Analyzing EU Bank, Sovereign, and Macro Risk Using a CCA Global VAR

(Joint work between MCM and European Central Bank)

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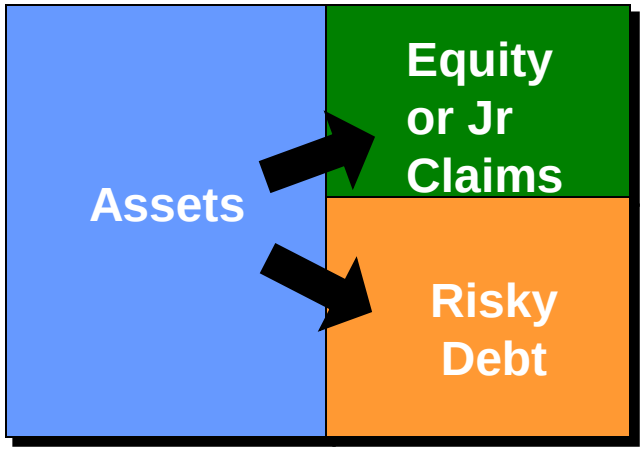
Core Concept of Contingent Claims Analysis (CCA): Merton Model



- Value of liabilities derived from value of assets.
- Liabilities have different seniority.
- Randomness in asset value.

Assets = Equity + Risky Debt

= Equity + Default-Free Debt – Expected Loss

= Implicit Call Option + Default-Free Debt – Implicit Put Option

As a result of the crisis, CCA concepts have now found their way into the mainstream

The structural CCA model, with its embedded fundamental volatility, shocks to assets endogenously change values of equity and risky debt and credit risk premiums

It helps explain complex risk, especially expected losses in financial system and "insidiousness" of risk exposures where small changes in value can lead to very large changes in risk due to convexity!

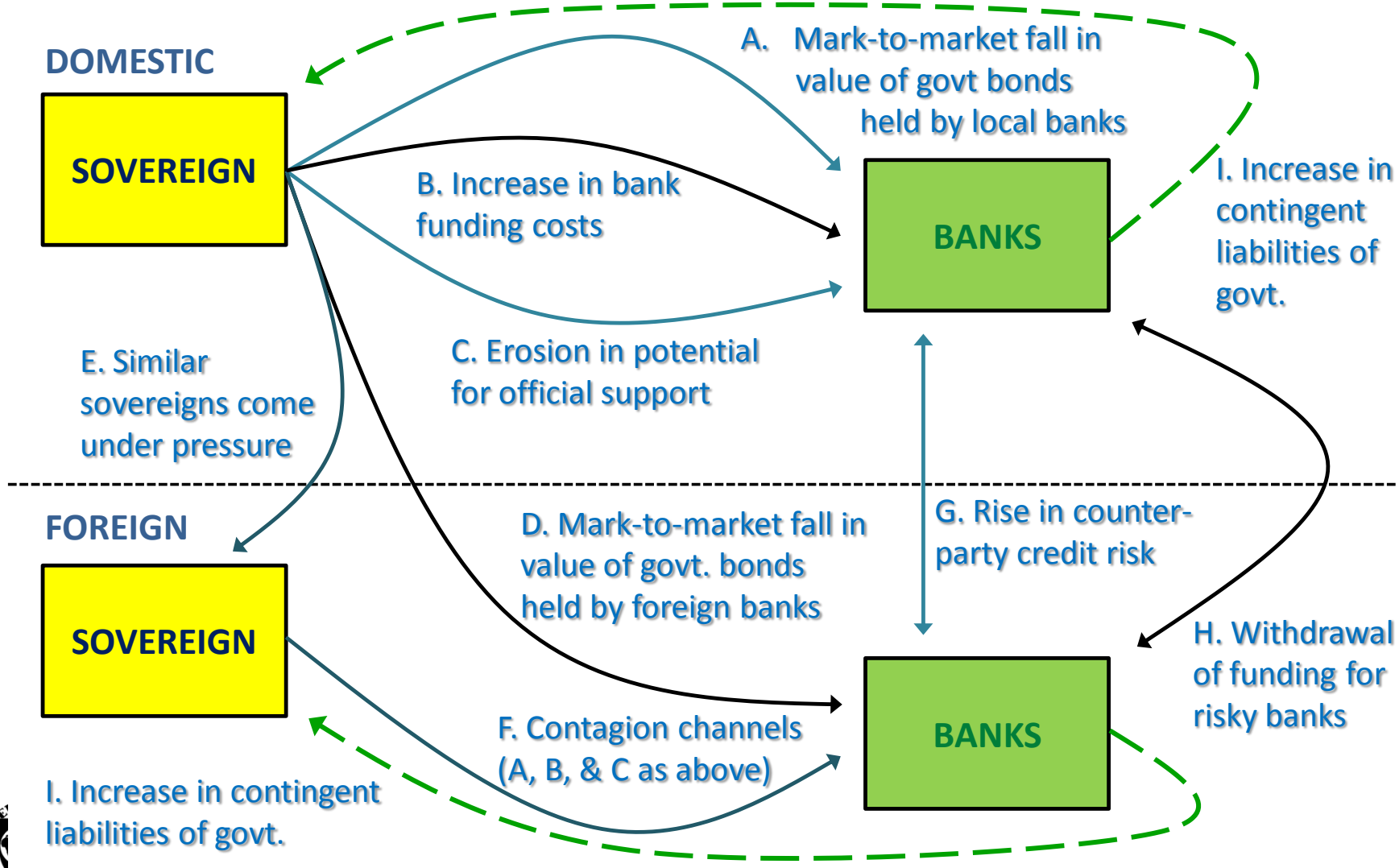
Stylized Interlinked CCA Balance Sheets for an Economy

Sectors of an economy can be viewed as interconnected risk-adjusted balance sheets with portfolios of assets, liabilities, and guarantees—explicit and implicit.

