

Global Banking Glut and Loan Risk Premium

Hyun Song Shin

Mundell-Fleming Lecture

IMF Annual Research Conference
November 10-11, 2011

Fleming (1962) and Mundell (1963)

- elevated **capital flows** as a separate modeling component
- ... not merely as residual to the real side of the economy
- Capital flows are back in focus, both for **advanced** and **emerging economies**
- Time to take stock of changes in financial system since Fleming (1962) and Mundell (1963)

Focus on Banking Sector

- Banking sector as driver of global liquidity conditions
- Global banks (esp. European global banks) as transmission channel of global liquidity conditions
- US dollar as currency underpinning global banking system

BIS Banking Statistics

- BIS **locational** banking statistics
 - Classification based on **residence**
 - Branches/subsidiaries of global banks classified under host country
 - Consistent with balance of payments and national income statistics
 - **Cross-border claims**
- BIS **consolidated** banking statistics
 - Classification based on **nationality** of parent
 - **Foreign claims** = cross-border claims + local claims
 - **International claims** = cross-border claims + local claims in foreign currency

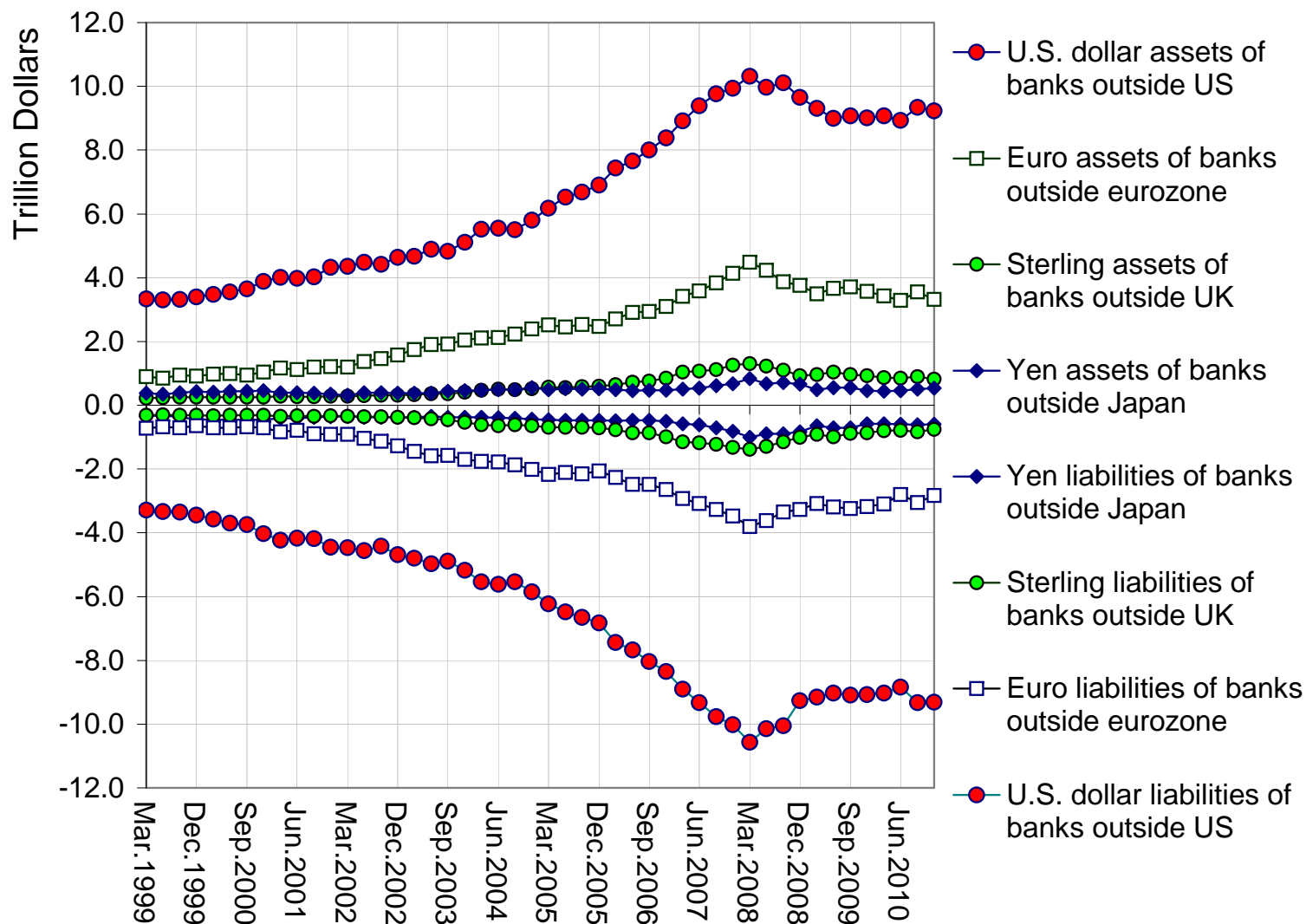


Figure 1: Cross-border foreign currency claims of BIS reporting banks by currency (Source: BIS locational banking statistics, Table 5A)

