International Monetary Fund

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Sovereign Debt Crisis, Capital Flows and Deleveraging

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Monetary and Capital Markets Department

Note: The views expressed herein are those of the author and should not be attributed to the IMF, its Executive Board, or its management.

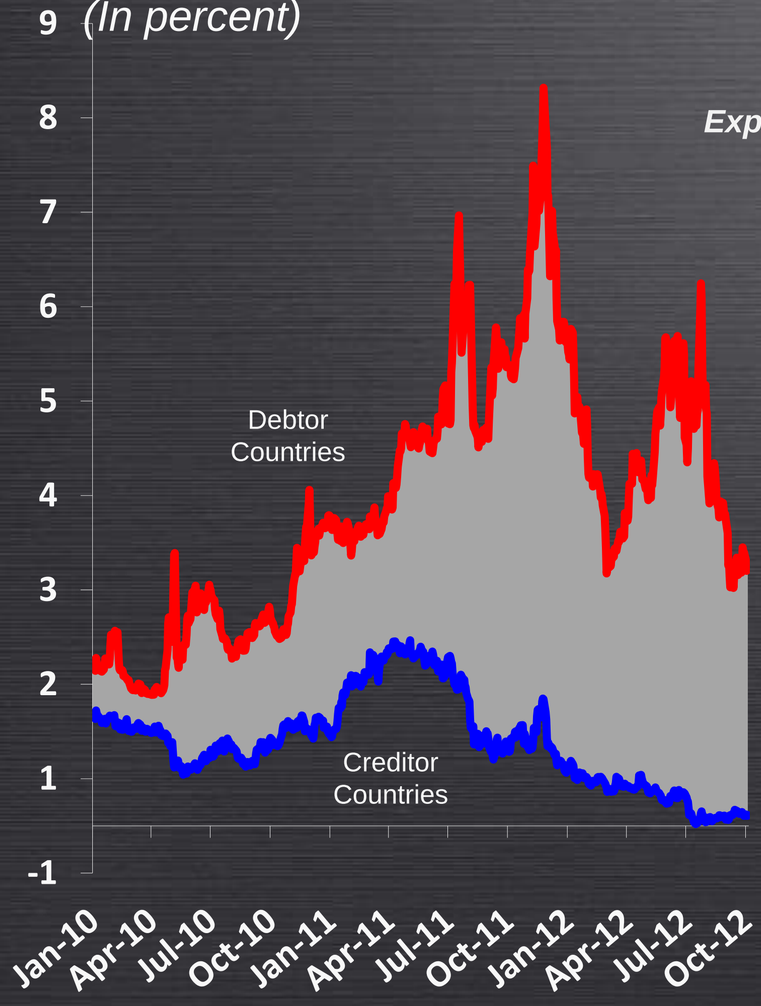
Agenda:

- **Recent developments and financial de-integration (GFSR, 2012)**
- GFSR (2012) and Deleveraging
- Financial Spillovers in Eastern Europe
- Deleveraging in Eastern Europe

Euro Area Financial Deintegration Intensifying

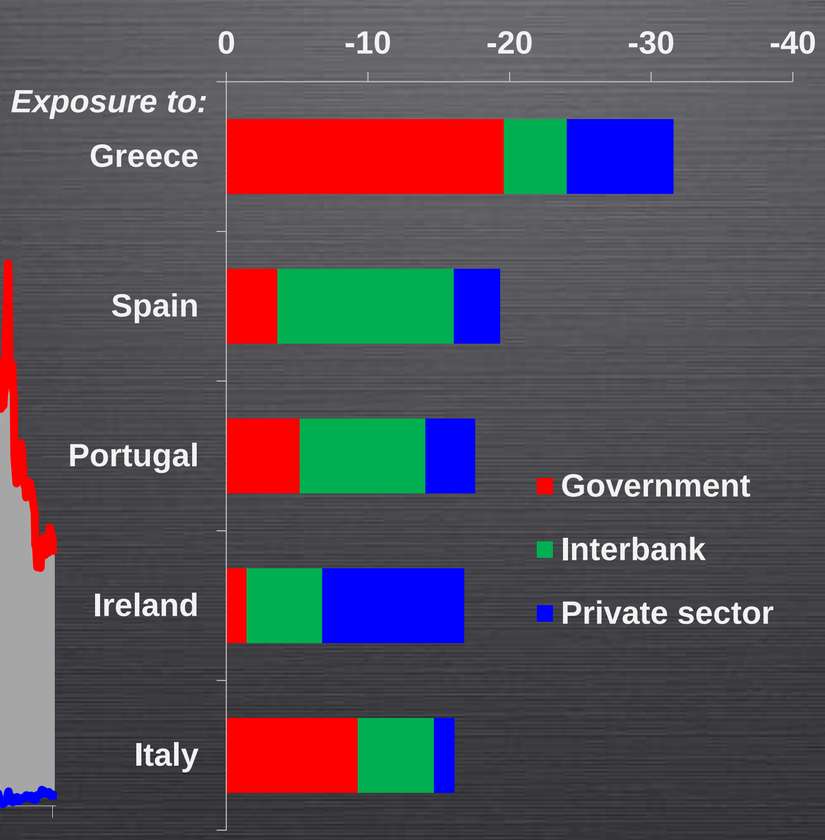
Sovereigns

European 2-year Sovereign Bond Yields
(In percent)



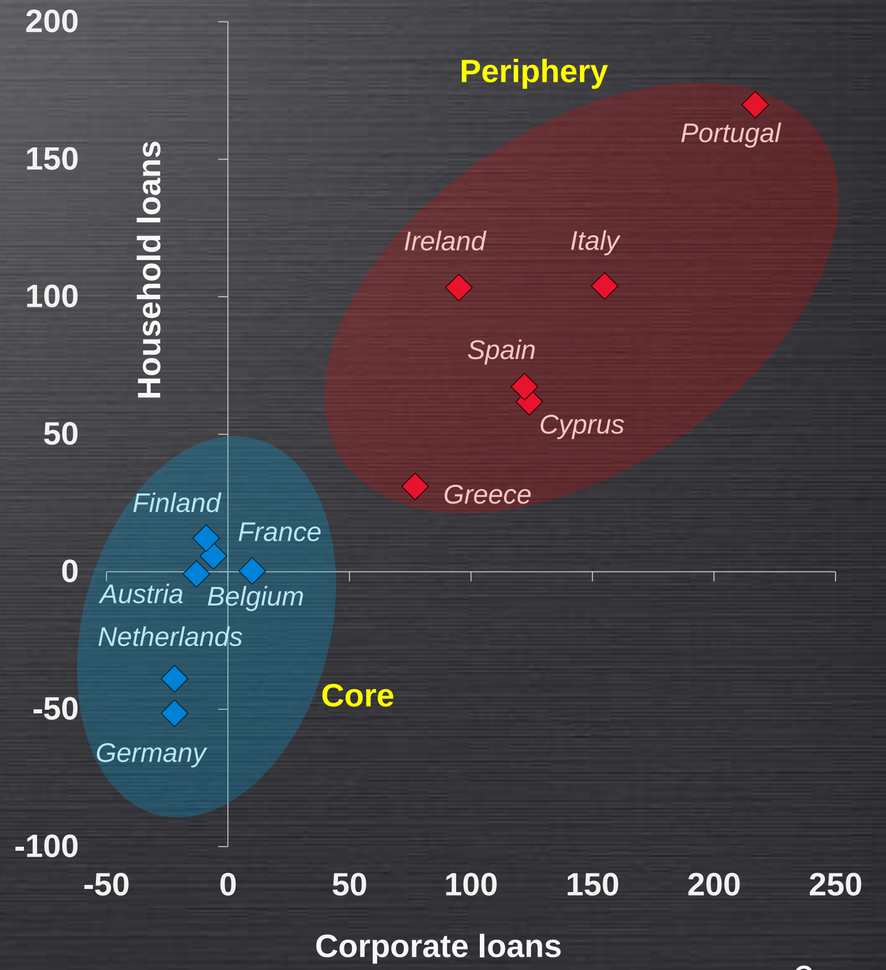
Banks

Change in Bank Intra-Euro Area Cross-border Exposures
(Percent, since December 2010)



Corporates and Households

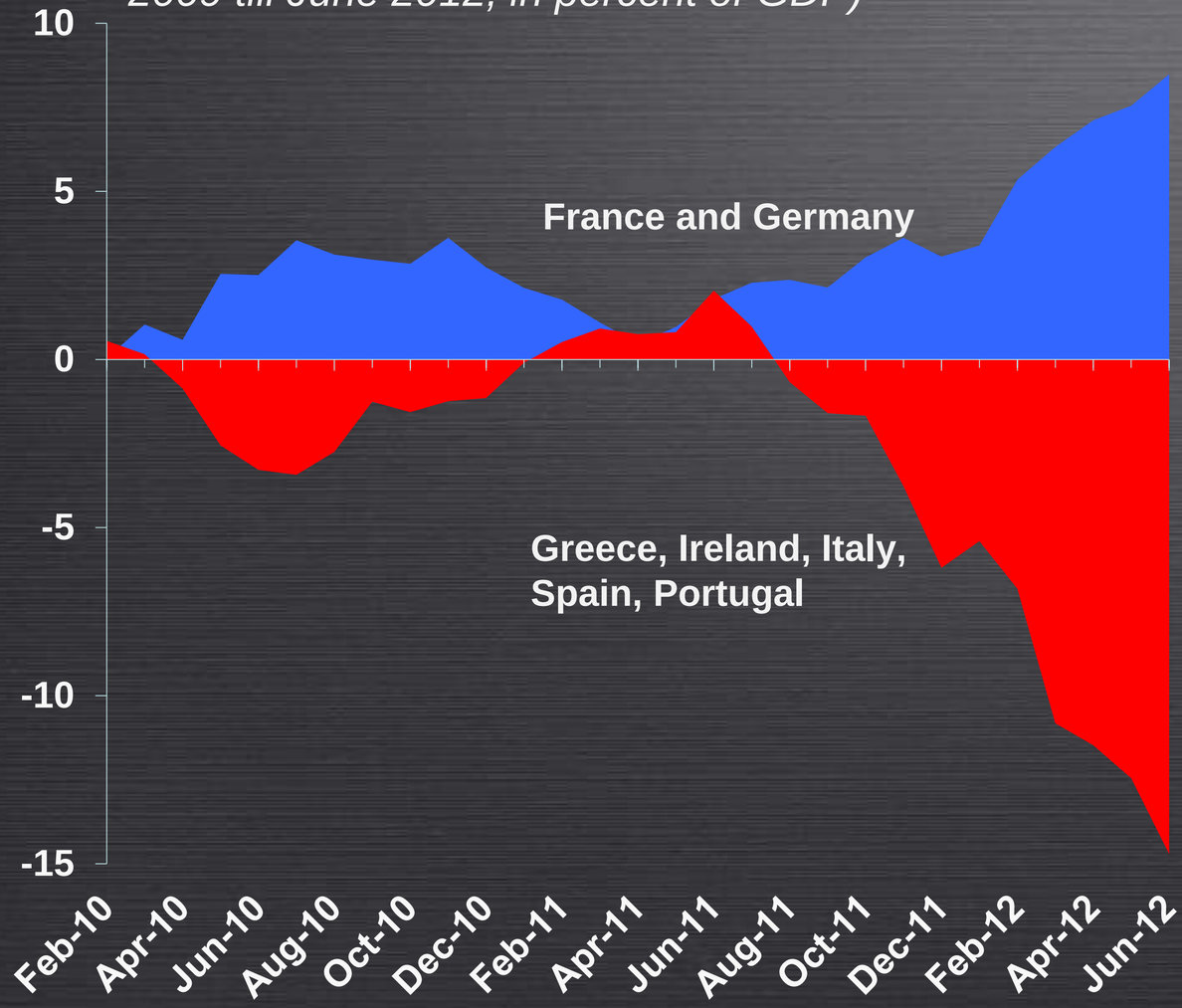
Change in Interest Rate on New Bank Loans
(Basis points, since December 2009)