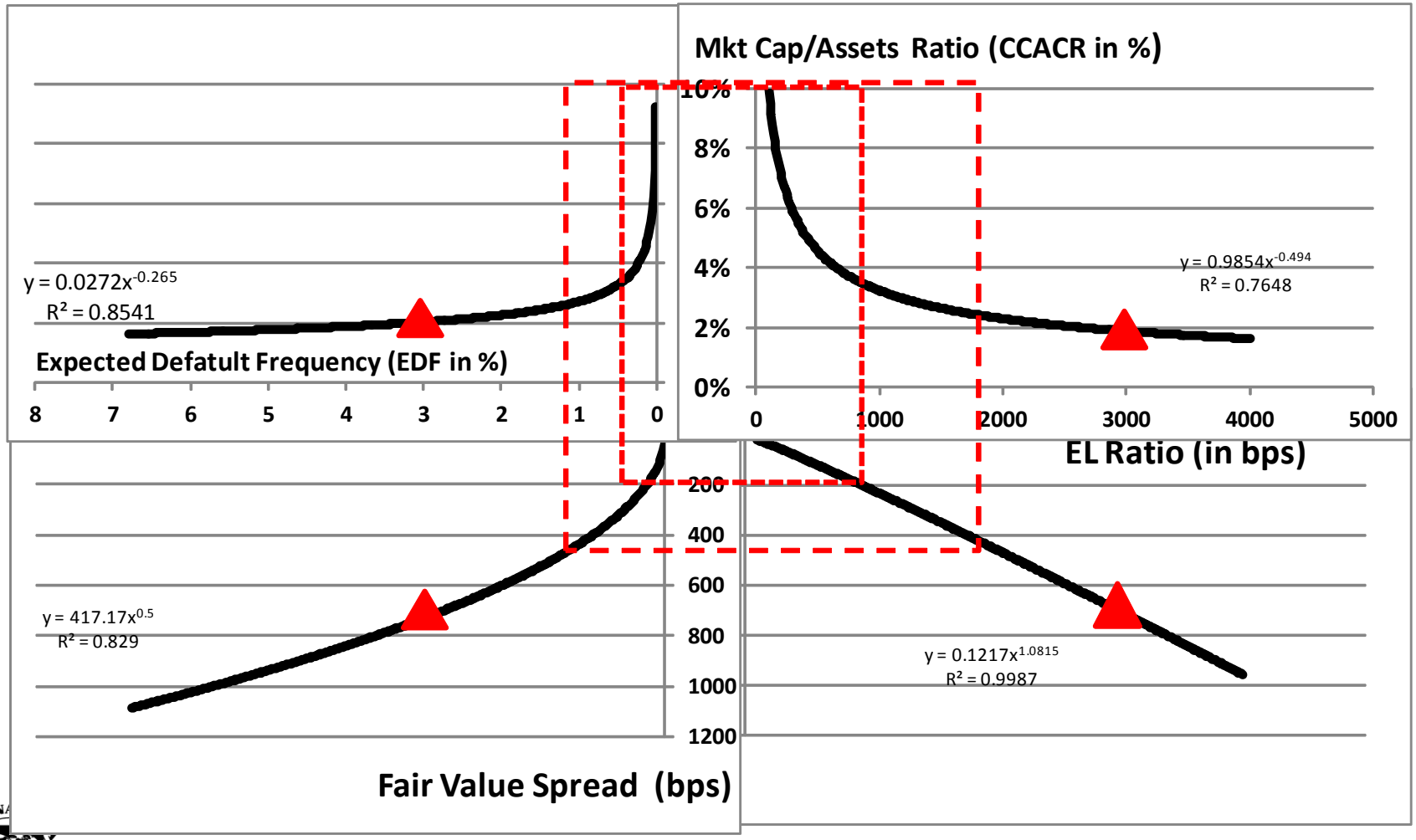
	Corporates	Households		Financial Sector	Sovereign		Foreign
		H BS	H RE		Govt.	MA	
Asset	A_C	A_{FIN} $+A_L$ $+E_{H,RE}$	$A_{H,RE}$	A_F	$PV(T-G)$ $+A_{G,Other}$	$R_{FX}+$ θE_G+ $A_{MA,Other}$	
ContingentAssets & Liab				$+\alpha P_F$	$-\alpha_G P_F$		
Equity/Jr. & Sub. Claims	$-E_C$	$-E_H$ $-c_H$	$-E_{H,RE}$	$-E_F$	$-E_G$ $-\bar{B}_{SLC}-i_{SLC}$ $+P_{SLC}$	$-M_{BM}$	
Senior Claims (Default Barrier)	$-\bar{B}_C$ $-i_C$		$-\bar{B}_{H,RE}$ $-i_{H,RE}$	$-\bar{B}_F-i_f$	$-\bar{B}_{SFX}-i_{SFX}$		*Foreign*
Put	$+P_C$		$+P_H$	$+(1-\alpha)P_F$	$+P_{SFX}$		*Claims*
Sum	0	0	0	0	0	0	0

- Gray, Merton Bodie, 2008

Spillovers from the Sovereign to the Banks and Banks to Sovereigns



Nonlinear relationships for typical bank (EDF, capital ratio, EL, and FV spread) - "lower risk zone" and smaller "safe zone" show by red outlines



Expected Loss Ratio=EL=1-exp(-FVCDS*T/10000)