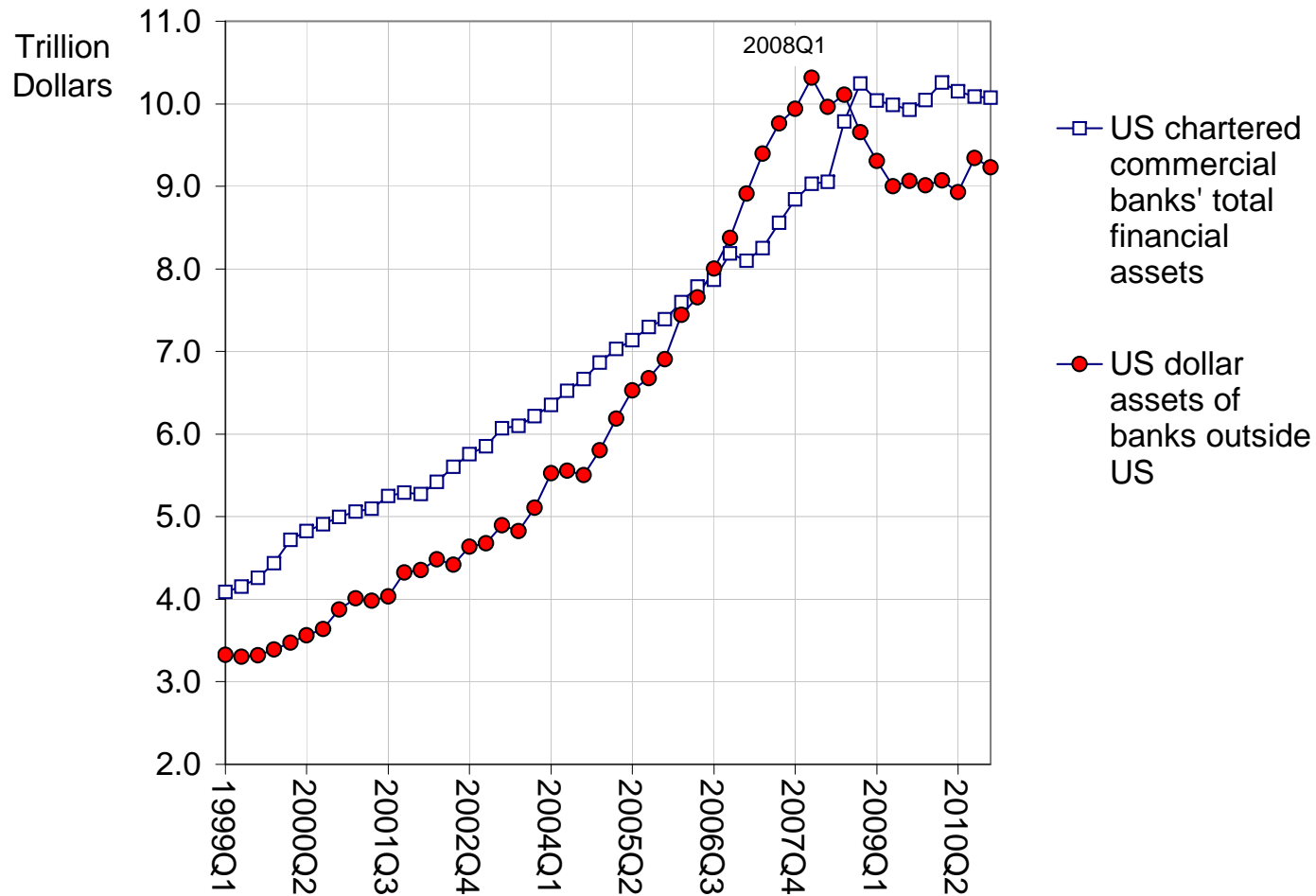


Figure 2: US dollar cross-border foreign currency claims and US commercial bank total assets (Source: Flow of Funds, Federal Reserve and BIS locational banking statistics, Table 5A)

