce portfolio risk?
 - ⇒ What is the impact of a possible substitution effect on tail risk?
 - ⇒ Would diversification help during crises?

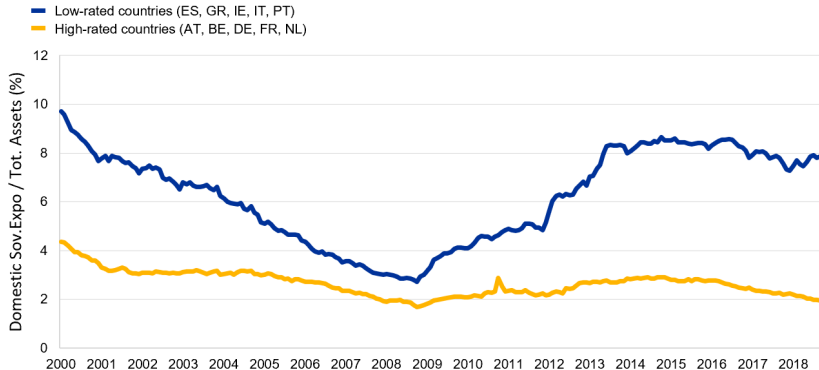
CO-MOVEMENT OF CDS SPREADS



EU SOVEREIGN DEBT IS NOT RISK-FREE

- ▶ Heterogeneous risk profiles
- ▶ Strong co-movements across countries \Rightarrow Mutual excitation (Ait-Sahalia et al., 2014)

DOMESTIC SOVEREIGN BOND HOLDINGS



- ▶ Exposure of banks to domestic sovereign debt decreased with the introduction of the euro
- ▶ The trend reversed after the financial crisis, especially for banks in low-rated countries

CURRENT REGULATORY TREATMENT OF SOVEREIGN EXPOSURES OF BANKS

Banks have incentives to hold sovereign bonds denominated in euro

- ▶ *Domestic Carve-out and Permanent Partial Use*
Zero capital requirement in the Standardized Approach (SA)
Banks that use internal ratings-based approach (IRB) can use the SA for sovereign bond exposures
- ▶ Exempt from the *Large Exposures Regime*
Exposures to a single issuer can be higher than 25% of eligible capital
- ▶ Liquidity Requirements
sovereign bonds denominated and funded in euro are considered as high quality liquid assets in the liquidity coverage ratio

PROPOSED SHIFT IN REGULATION

INTRODUCTION OF

- ▶ Capital requirements proportional to credit risk
- ▶ Limit on large sovereign bond exposures

Regulatory intent (ESRB, 2015; Juncker et al., 2015; Arnold, 2016; Veron, 2017)

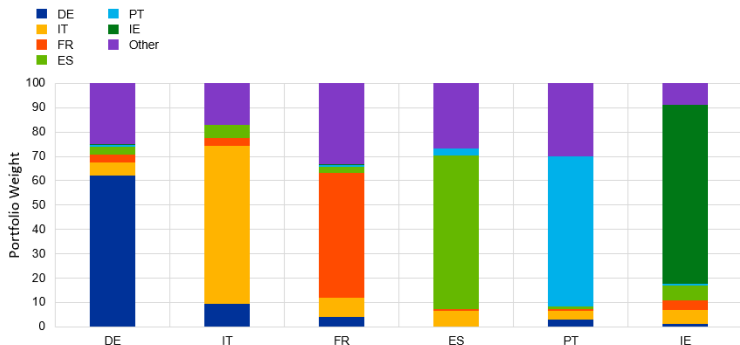
Weaken the *Doom Loop*

- ▶ Countries with weak public finances may affect the banking system
- ▶ Banking sectors in distress may require government intervention
- ▶ Gennaioli et al. (2014); Erce (2015); Fabozzi et al. (2015)

Reduce *Home-Bias* and systemic risk

- ▶ Increase diversification in banks' sovereign bond portfolios
- ▶ Further step toward European Deposit Insurance Scheme
- ▶ Uhlig (2013); Buch et al. (2013); Battistini et al. (2014); Acharya and Steffen (2015)