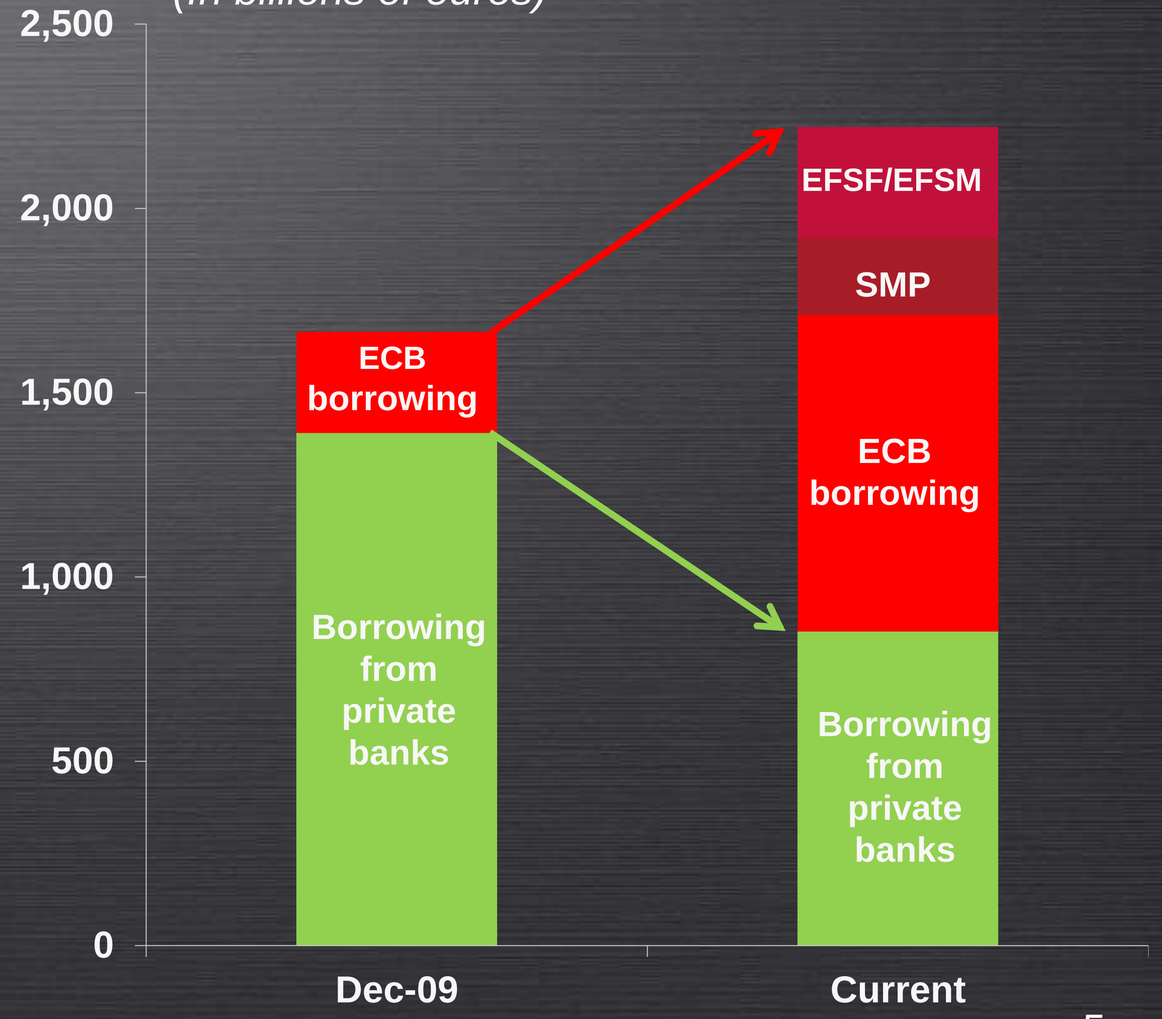
Source: GFSR (October 2012)

Cross-Border Private Funding is being Replaced by Public

Portfolio and Other Investment Capital Flows
(Excluding central banks, cumulative from December 2009 till June 2012, in percent of GDP)



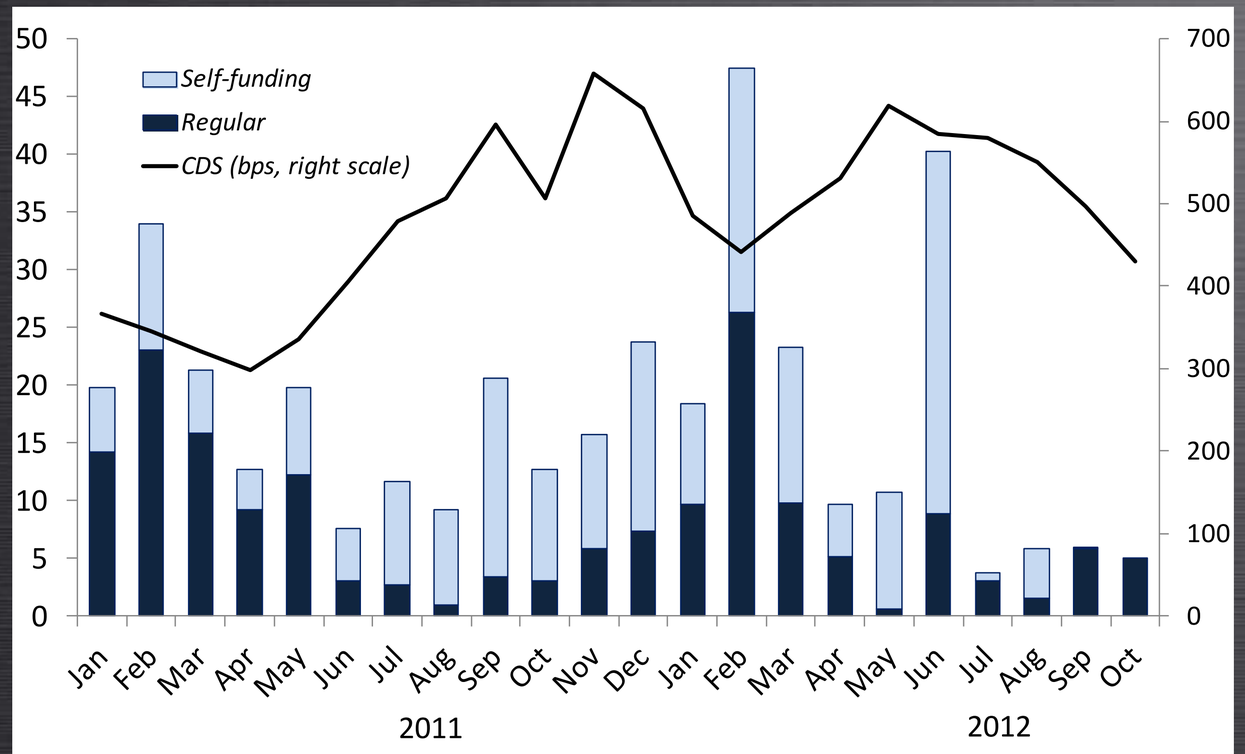
Euro Area Exposures to Greece, Ireland, Italy, Portugal, and Spain
(In billions of euros)



Source: GFSR (October 2012)

Funding to Peripheral Banks

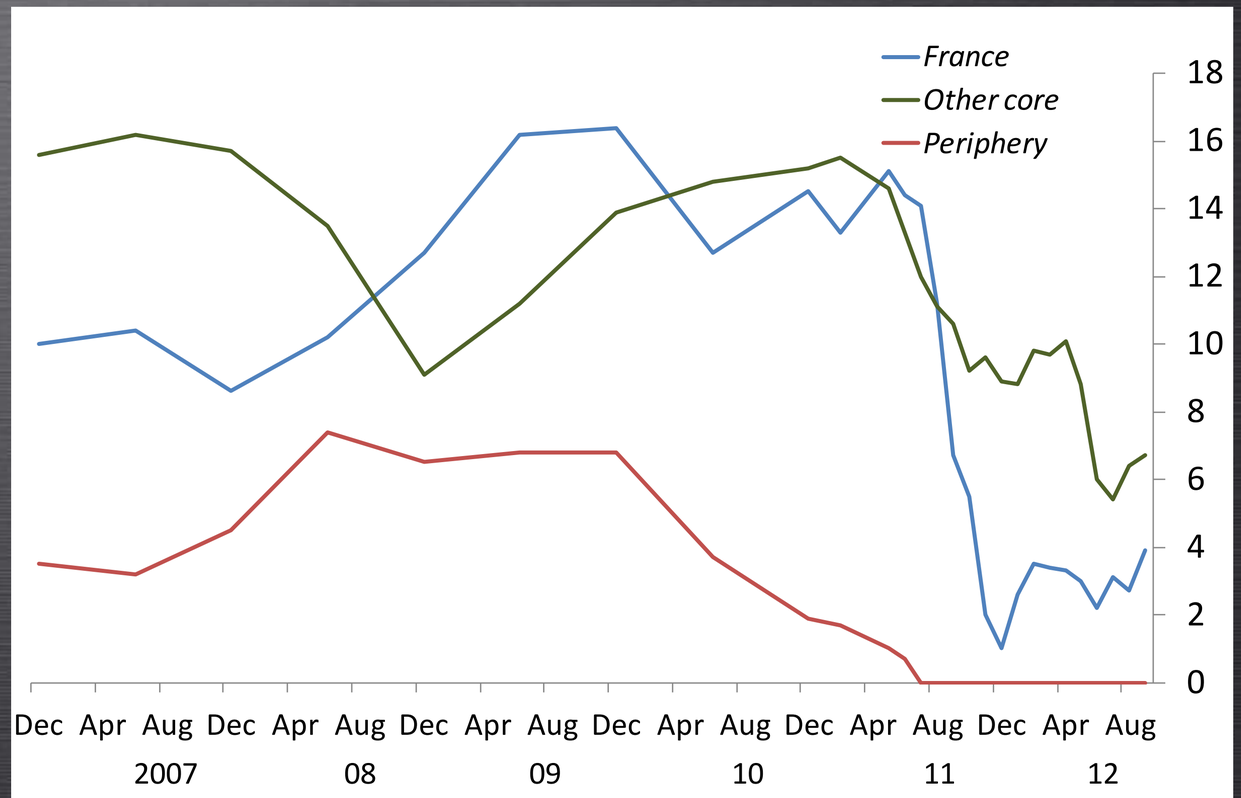
Peripheral euro area bank debt issuance and CDS spreads (Billions of euros, unless otherwise specified



Source: Dealogic, Bloomberg

Note: Self-funded deals occur when the issuer is the sole underwriter. Periphery countries are Cyprus, Greece, Ireland, Italy, Portugal and Spain.

US prime money-market funds' (MMF) exposures to euro area banks (Percent of total assets)



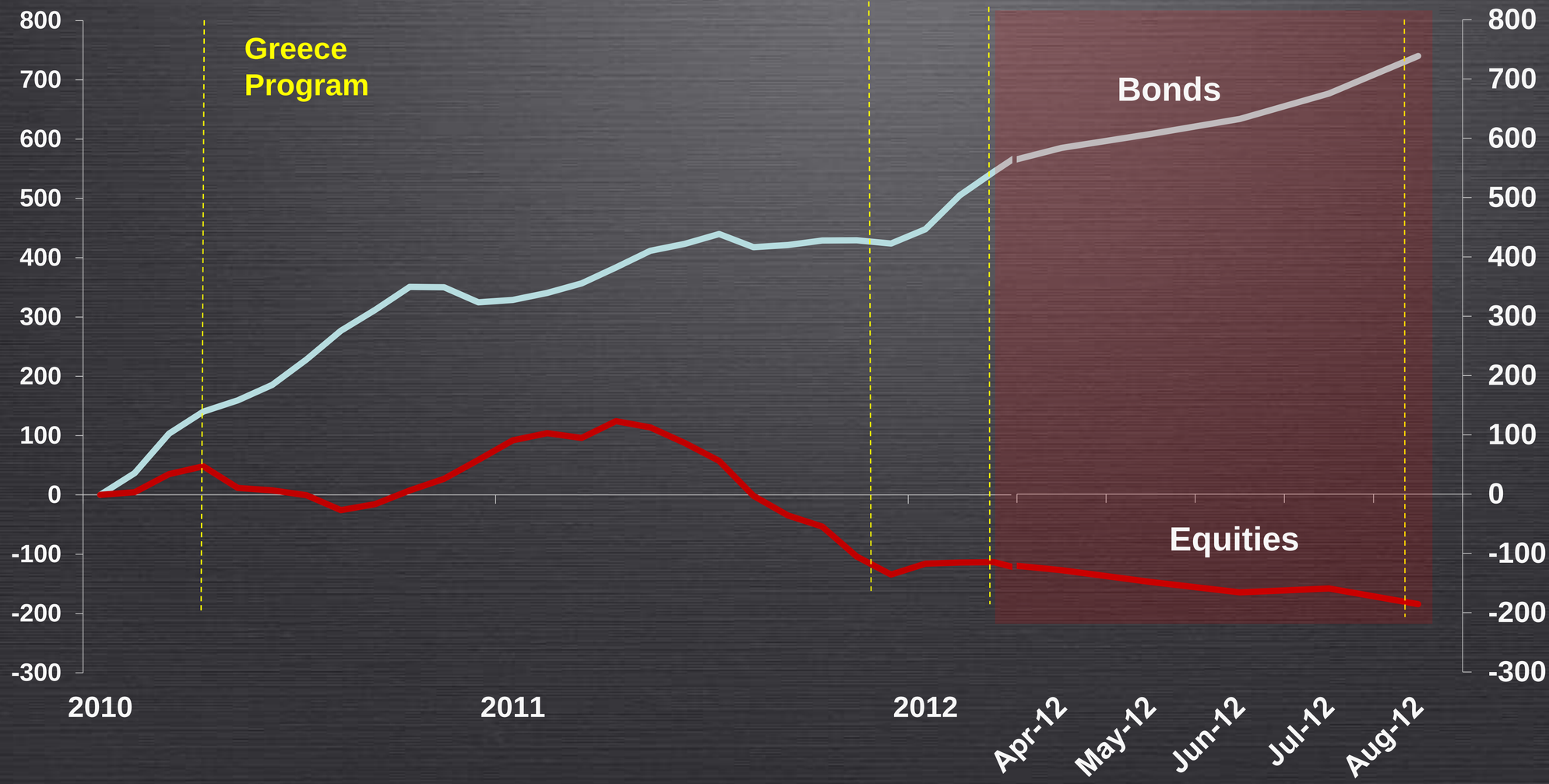
Source: Fitch.