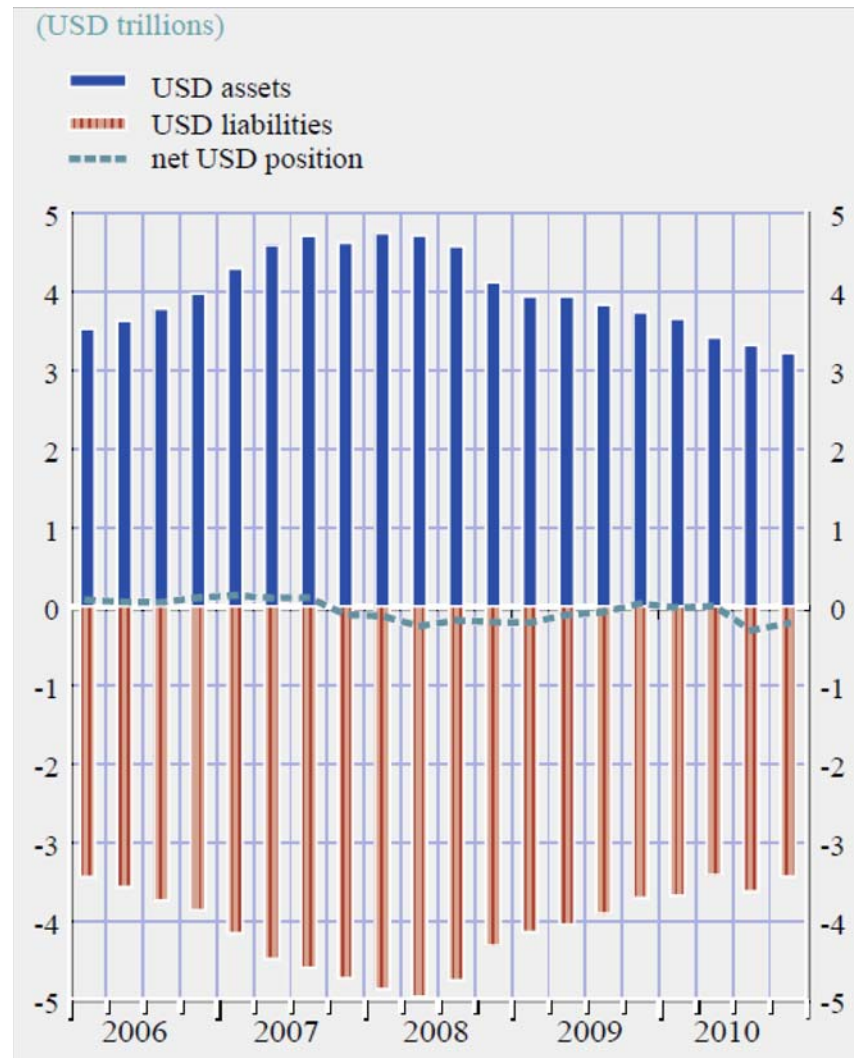


Figure 3: US Dollar-denominated assets and liabilities of euro area banks (Source: ECB Financial Stability Review, June 2011, p. 102)