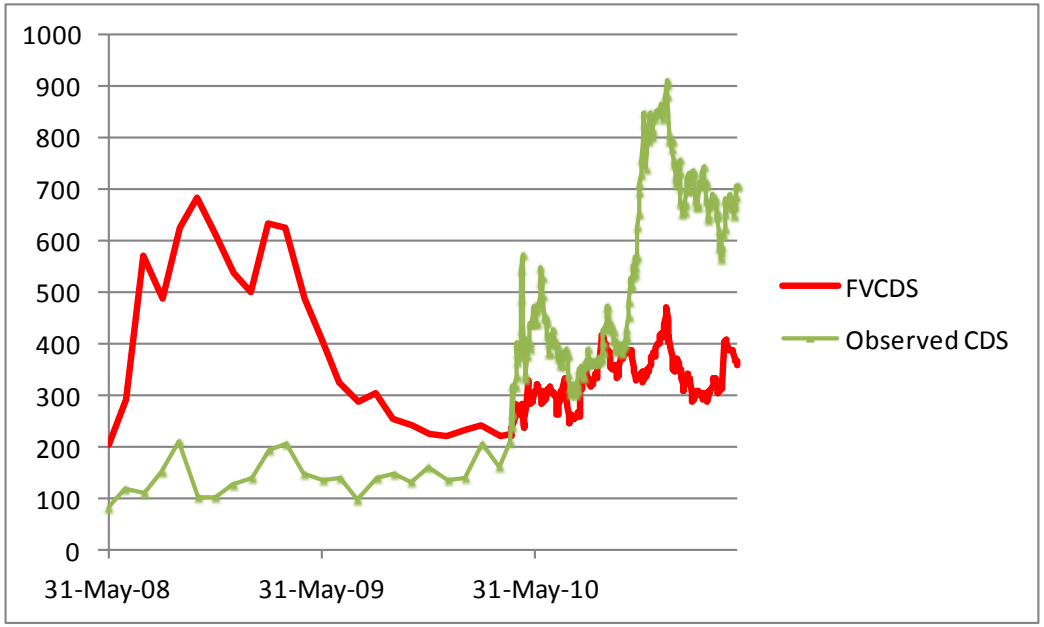
Implied credit spreads (i.e. Fair Value Credit Spreads) derived from CCA models (i.e. derived from equity information) are frequently higher than the observed market CDS

This is due to the depressing effect of implicit and explicit government guarantees

FVCDS are not affected by guarantees, or spillovers from high sovereign spreads

Example:

Banco Comercial – Portugal
Fair Value (equity mkt based) spread vs Observed CDS

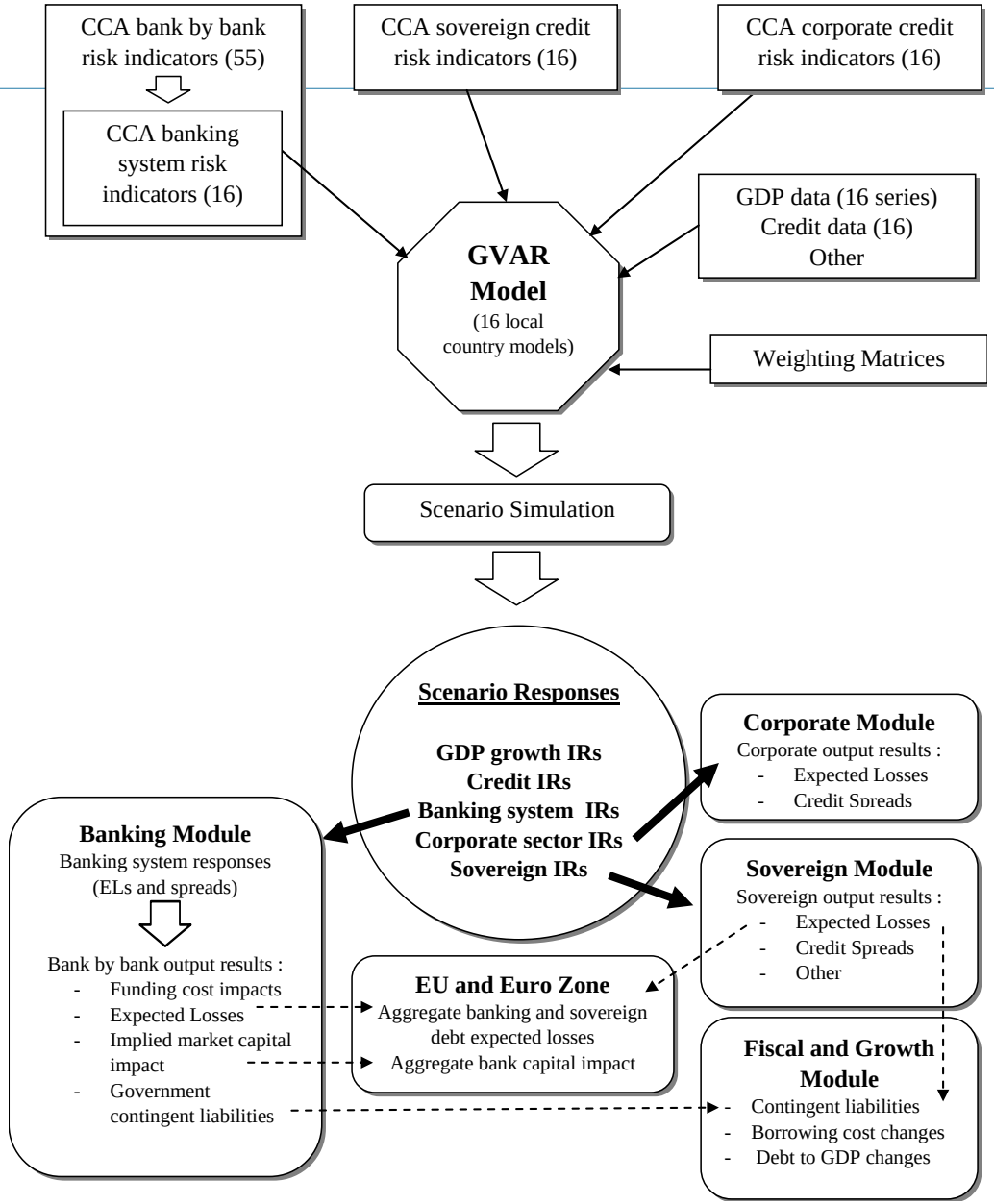


Clear impact of government guarantees 2008/09 but spillover from sovereign to bank in 2011