EBA BANKS SOVEREIGN BOND EXPOSURE



- ▶ Banks show a similar low level of diversification across countries
- ▶ The risk of banks' sovereign bond portfolios depends significantly on the risk of their home country

PORTFOLIO STATISTICS

Vector of portfolio weights w_j , where j is the banking sector in each country

$$w_{j,i} := \frac{\text{Exposure of } j \text{ to issuer } i}{\text{Tot. Sovereign Exposure of } j}$$

Portfolio risk, given the estimated covariance matrix $\widehat{\Sigma}$ of d CDS spreads

$$\sigma^2 = \mathbf{w}\widehat{\Sigma}\mathbf{w}'$$

Diversification measures

$$D_w = \frac{1}{d \sum_{i=1}^d w_i^2} \quad D_r = \frac{1}{d \sum_{i=1}^d RC_i^2}$$

where RC_i is the risk contribution of sovereign i to portfolio risk

$$RC_i := w_i \frac{\partial \sigma}{\partial w_i}$$

D_w and D_r equal 1 for a fully diversified portfolio and $1/d$ for a totally concentrated portfolio

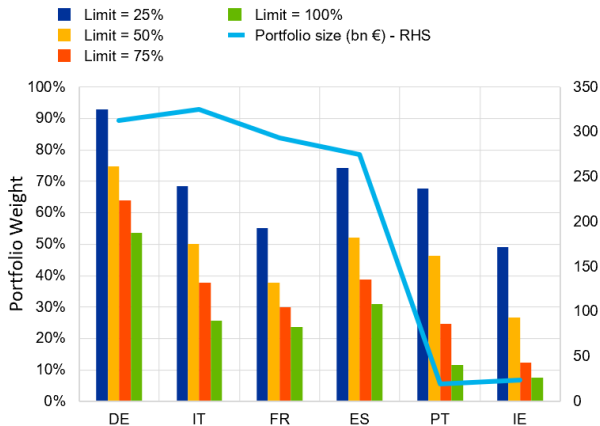
CURRENT PORTFOLIOS

Average Annualized Portfolio Risk and Diversification measures (Jun. 2013 - Dec. 2015)

Banks	σ^2	D_w	D_r
DE	3.12	0.17	0.33
IT	8.37	0.17	0.13
FR	4.72	0.21	0.27
ES	10.24	0.13	0.13
PT	18.94	0.12	0.11
IE	14.84	0.16	0.12
EU	5.47	0.65	0.51
Equally Weighted	7.40	1.00	0.60
Min Variance	1.98	0.22	0.22
Equal Risk Contrib	3.74	0.69	1.00

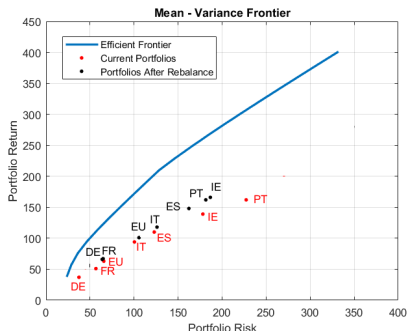
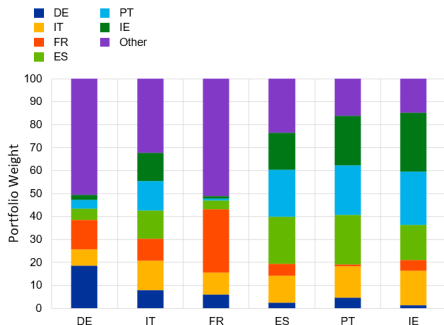
- ▶ Home-bias results in similar levels of D_w and D_r across countries
- ▶ Banks' portfolios are far away from the levels of diversification of three benchmarks in portfolio theory
- ▶ The aggregated EU portfolio is better diversified and less risky

IMPACT OF DIVERSIFICATION REQUIREMENTS



- ▶ Banks would rebalance a large part of their sovereign bond portfolio
- ▶ The limit on large exposures acts as a diversification constraint if the ratio between banks' capital and sovereign portfolio is the same