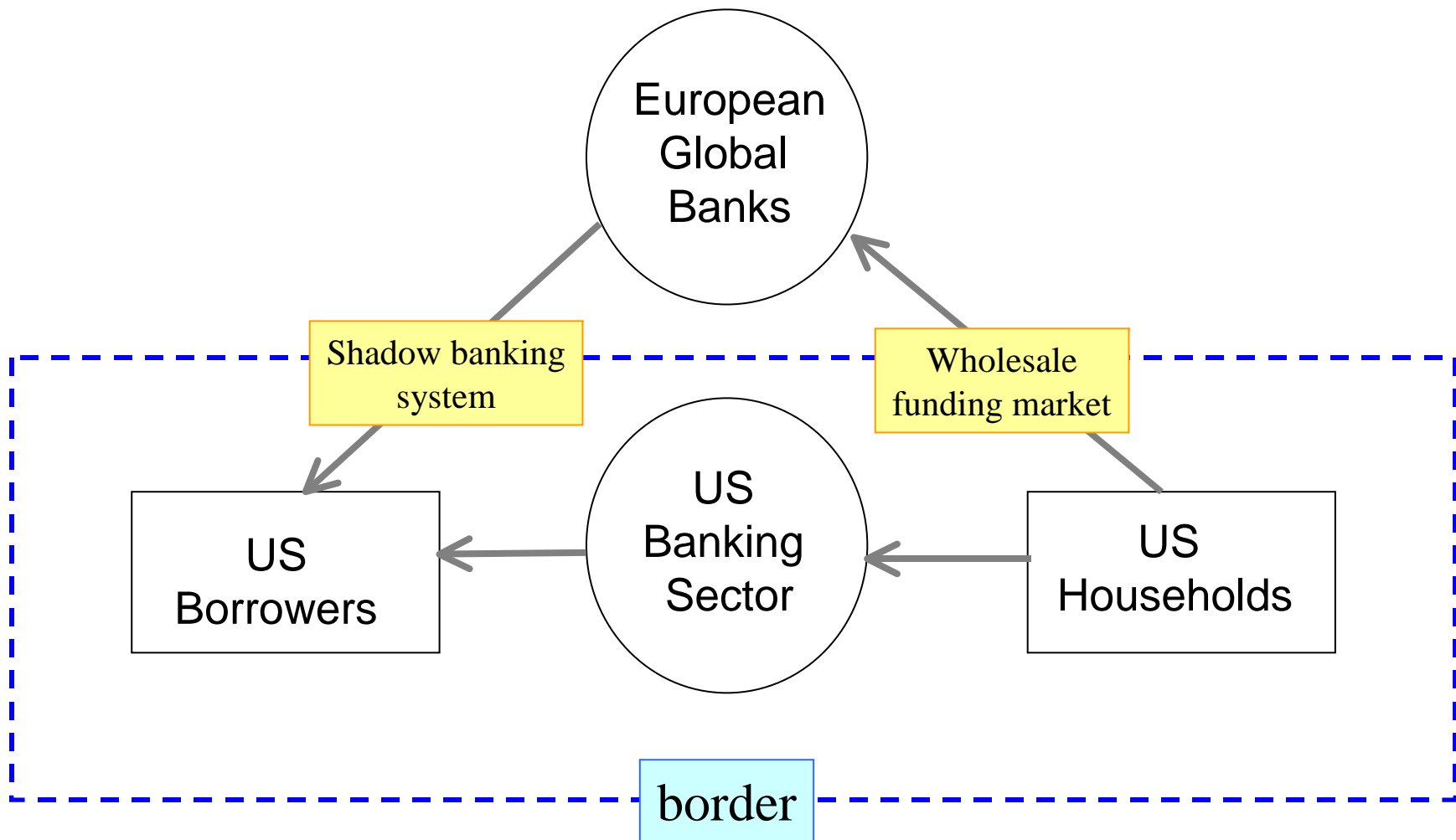


Figure 4: European global banks add intermediation capacity for connecting