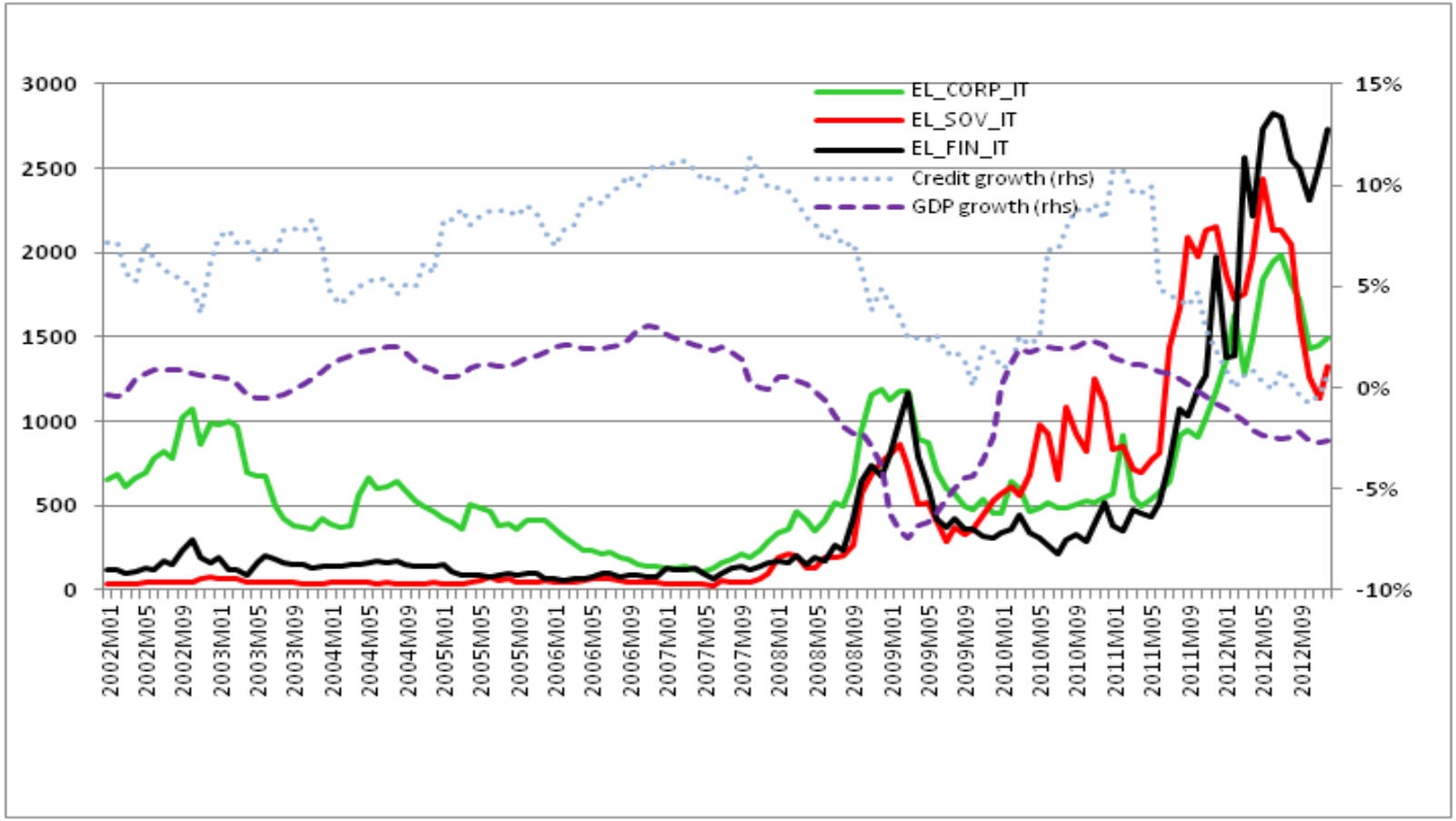
CCA-GVAR for EU and US
(Joint work with ECB: Marco Gross, Matthias Sydow, and Joan Paredes)

- Framework for analysis the interactions of banking sector risk, sovereign risk, GDP growth, credit for 15 EU countries plus the US. (55 banks total)
- Uses CCA risk indicators for the banking systems and corporate sectors and sovereigns in each country,
- Together with the GVAR (Global Vector Autoregression) model for each country, endogenous weight matricies
- Impulse responses captures the non-linearity of changes bank credit spreads, sovereign spreads and corporate credit risk and impact on GDP growth and credit

CCA-GVAR Model Framework



INPUT DATA: Example of Italy Risk Indicators (EL Ratios), GDP Growth and Credit Growth (monthly



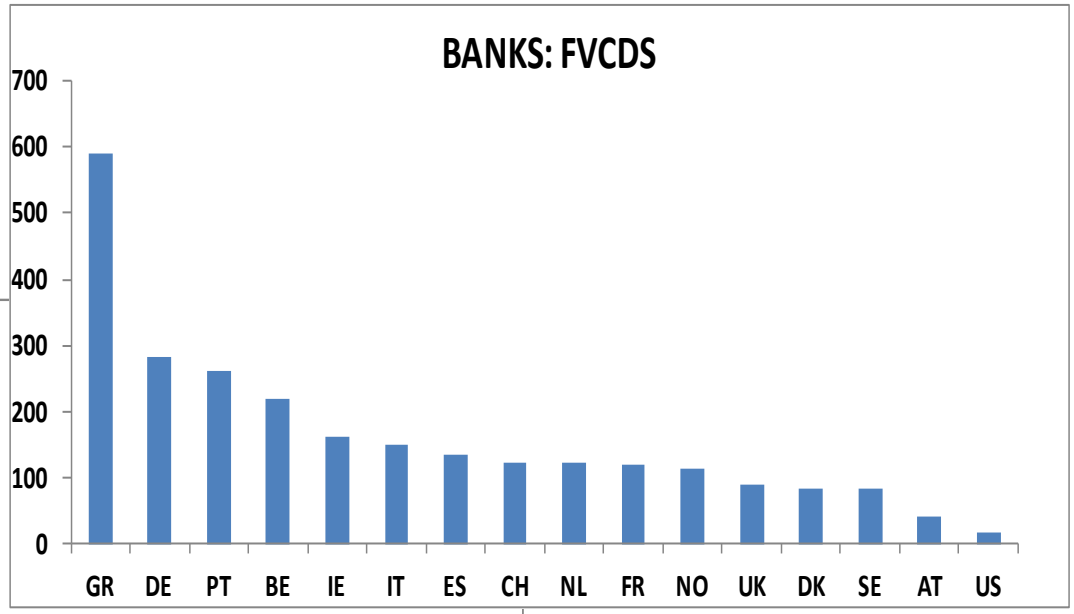
- **Assets/Debt = Equity/Debt +1 – Expected Loss/Debt**