SIMPLE PORTFOLIO REBALANCE



- ▶ Rebalance assumption: banks adjust their sovereign bond portfolios to match as close as possible the risk-return profile of their current exposures, without modifying their total portfolio size (Lenarcic et al., 2016)
- ▶ Rebalanced sovereign bond portfolios have higher diversification, but not necessarily less risk, due to high correlation between EA sovereign bonds

PORTFOLIO STATISTICS

Average Annualized Portfolio Risk and Diversification measures (After Rebalance)

Banks	σ^2	D_w	D_r
DE	5.40	0.80	0.82
IT	10.51	0.92	0.47
FR	5.32	0.57	0.56
ES	13.52	0.71	0.37
PT	15.12	0.56	0.36
IE	15.55	0.57	0.34
EU	8.80	0.95	0.56
Equally Weighted	9.06	1.00	0.53
Min Variance	2.01	0.10	0.10
Equal Risk Contrib	4.11	0.64	1.00

- ▶ Higher levels of diversification
- ▶ Portfolio variance increases, except for Portugal
- ▶ The aggregated EU portfolio is better diversified, but riskier

⇒ What about tail risk?

RISK AGGREGATION AND TAIL RISK

- ▶ Given \mathbf{R} , the $N \times d$ matrix of daily CDS log-returns
For each banking sector, we compute $\mathbf{Y} = \mathbf{w} \cdot \mathbf{R}$,
where N observations/scenarios, d sources of sovereign risk
- ▶ Define $\mathbf{P} = \sum_{i=1}^N \mathbf{Y}_i$ is the $N \times 1$ joint portfolio
- ▶ We want to find the VaR of \mathbf{P}

Problem: aggregating risk when the distributions of the risky components are known but not their interdependence

RISK AGGREGATION AND TAIL RISK

SCENARIO APPROACH (BERNARD AND VANDUFFEL, 2015)

- ▶ We know the marginal distributions of \mathbf{Y}_j on \mathbb{R} for $j = 1, \dots, d$
- ▶ We fit a joint distribution on \mathbf{Y} , which is our benchmark model
- ▶ Due to partial information on dependence, we split data in two parts
 \mathcal{F} : trusted region, where we expect the fitted model to be appropriate
 $\mathcal{U} = \mathbb{R}^d \setminus \mathcal{F}$: untrusted region
- ▶ We account for model risk by attaching a probability $p_{\mathcal{F}} = P(\mathbf{Y} \in \mathcal{F})$

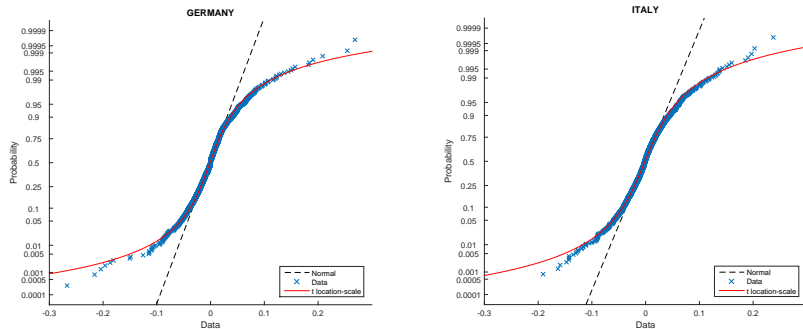
If $p_{\mathcal{F}} \neq 1 \Rightarrow \text{VaR}$ cannot be computed precisely

\Rightarrow Approximate min and max VaR by rearranging the data to obtain the best and worst dependence structures (Embrechts et al., 2013)

\Rightarrow Add dependence information to sharpen the bounds (Bernard and Vanduffel, 2015)