US savers and borrowers

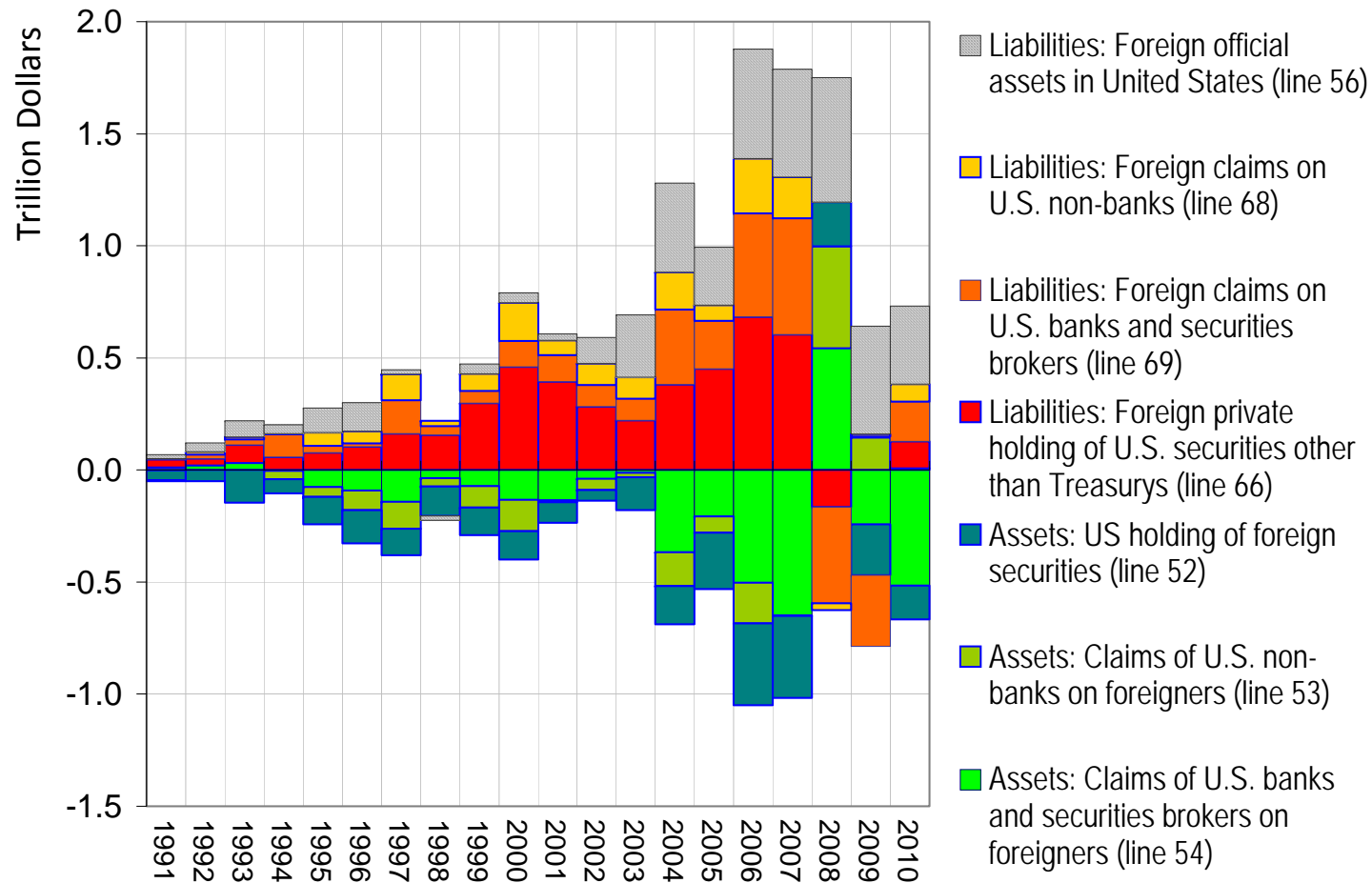
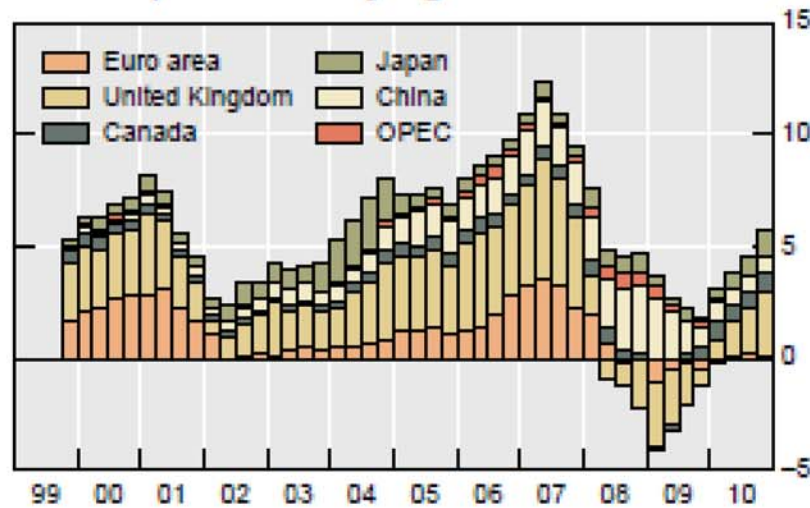