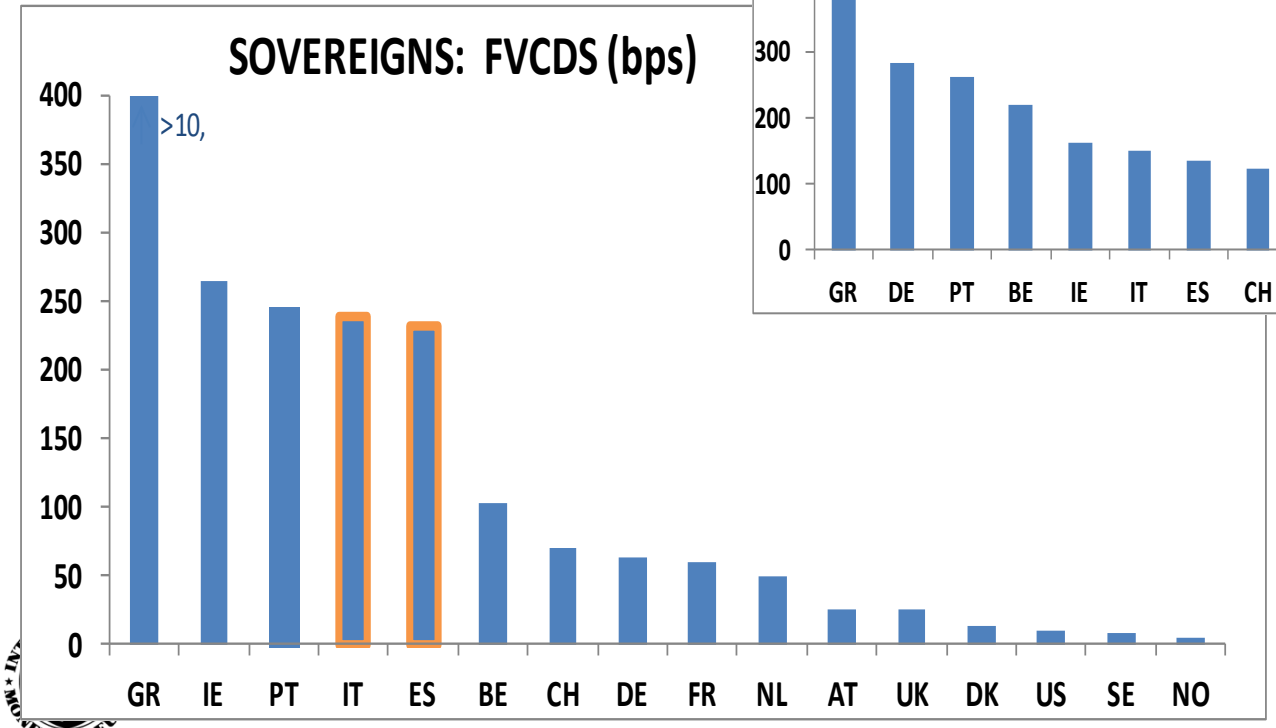
Leverage ratio = Capital ratio + 1 – EL ratio

- **(EL ratio for financial and corporate sectors weighted by assets)**

OUTPUT RESPONSES TO Shock Scenario 1:
Negative Shock to Spanish and Italian Sovereigns