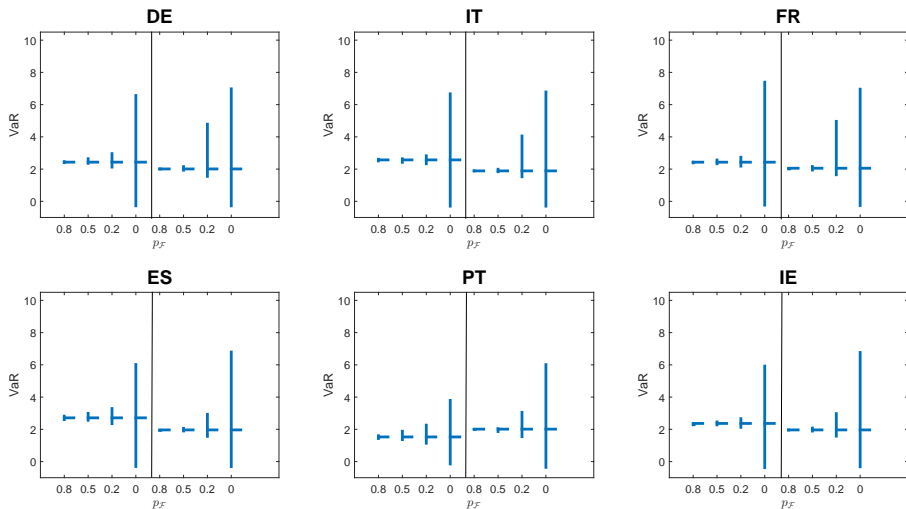
RISK AGGREGATION AND TAIL RISK

- ▶ Assume Y_j are t-Student distributed, for $j = 1, \dots, d$
 Y follows a multivariate t-Student distribution



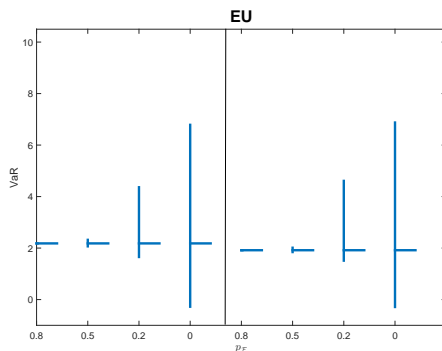
- ▶ Assign different probabilities to the benchmark model:
 $p_{\mathcal{F}} = P(\mathbf{Y} \in \mathcal{F})$
- ▶ Compute the worst return of the aggregated sovereign portfolio with 95% confidence: $\text{VaR}_{95\%}$

RISK AGGREGATION AND TAIL RISK



VaR bounds for current (left panel) and rebalanced portfolios (right panel)

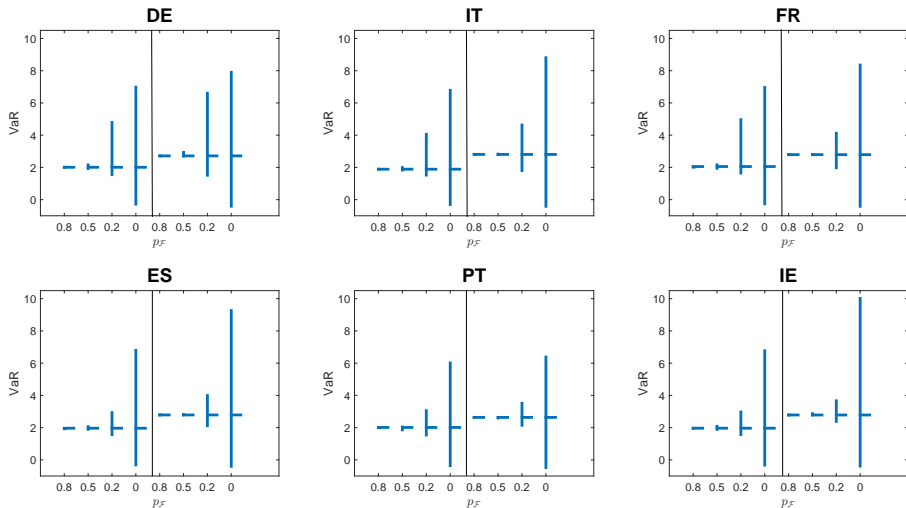
RISK AGGREGATION AND TAIL RISK



VaR bounds for current (left panel) and rebalanced portfolios (right panel)