Note: Periphery = Ireland, Italy, Portugal and Spain. Other core = Belgium, Germany and Netherlands.

Source: IMF

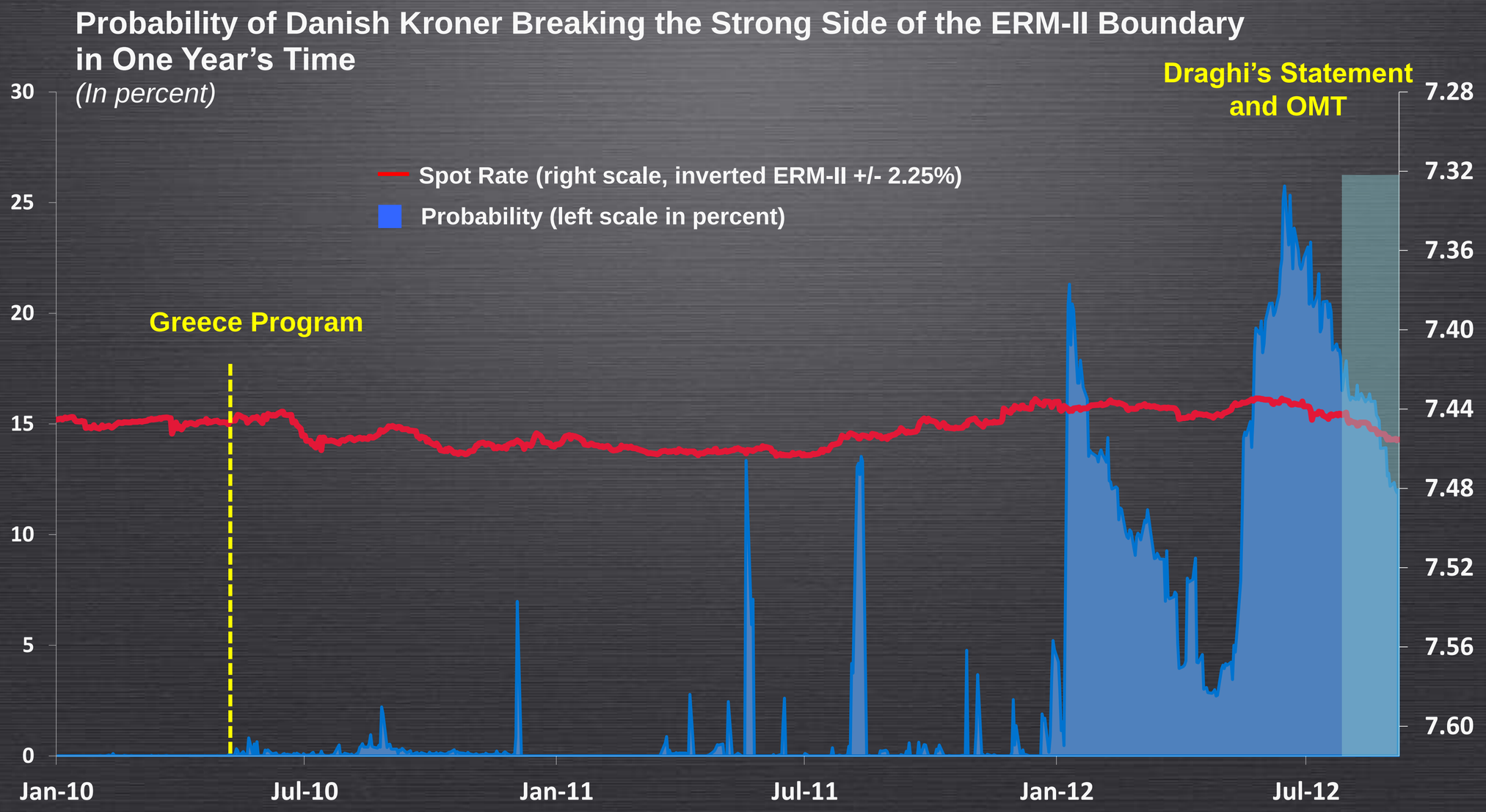
Continued Flows into Safe Havens and Out of Risk Assets

Cumulative Flows to Global Mutual Funds
(In billions of U.S. dollars)



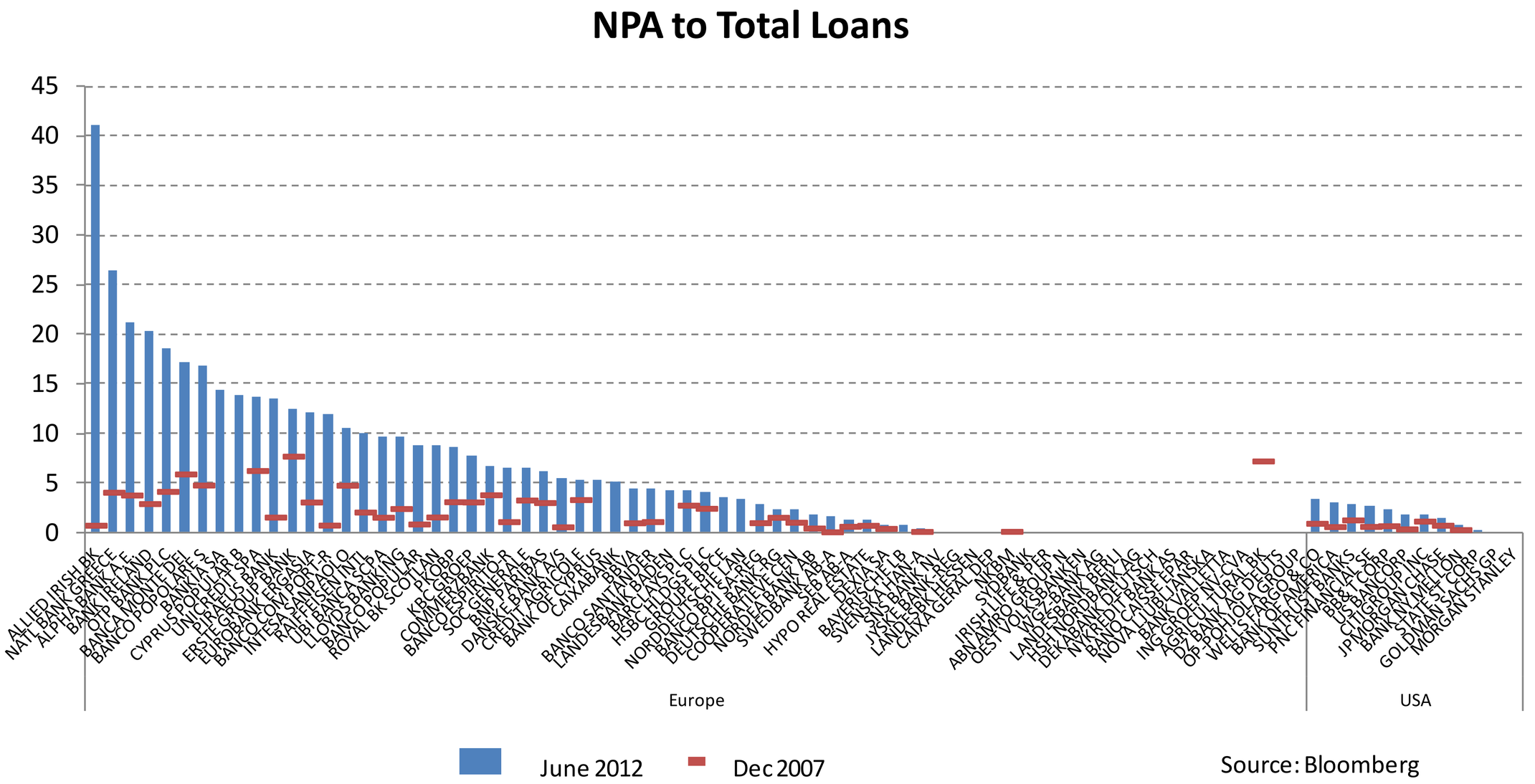
Source: GFSR (October 2012)

Redenomination Fears Have Mounted



Source: GFSR (October 2012)

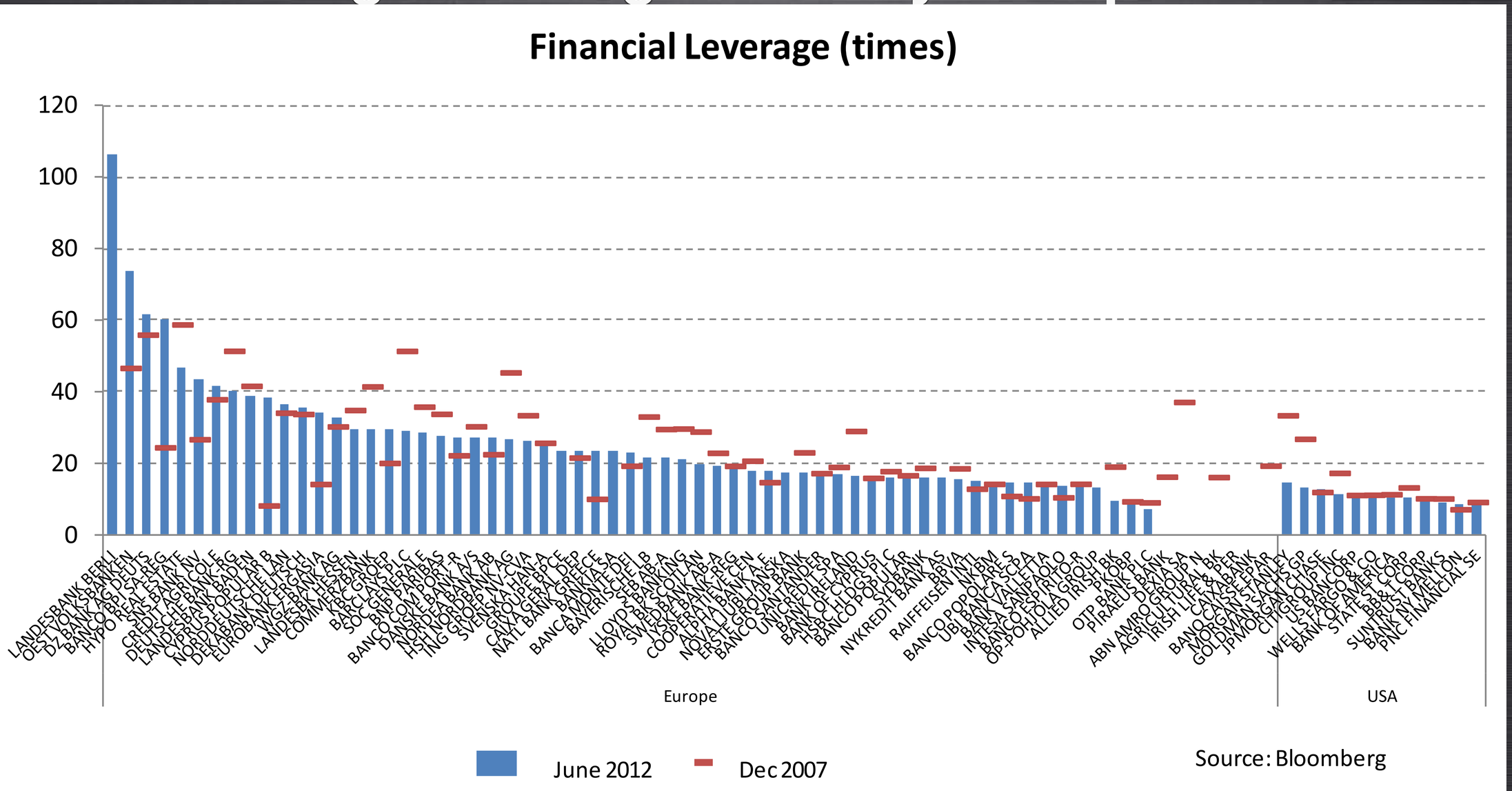
NPL Developments



Note: NPLs includes Non-Accrual Loans + Renegotiated/Restructured Loans + Other Real Estate Owned (OREO) or Foreclosed Real Estate.