Reponses show increases in all sovereign and bank FVCDS spreads

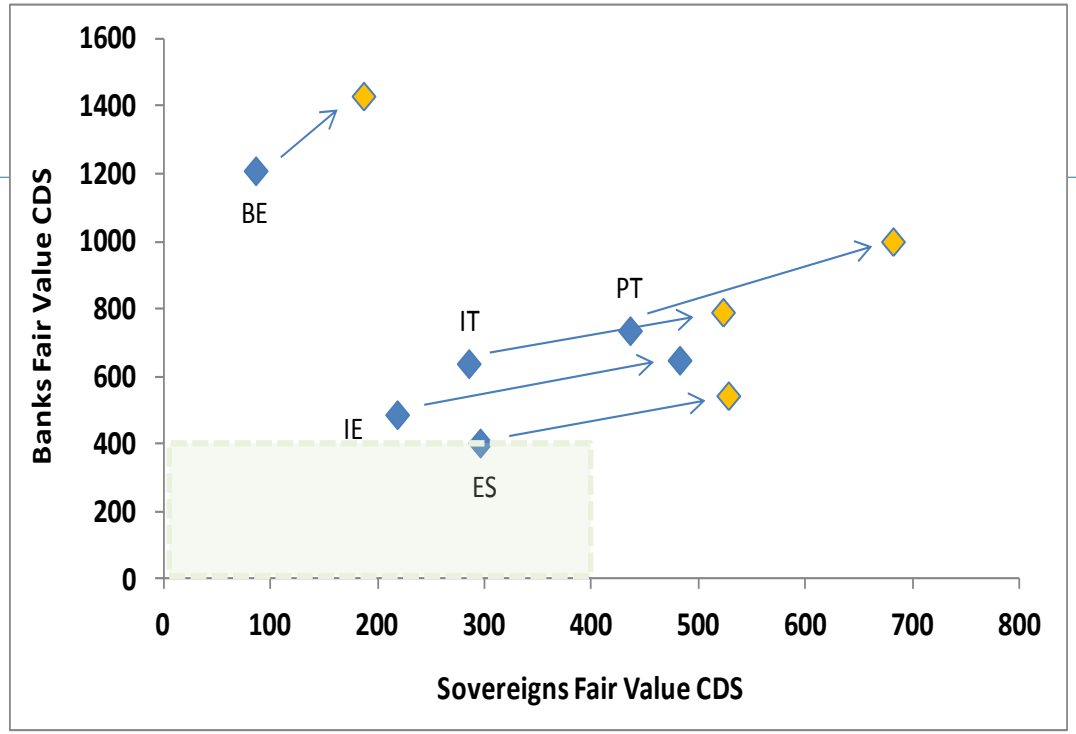


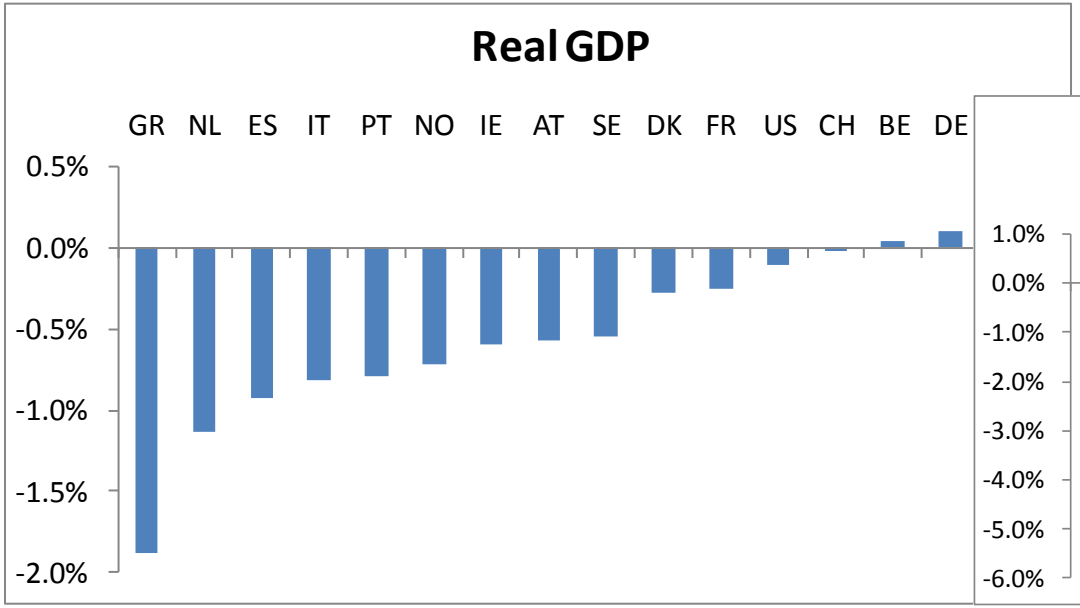


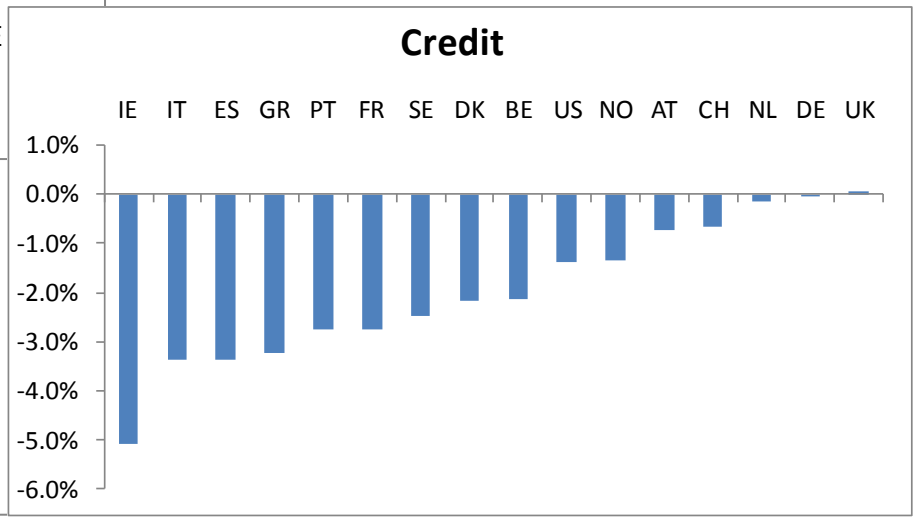
Italy and Spain sovereigns shock origins, 5% marginal prob; 0.7 % joint prob

Scenario 1 (cont.)

Negative Shock to Spain and Italy Sovereigns: Bank and Sovereign FVCDS increase; Real GDP growth down; Credit growth down