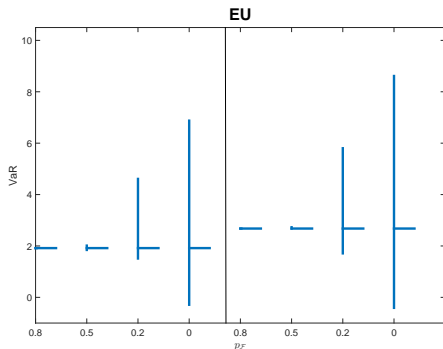
- ▶ The costs of rebalancing portfolios to increase diversification could be sizable, but the benefits in terms of tail risk are uncertain
- ▶ Assuming default risk of sovereigns remains unchanged

STRESS TESTING



VaR bounds of the rebalanced portfolios in the whole period (left side) and during the European sovereign debt crisis (right side).

STRESS TESTING



VaR bounds of the rebalanced portfolios in the whole period (left side) and during the European sovereign debt crisis (right side).

- ▶ Rebalancing portfolios to increase diversification may increase tail risk during crises, i.e. when correlation between sovereign bonds is high

CONCLUSIONS

Is it efficient to reduce *home-bias*?

- ▶ Portfolio risk may not decrease due to high levels of correlation between sovereign bonds, especially during crises
- ▶ Dependence needs to be taken into account

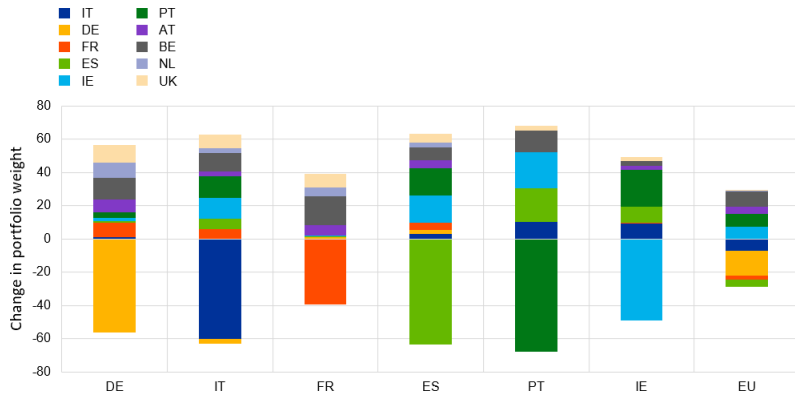
Diversification at the level of single country does not necessarily reduce risk in the EU banks' sovereign portfolio

- ▶ Overlapping portfolios represent a contagion channel in presence of financial distress
- ▶ The costs of rebalancing portfolios to increase diversification could be sizable, but the benefits in terms of risk reduction are uncertain

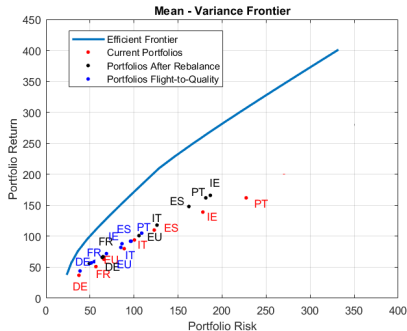
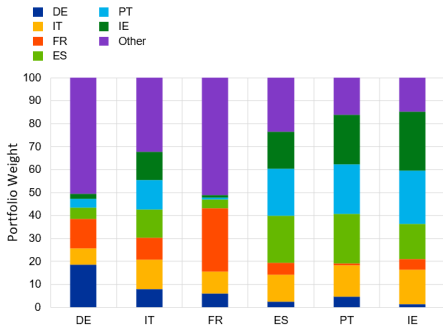
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SIMPLE PORTFOLIO REBALANCE



FLIGHT-TO-QUALITY



- ▶ Rebalance assumption: banks adjust their sovereign bond portfolios by buying less risky sovereign bonds

FLIGHT-TO-QUALITY