Sources: Bloomberg

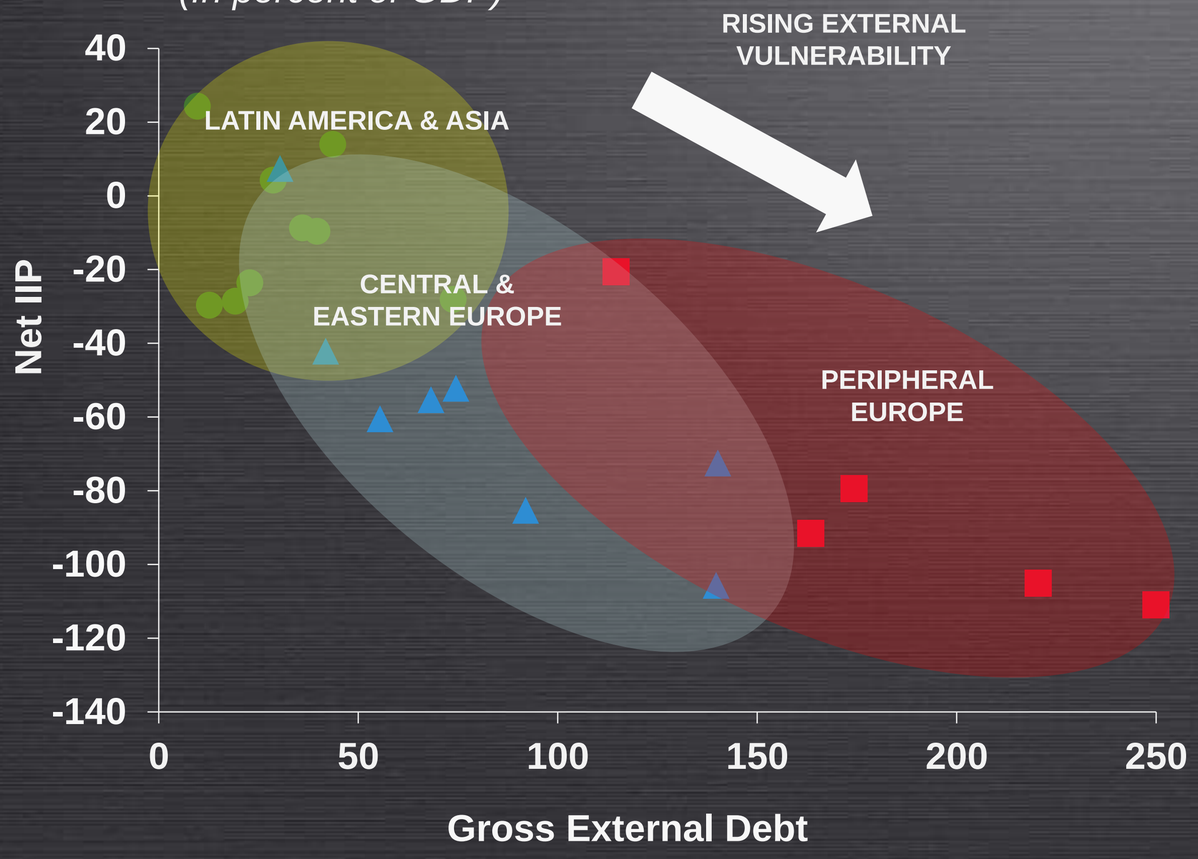
Still high leverage in many European banks



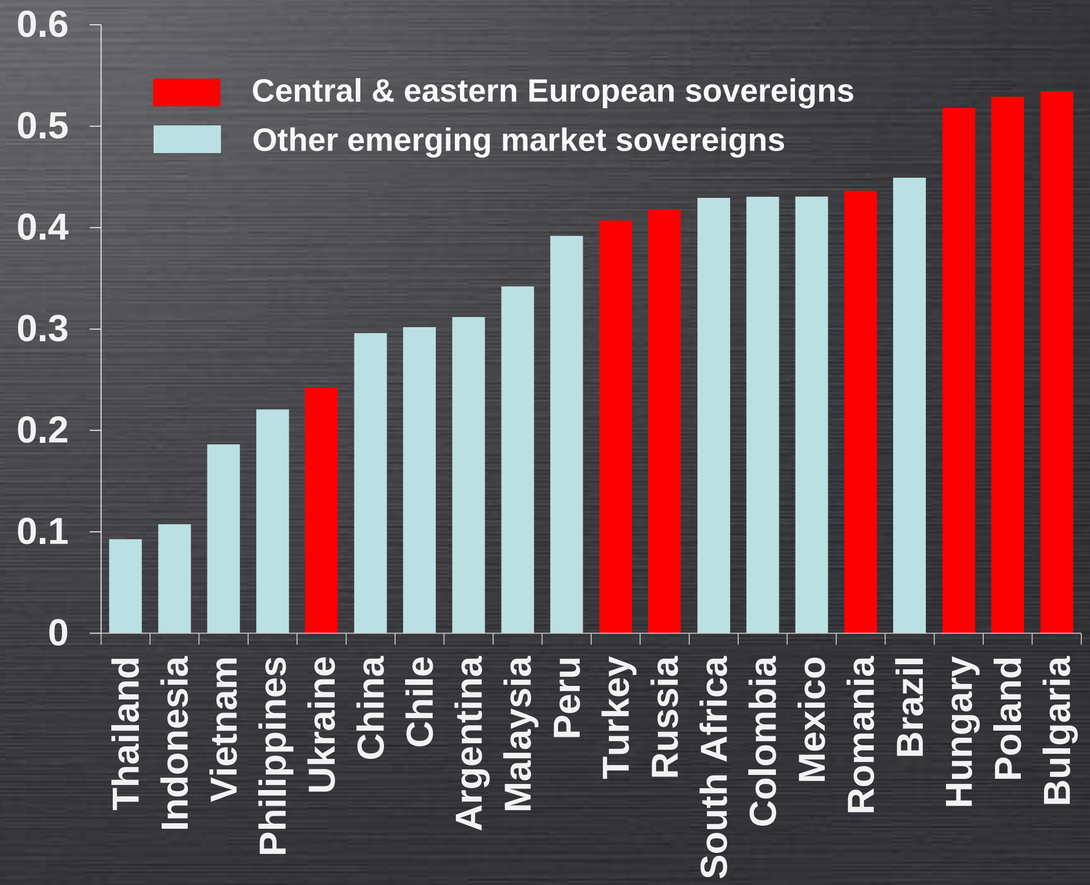
Sources: Bloomberg

Emerging Europe Particularly Vulnerable

Net International Investment Position versus Gross External Debt, 2011
(In percent of GDP)

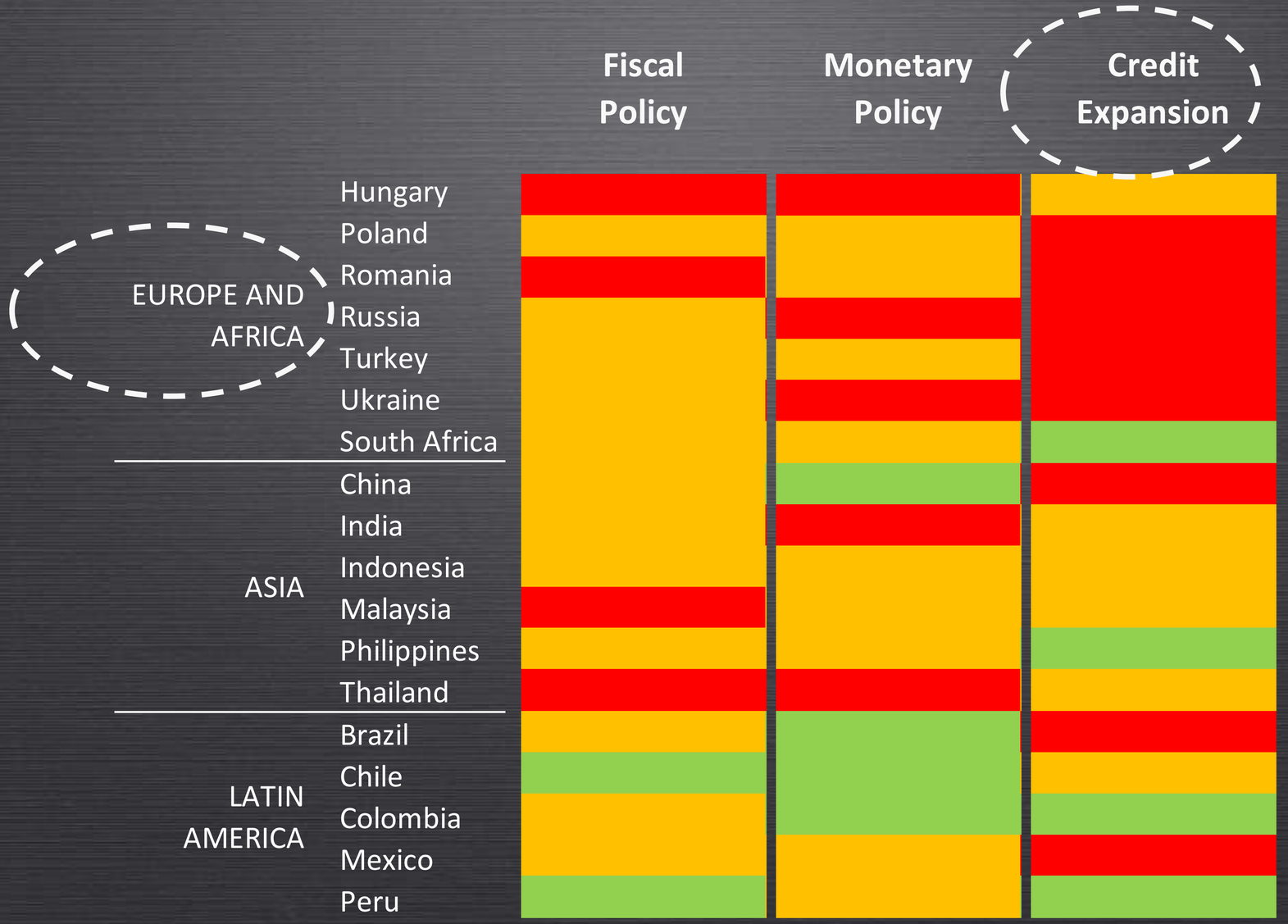


Sensitivity to Euro Area Periphery CDS, 2011-2012



Source: GFSR (October 2012)

Policy Space is Constrained



Source: GFSR (October 2012)

Agenda:

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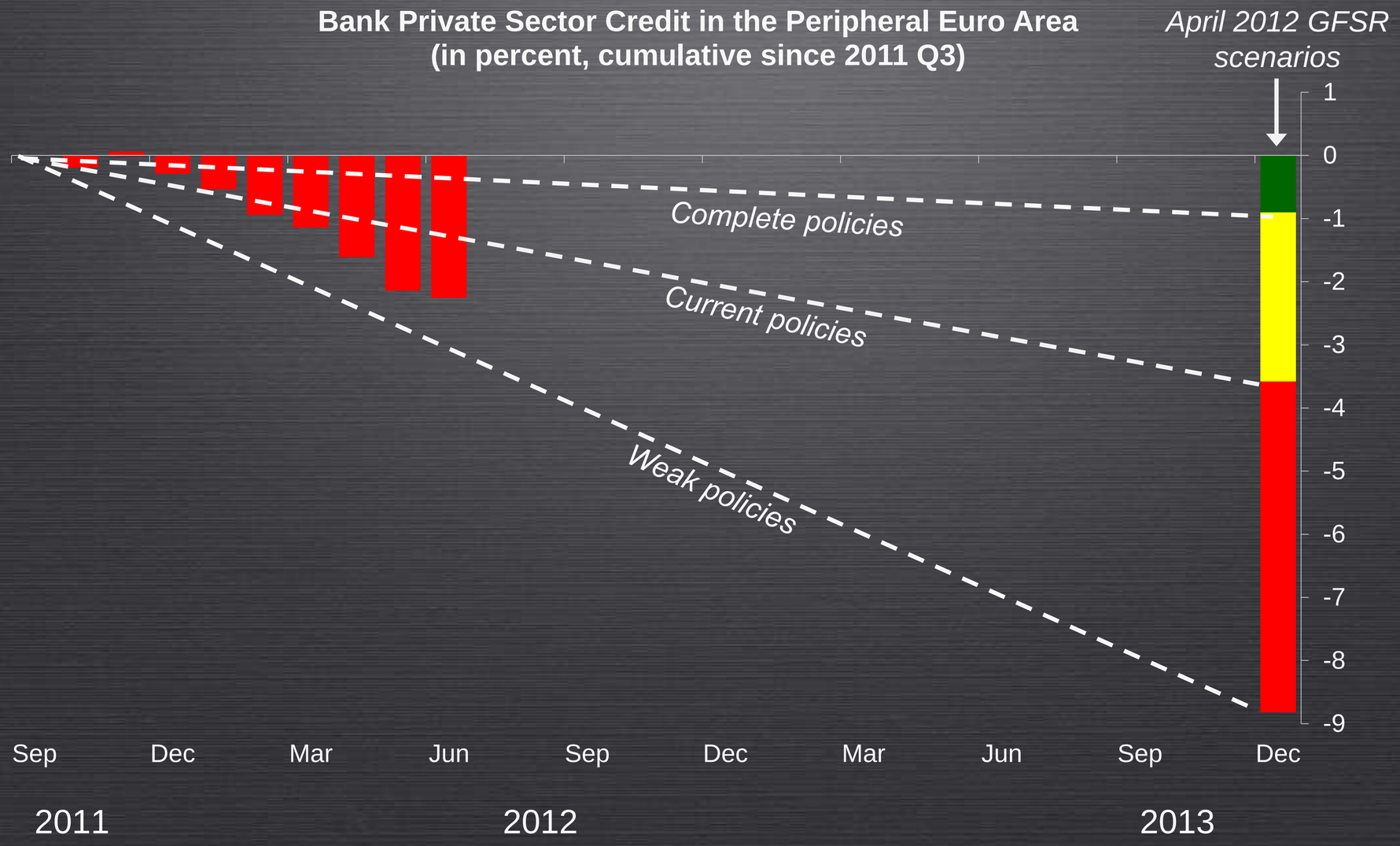
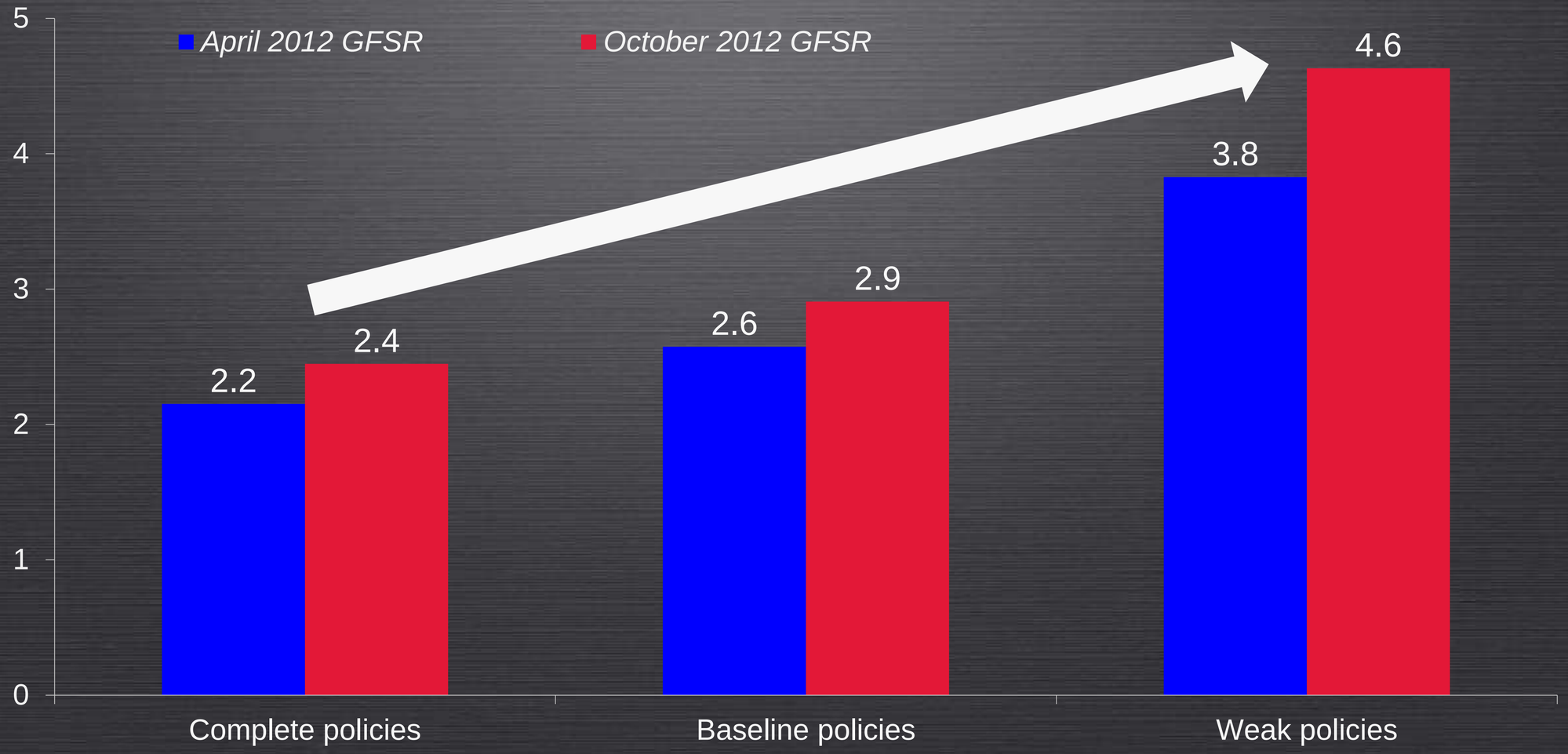
Credit Contracting in the Periphery…

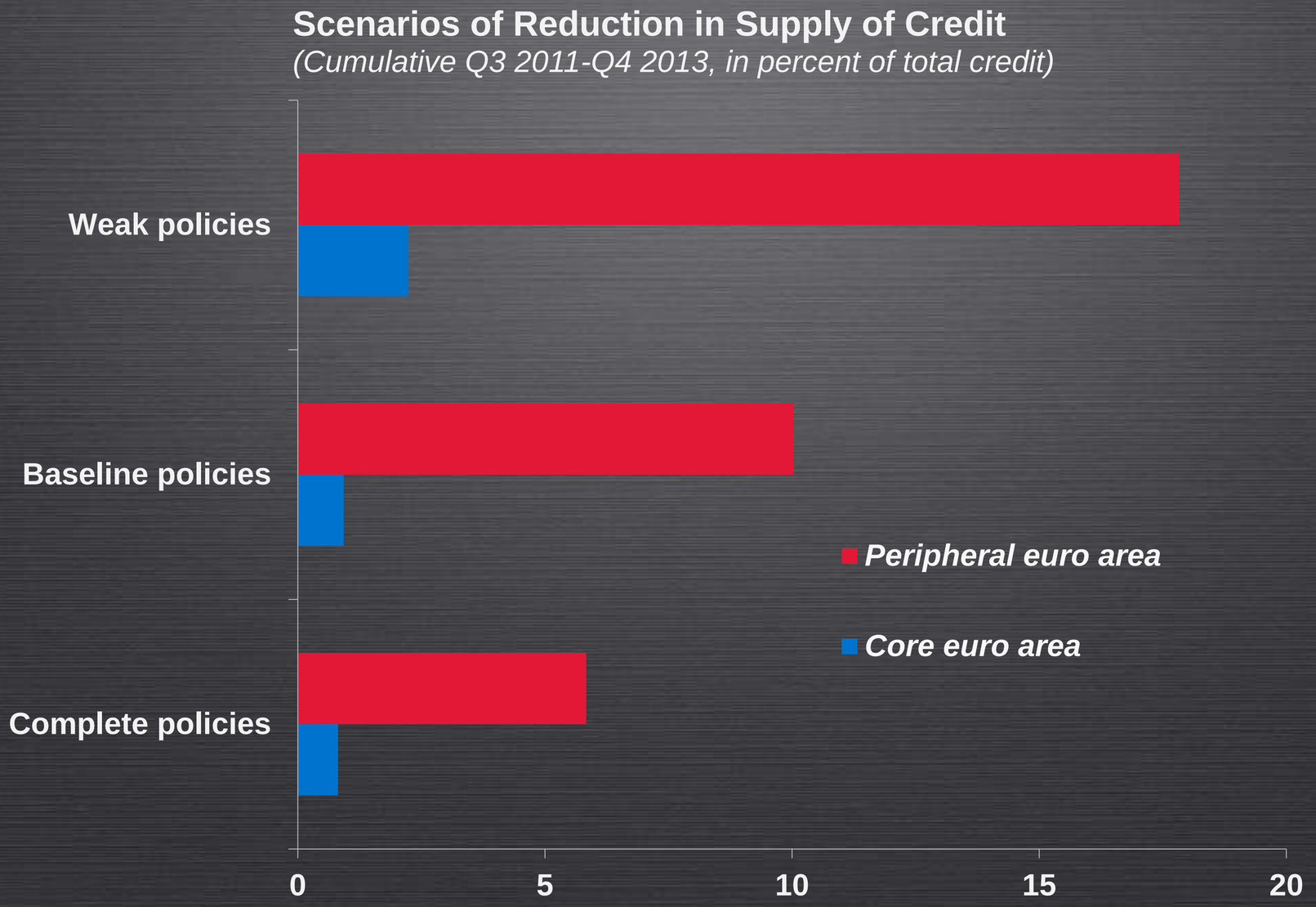


…as Deleveraging Pressures are Rising…

Deleveraging Scenarios-October versus April 2012 GFSR
(In trillions of U.S. dollars)

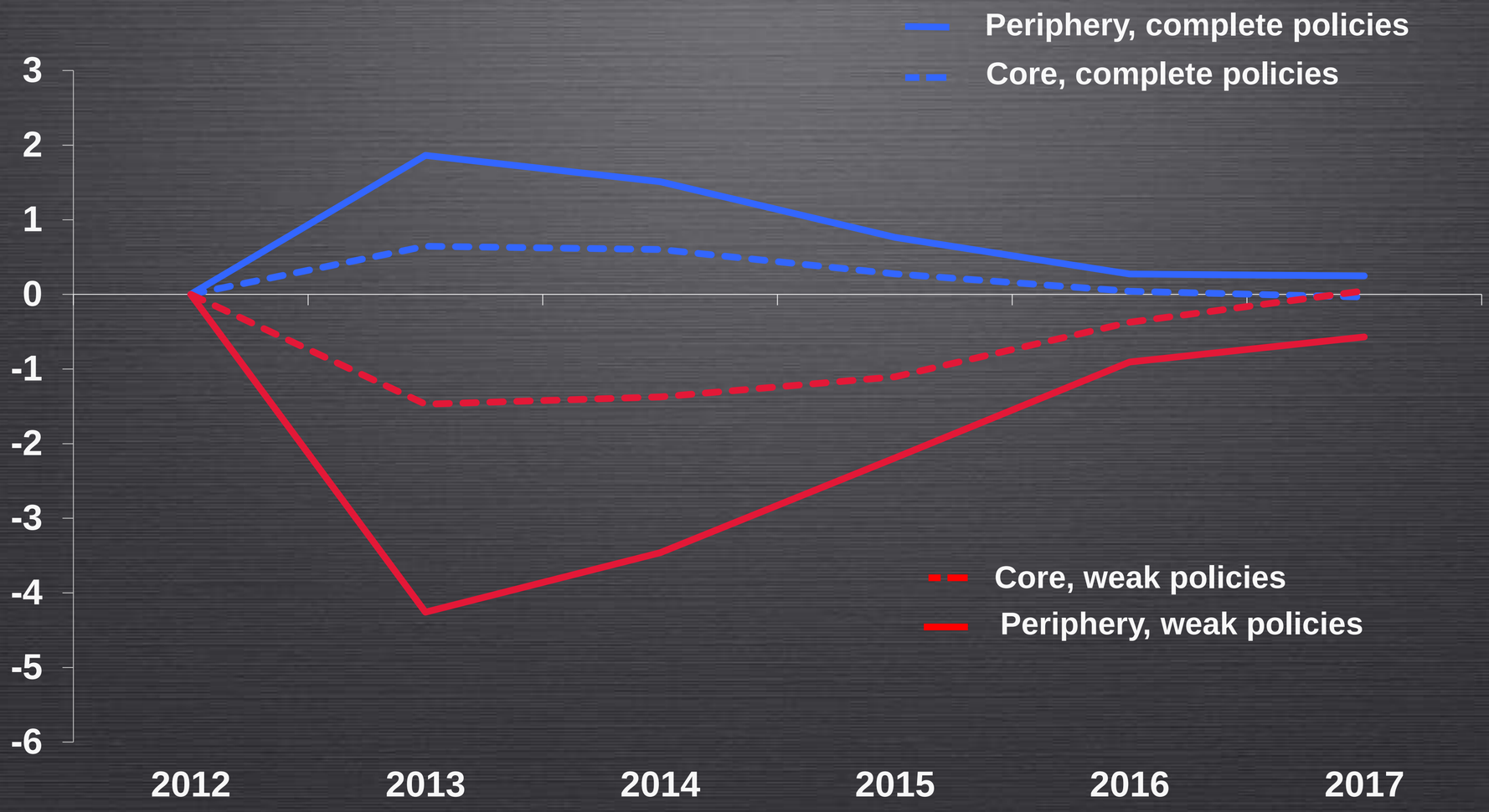


…Deepening Credit Crunch in the Periphery…



Fragmentation: Economic Impact

Impact on GDP from EU Bank Deleveraging
(Percentage point deviation from WEO baseline)