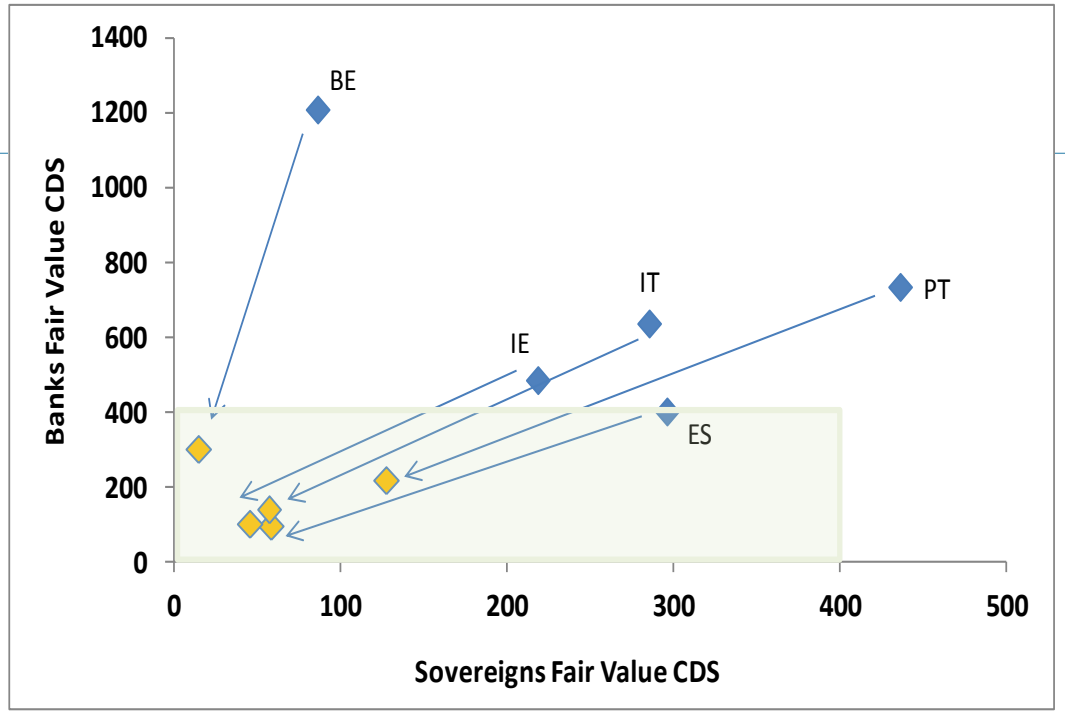


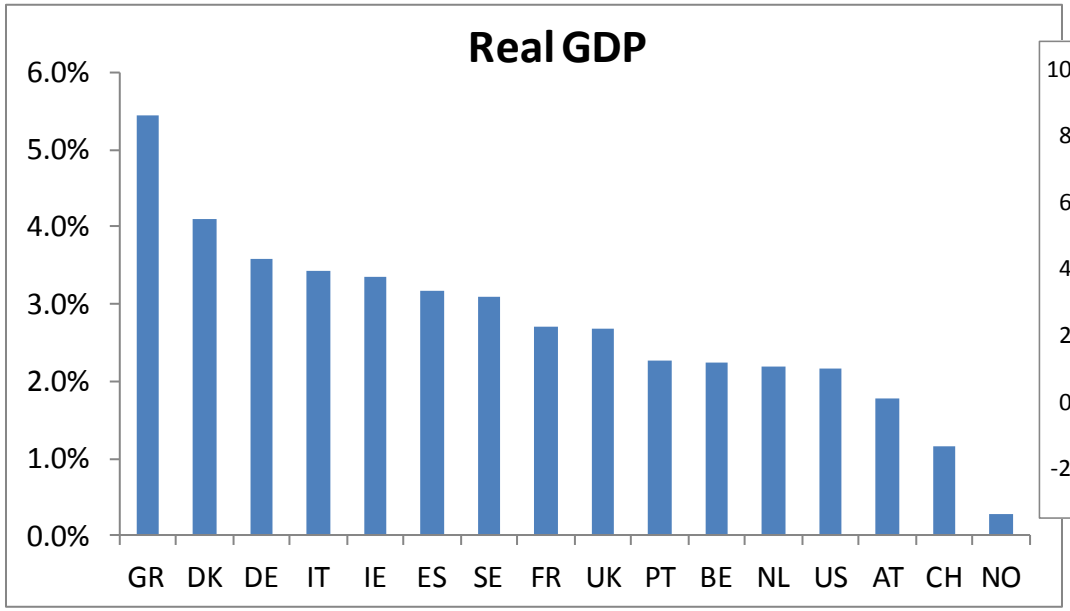


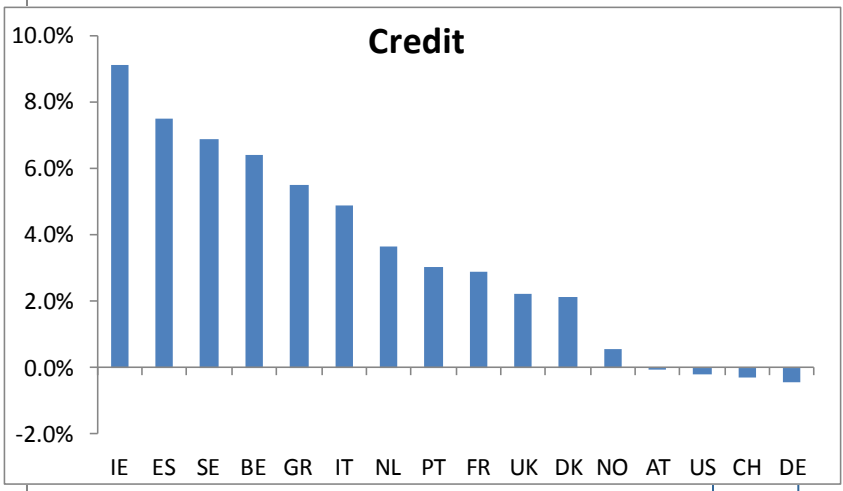
Shock Scenario 2

Positive Shock to Spain and Italy Sovereigns:

Bank and Sovereign FVCDS to "safe zone"; Real GDP up; Credit Growth up

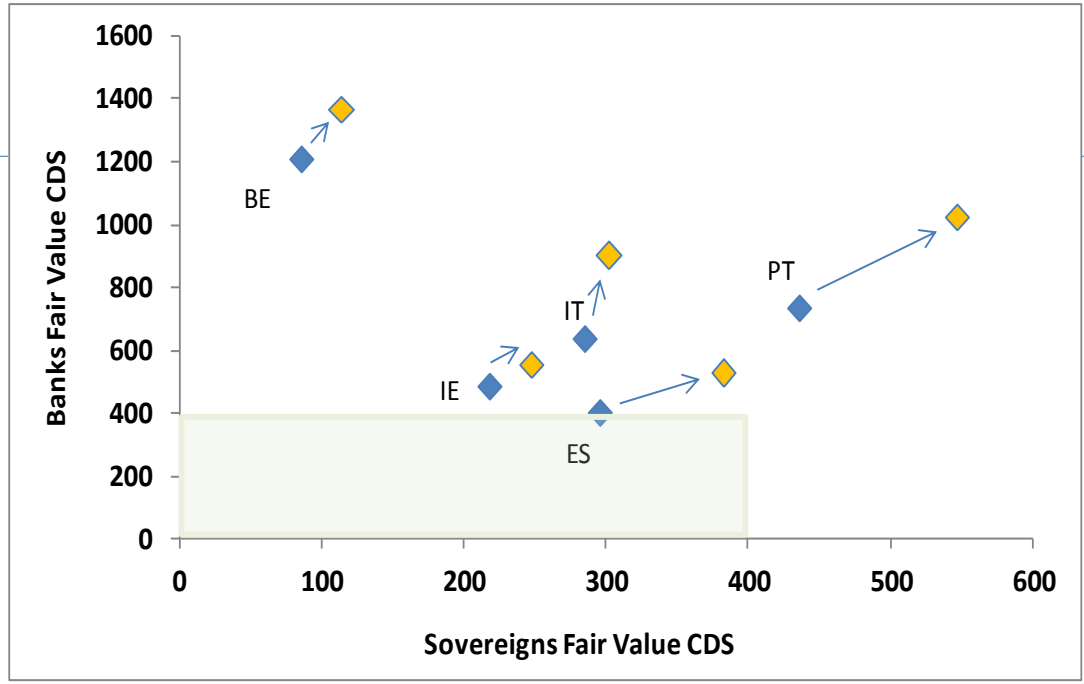


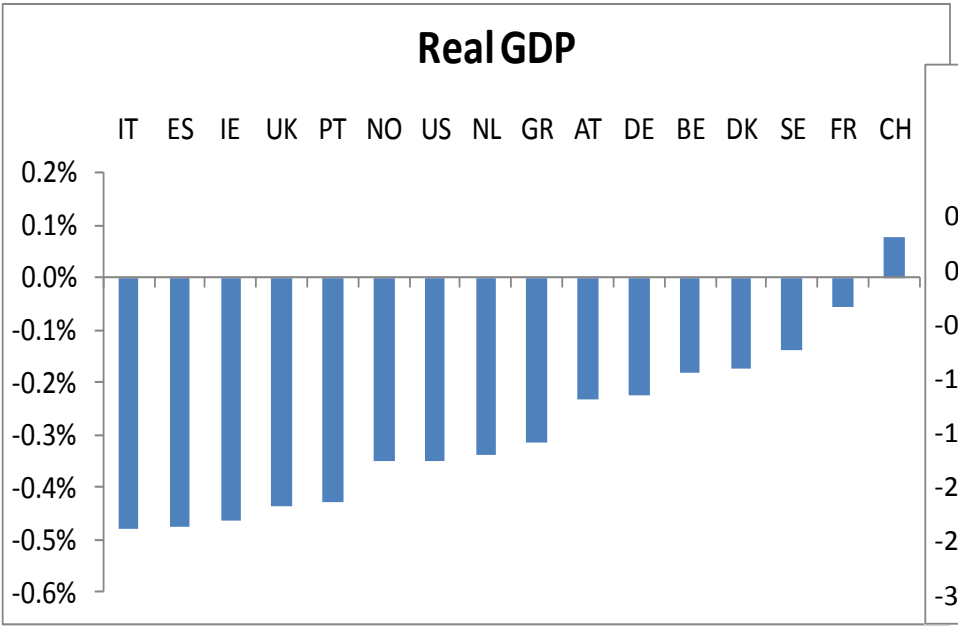


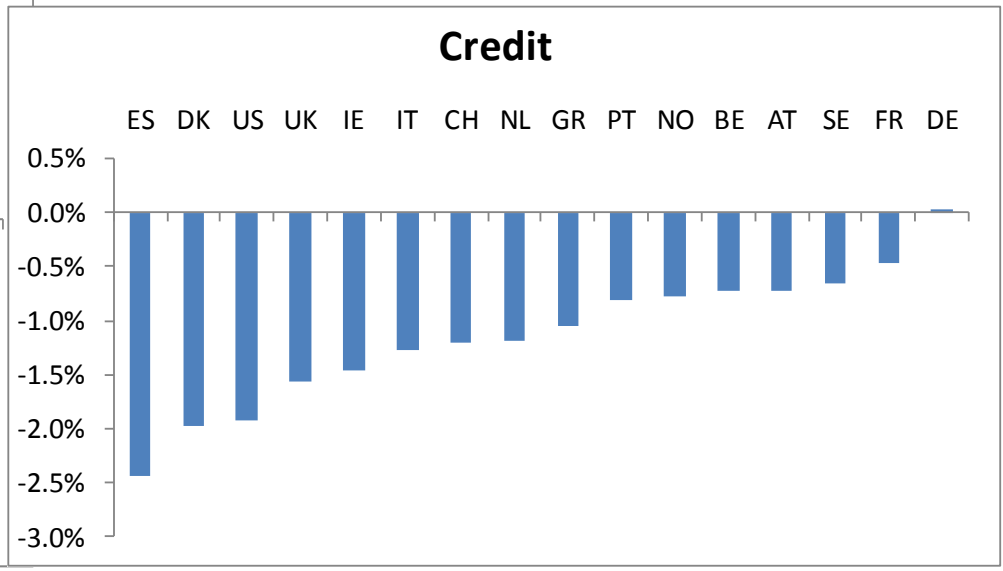


Scenario 3

Negative Shock to Spain and Italy Banks:
Bank and Sovereign FVCDS increase; Real GDP growth down; Credit growth down







Facilitate Quantitative Analysis of Risk Mitigation Policy Options

- **Banks:**
  - **Increase bank capital → higher assets, lower expected losses**
  - **Portfolio adjustment/ring-fenced asset guarantees → Lower asset volatility**
  - **Debt to equity conversion → lower default barrier, higher equity**
  - **Guarantees on bank debt → lower borrowing spreads**
- **Sovereigns:**
  - **Increase debt maturity → lower default barrier**
  - **Guarantees/insurance on sovereign debt → lower sovereign spreads**
- **Central Banks and Supranationals: Fed QE targeting lower spreads,**
  - **Debt purchases by public entity (ECB, EFSF, ESM, other) → lower sovereign spreads**
  - **Eurobonds → lower sovereign spreads, risk diversification**

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CCA-GVAR Model Framework