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GARCH Methodology

- Multivariate GARCH framework
- Dynamic Conditional Correlation (DCC) model by Engle (2002) which allows for time-varying correlations
- Model in first differences to account for the nonstationarity of the variables in the crisis period
- See also Frank, Gonzalez-Hermosillo and Hesse (2008, IMF WP 200) and Frank and Hesse (2009, IMF WP 104)
- See Romania AIV SIP (2012) on “Financial Sector Linkages in Romania”

DCC GARCH Methodology

The DCC model is estimated in a three-stage procedure. Let *rt denote an n x 1* vector of asset returns, exhibiting a mean of zero and the following time-varying covariance:

$$r_t \mid \Im_{t-1} \sim N(0, D_t R_t D_t) \qquad \text{where } D_t = diag\left\{\sqrt{h_{it}}\right\}$$

Here, *Rt is made up from the time dependent correlations and Dt is defined as* a diagonal matrix comprised of the standard deviations implied by the estimation of univariate GARCH models, which are computed separately, whereby the *ith element* is denoted as $\sqrt{h_{it}}$

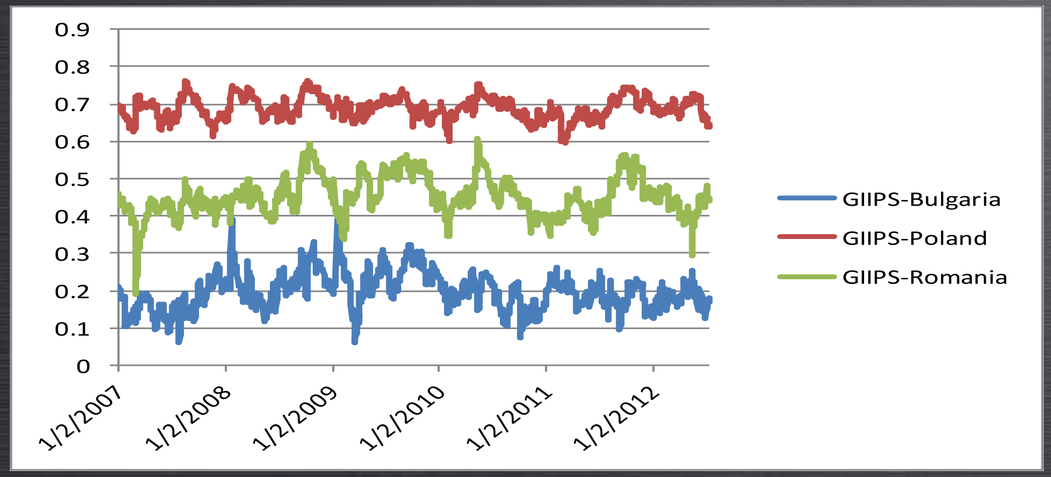
In other words, in this first stage of the DCC estimation, we fit univariate GARCH models for each of the five variables in the specification. In the second stage, the intercept parameters are obtained from the transformed asset returns. Finally, in the third stage, the coefficients governing the dynamics of the conditional correlations are estimated. Overall, the DCC model is characterized by the following set of equations (Engle, 2002):

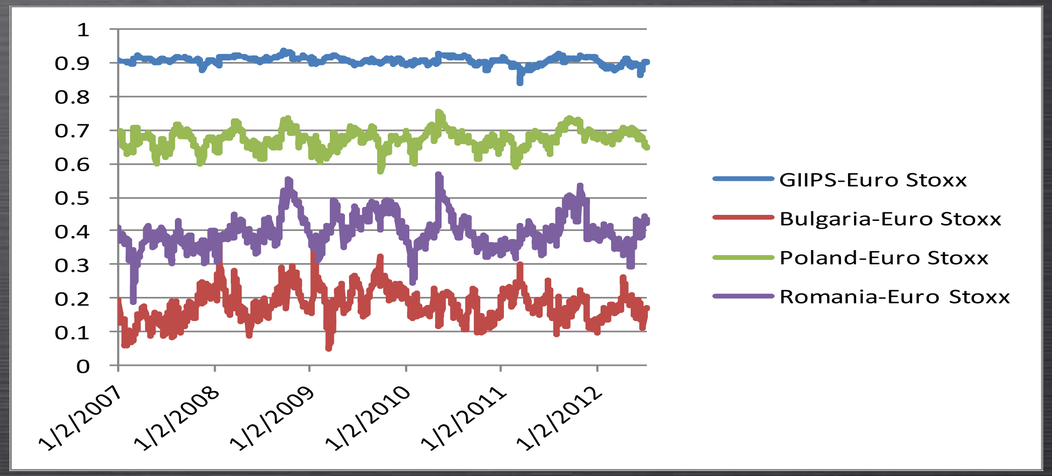
$$\begin{aligned}
D_t^2 &= diag\{\omega_i\} + diag\{\kappa_i\} \circ r_{t-1} r_{t-1}' + diag\{\lambda_i\} \circ D_{t-1}^2 \\
\varepsilon_t &= D_t^{-1} r_t \\
Q_t &= S \circ (\iota\iota' - A - B) + A \circ \varepsilon_{t-1}\varepsilon_{t-1}' + B \circ Q_{t-1} \\
R_t &= diag\{Q_t\}^{-1} Q_t diag\{Q_t\}^{-1} \\
S &= E[\varepsilon_t \varepsilon_t']
\end{aligned}$$

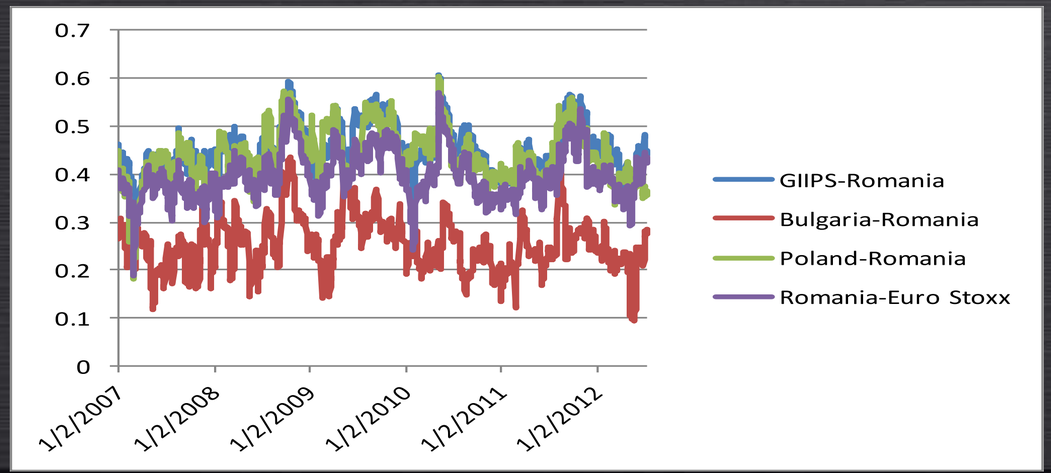
Here, S is defined as the unconditional correlation matrix of the residuals ε_t of the asset returns rt. As defined above, Rt is the time varying correlation matrix and is a function of Qt, which is the covariance matrix. In the matrix Q_{t-1} is a vector of ones, A and B are square, symmetric and ⊙ is the Hadamard product. Finally, λi is a weight parameter with the contributions of D_{t-1}^2 declining over time, while κi is the parameter associated with the squared lagged asset returns.

GARCH Equity Market Model

1. Poland's implied equity market co-movement with a GIIPS average and the Euro Stoxx appears higher than of Romania and Bulgaria.
2. For example, Romania hovers around 0.4-0.5 in terms of the implied correlation with a occasional correlation jump, corresponding to volatile episodes.

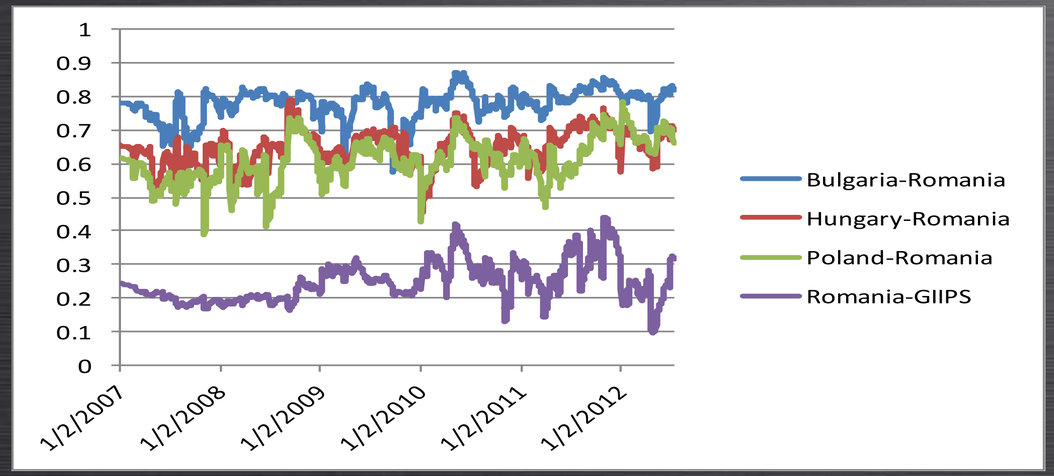


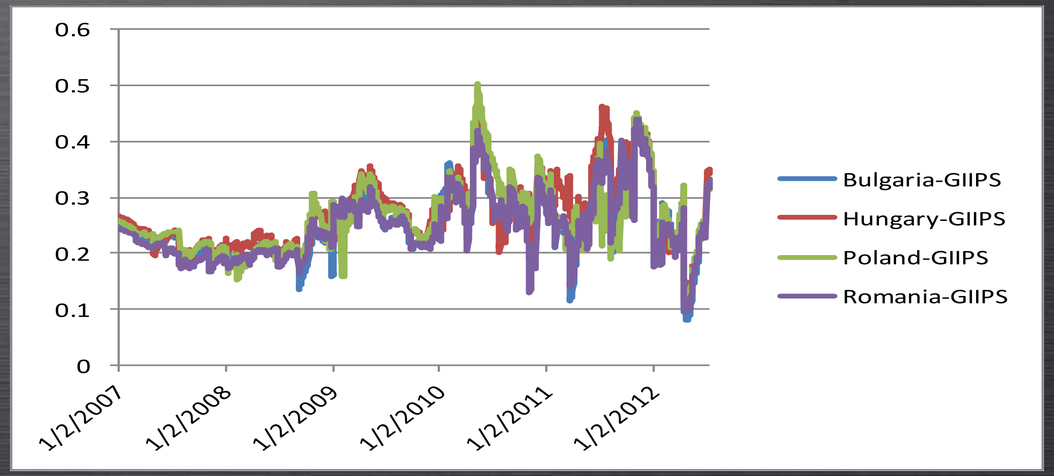


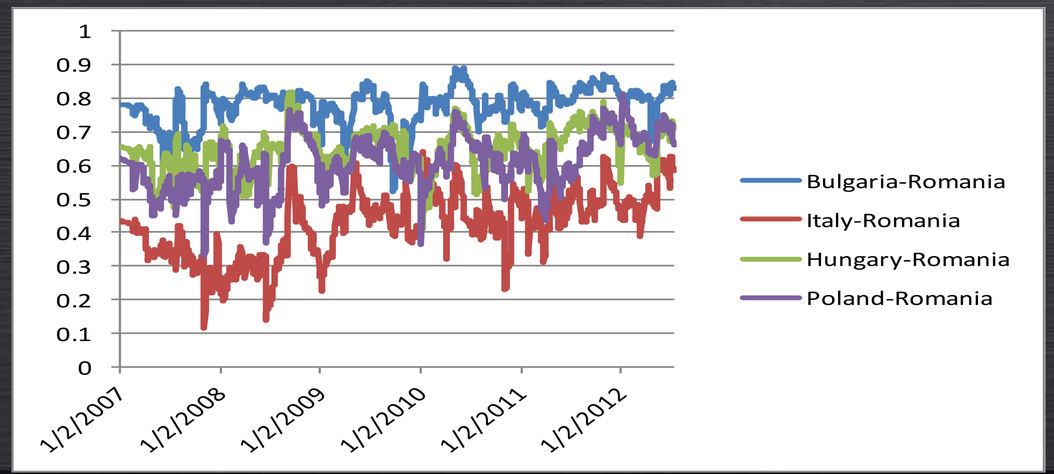


GARCH CDS Model

In terms of CDS co-movements, Romania shows the highest implied correlation with Bulgaria followed by Hungary/ Poland and then Italy (used as an example). Using the average GIIPS CDS price development confirms the picture.

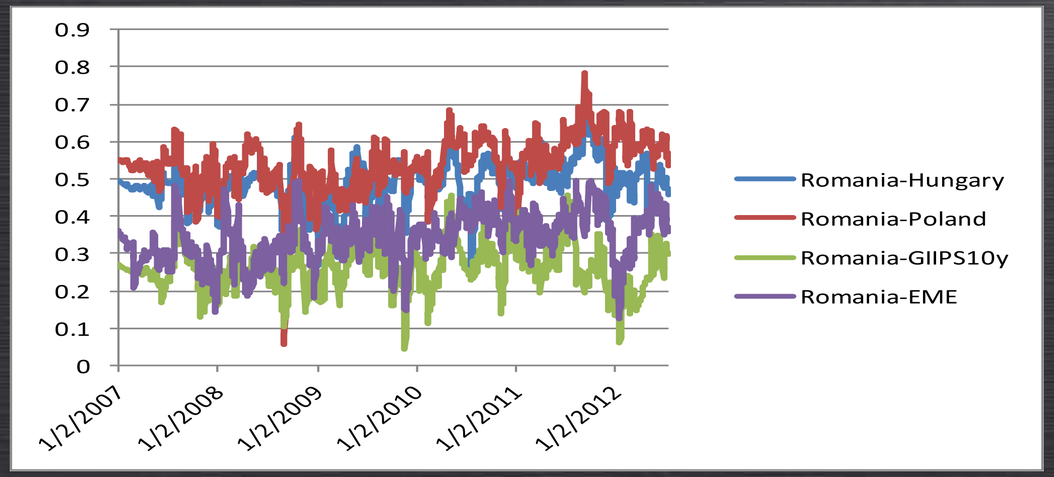


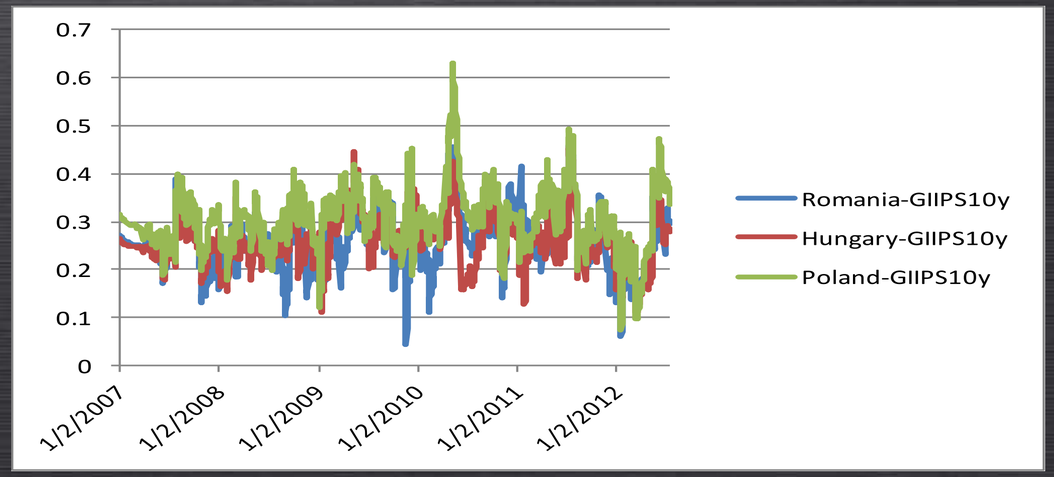




GARCH EMBIG Model

1. Romania's EMBIG spread moves closer to Hungary and Poland than the GIIPS10y and EME.
2. Comparing Romania, Hungary and Poland against GIIPS10y indicates that Romania's EMBIG spread tends to exhibit a lower DCC GARCH implied correlation to the GIIPS10y for the most part of the sample period.
3. Results do suggest that Romania as Hungary and Poland have not been immune to volatility in the GIIPS bond spread over Germany with correlation jumps up to 0.5-0.6.





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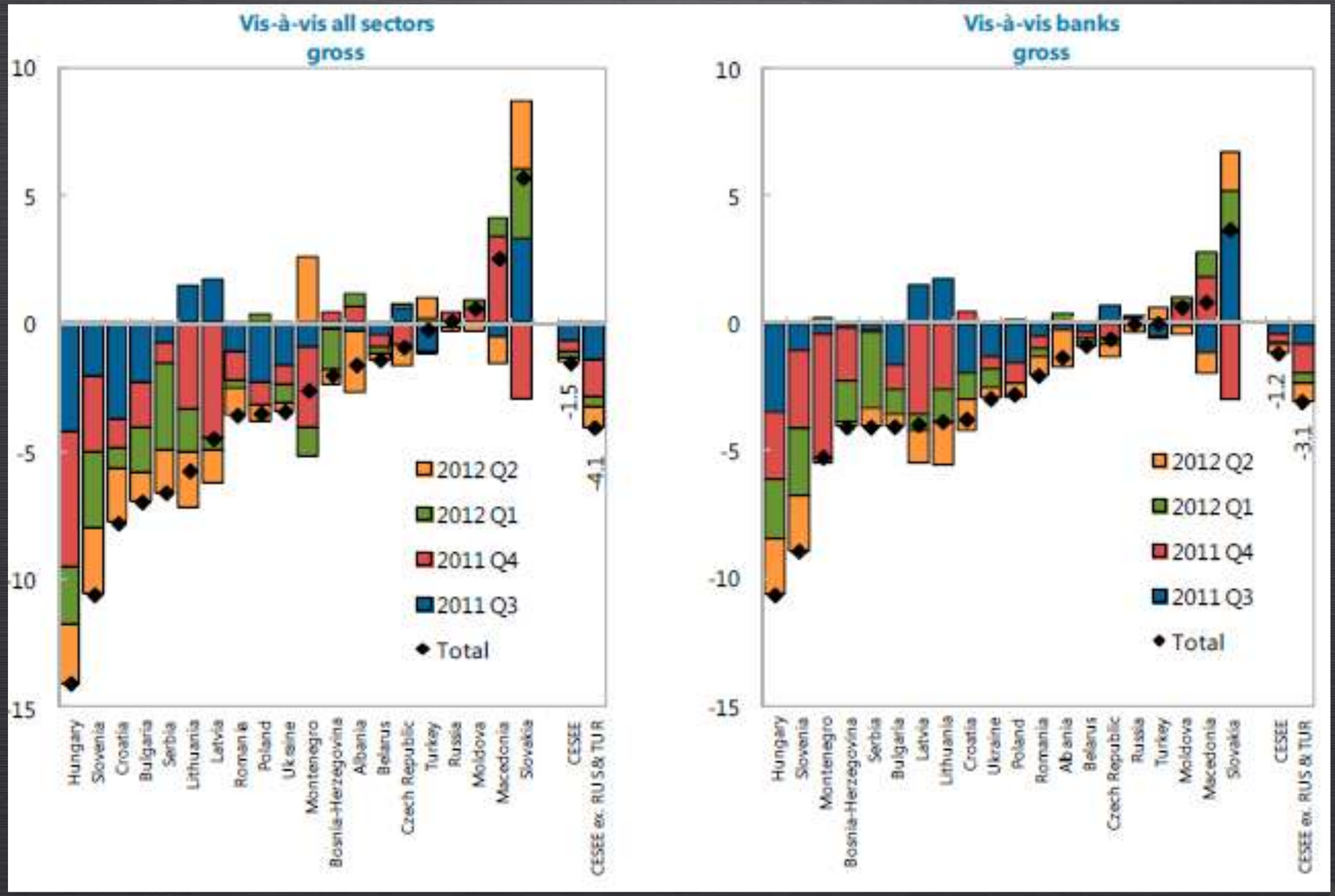
Causes and Consequences of Foreign Bank Deleveraging

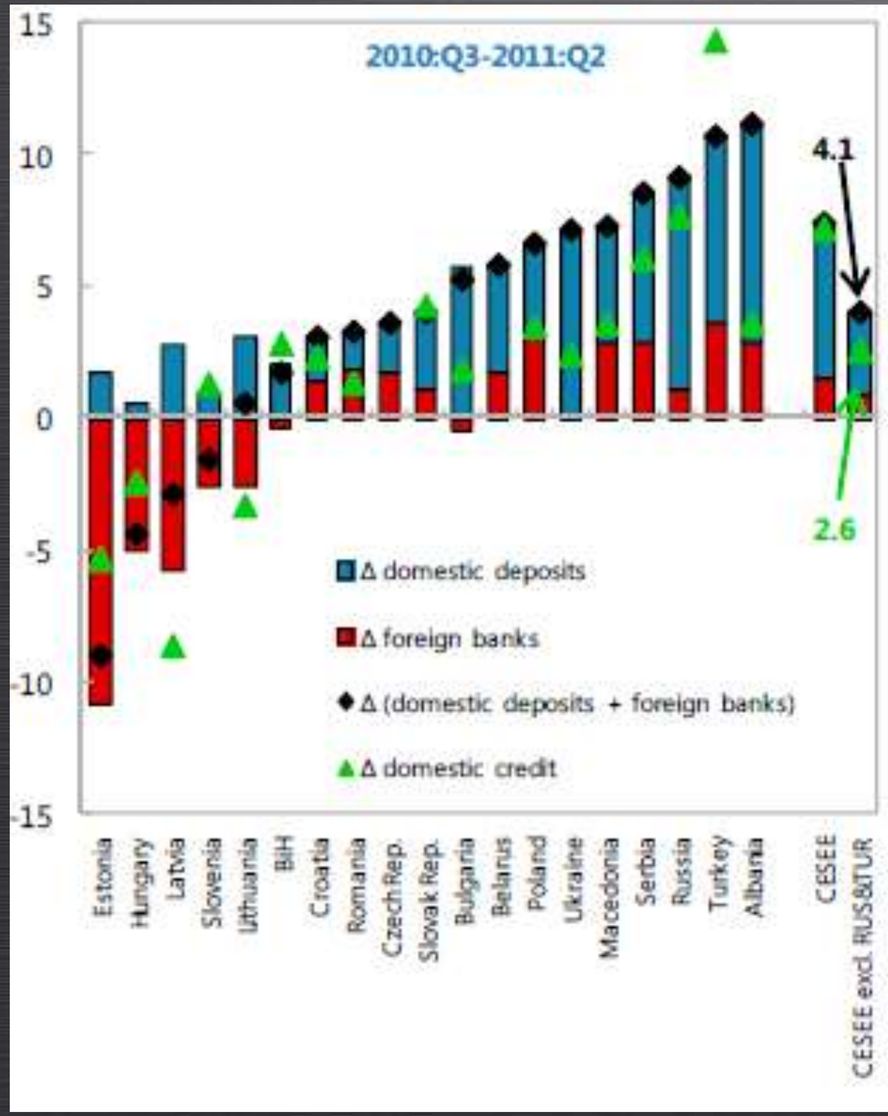
1. The risk of disruptive parent funding withdrawals by European banks from CESEE has been a longstanding concern. Some orderly deleveraging is healthy though given past excessive FX driven credit booms and also expected given European banks' desire to shrink non-core assets over time.
2. Disorderly foreign bank deleveraging can risk a credit crunch, balance of payment stress and loss of reserves, a sharp depreciation, increases in risk premia as well as spillovers to the real economy inhibiting any recovery.
3. In general, a difficult financial sector environment in many CESEE countries including soaring NPLs and poor profits could lead some parents to scale back their long-term support for the subsidiaries, thus making them more exposed to domestic funding pattern.
4. Compared to regional peers, foreign bank deleveraging in Romania has been orderly and moderate so far, also partly thanks to the Vienna I initiative. Some causes for the orderly foreign bank deleveraging in Romania were weak parent banks (especially Greece), changes in parent funding strategy (e.g. French banks) or some loss in domestic funding (e.g. Greek subs).

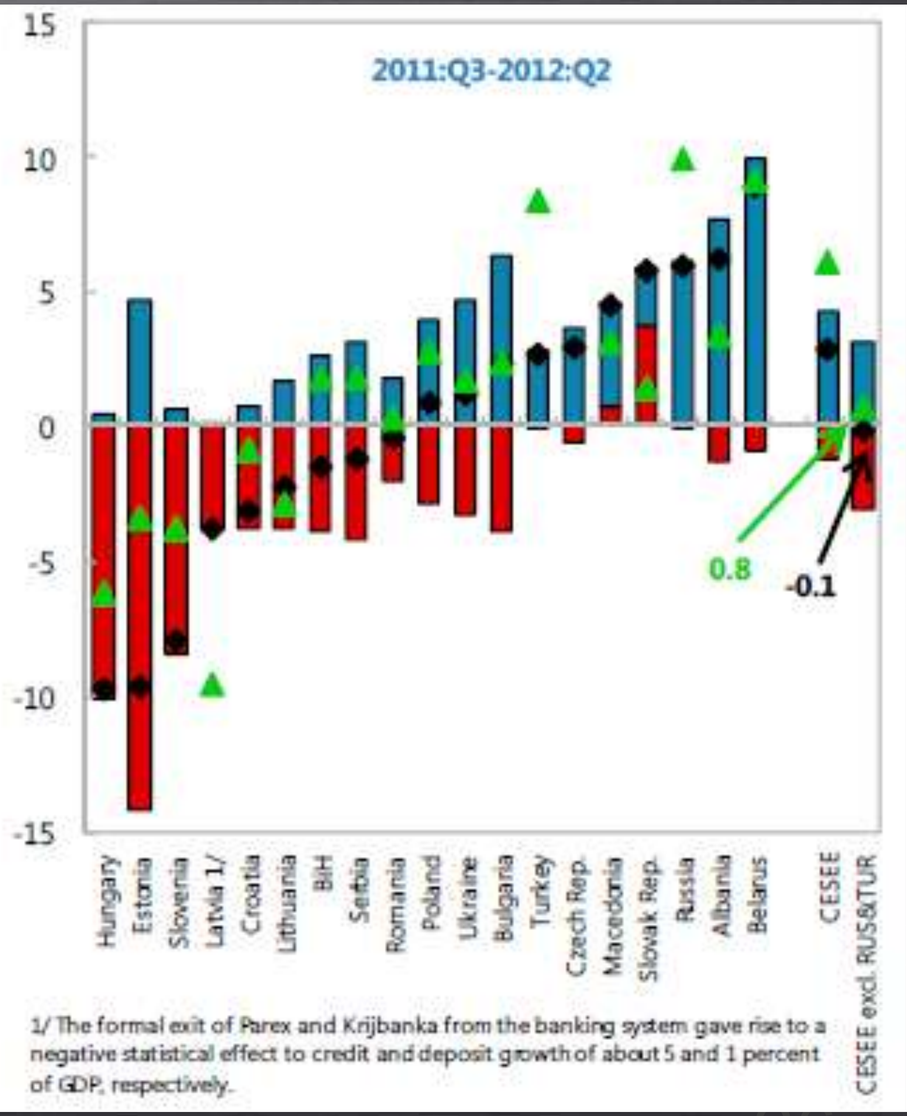
CESEE: External Positions of BIS-reporting Banks (Δ% of GDP)



Sources: EBCI Vienna Initiative , CESEE Deleveraging Monitor, BIS, Locational Banking Statistics; and IMF staff calculations

CESEE: Banks' Funding Sources and Credit Developments

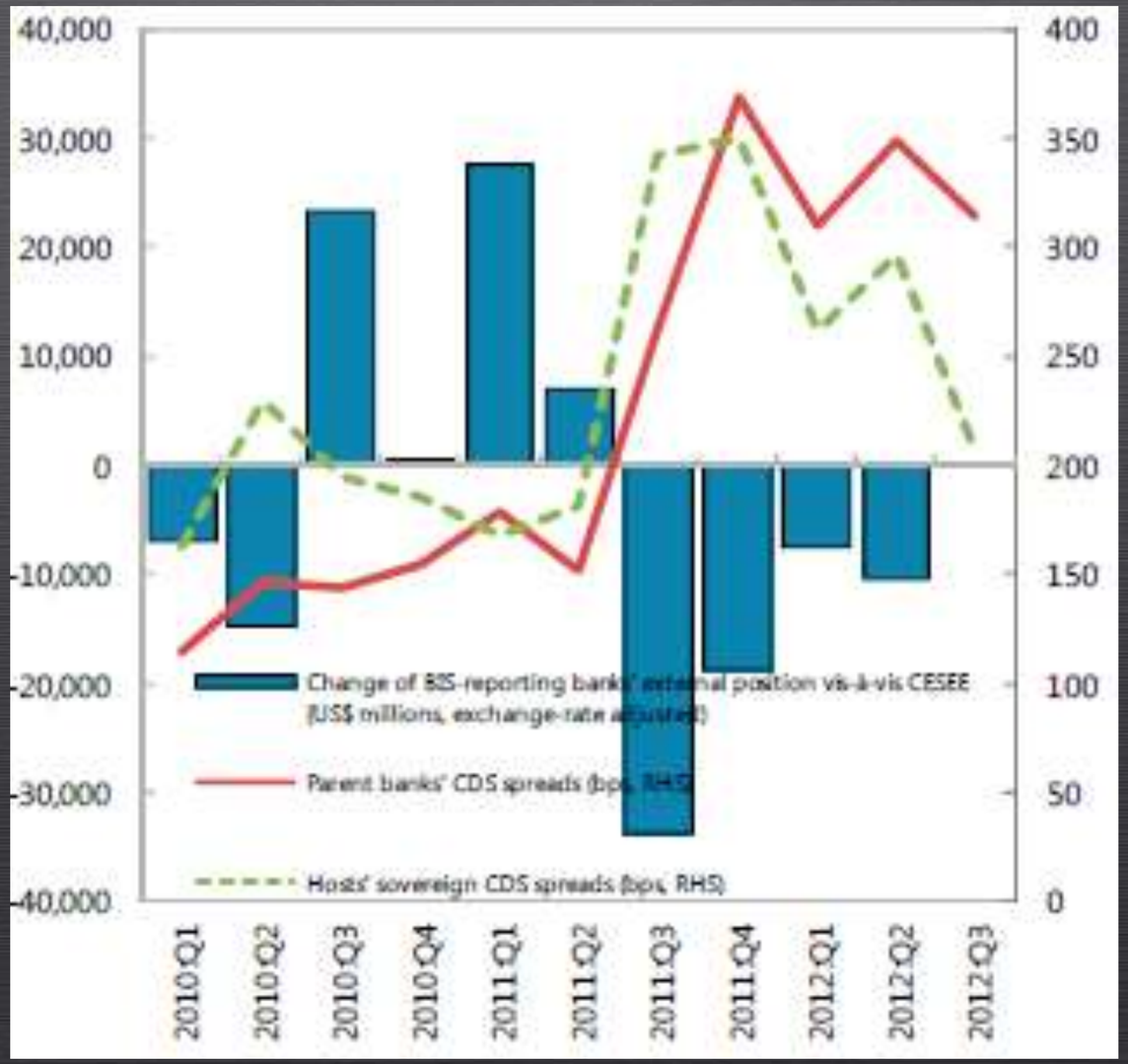




1/ The formal exit of Parex and Krijbanka from the banking system gave rise to a negative statistical effect to credit and deposit growth of about 5 and 1 percent of GDP, respectively.

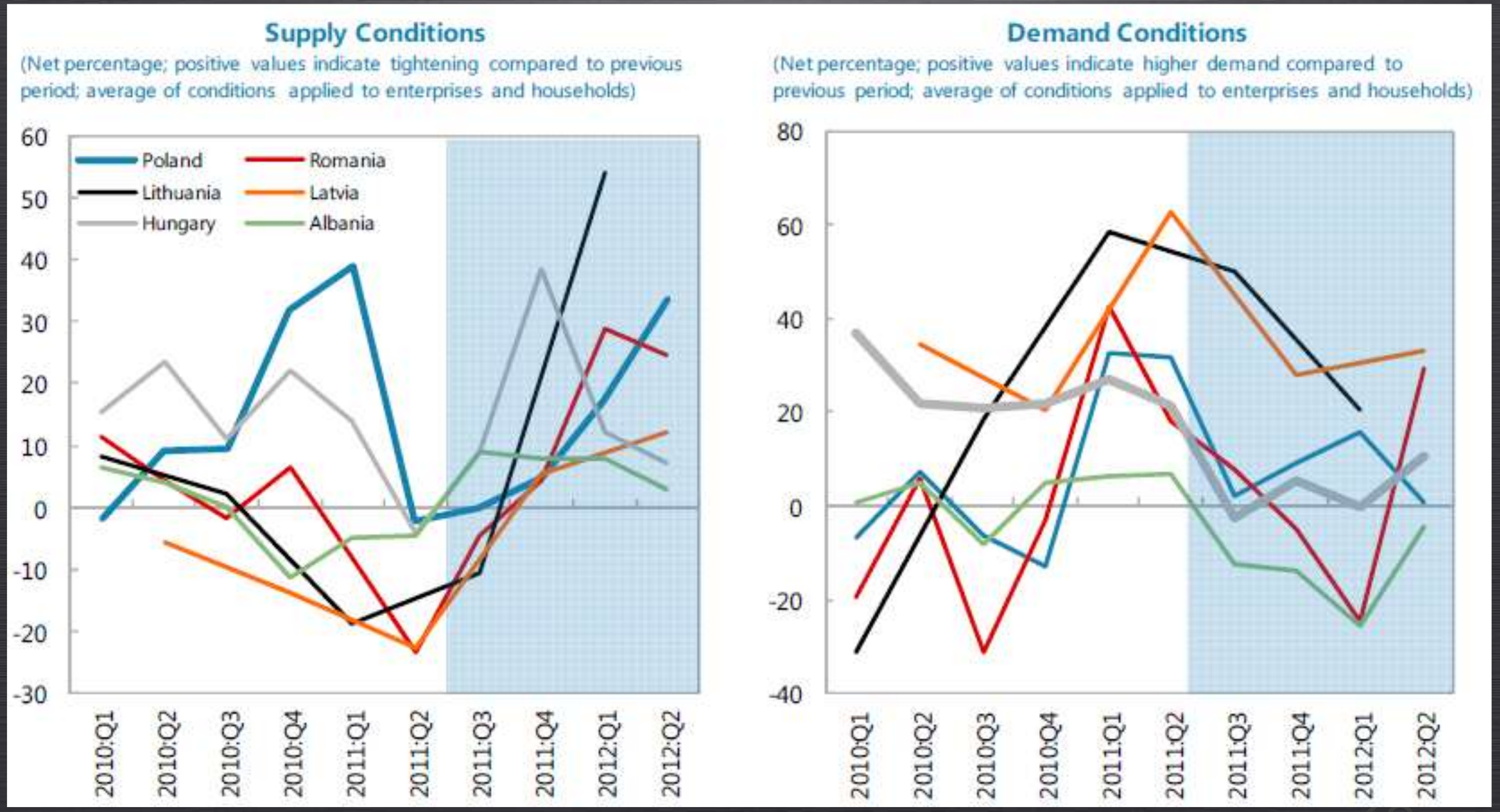
Sources: CESEE Deleveraging Monitor, BIS, Locational Banking Statistics; IMF, IFS; IMF, WEO; national authorities; EBRD; and IMF staff calculations.

CESEE: Funding by Western Banks and Their Funding Costs



Sources: EBCI Vienna Initiative , CESEE Deleveraging Monitor, BIS, Locational Banking Statistics; Bloomberg; and IMF staff

Selected CESEE Countries: Credit Supply and Demand Conditions, 2010:Q1 - 2012:Q2



Sources: EBCI Vienna Initiative , CESEE Deleveraging Monitor, Lending surveys of central banks; and IMF staff calculations

IMF Analysis in 2012 Spillover Report

In simulation, the countries in Central, Eastern, and South Eastern Europe (CESEE) bear much of the brunt of euro area stress, reflecting extensive trade and banking linkages—the latter have played a major role in credit boom-bust cycles in several CESEE countries.