Figure 5: US gross capital flows by category (Source: US Bureau of Economic Analysis). Increase in US liability to foreigners is indicated by positive bar, increase in US claims on foreigners is indicated by negative bar.

Gross capital inflows by region



Gross capital outflows by region

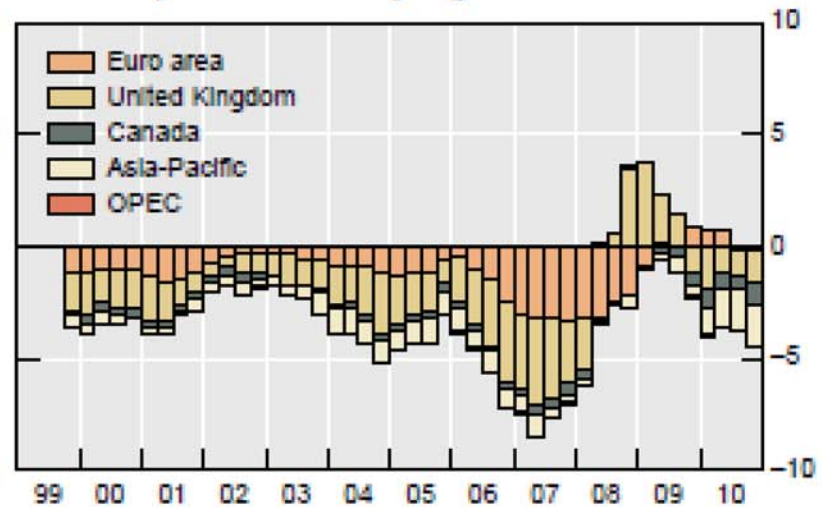


Figure 6: US gross capital flows by region (Source: Borio and Disyatat (2011, graph 6)) Gross capital flows are expressed as percentage of US GDP

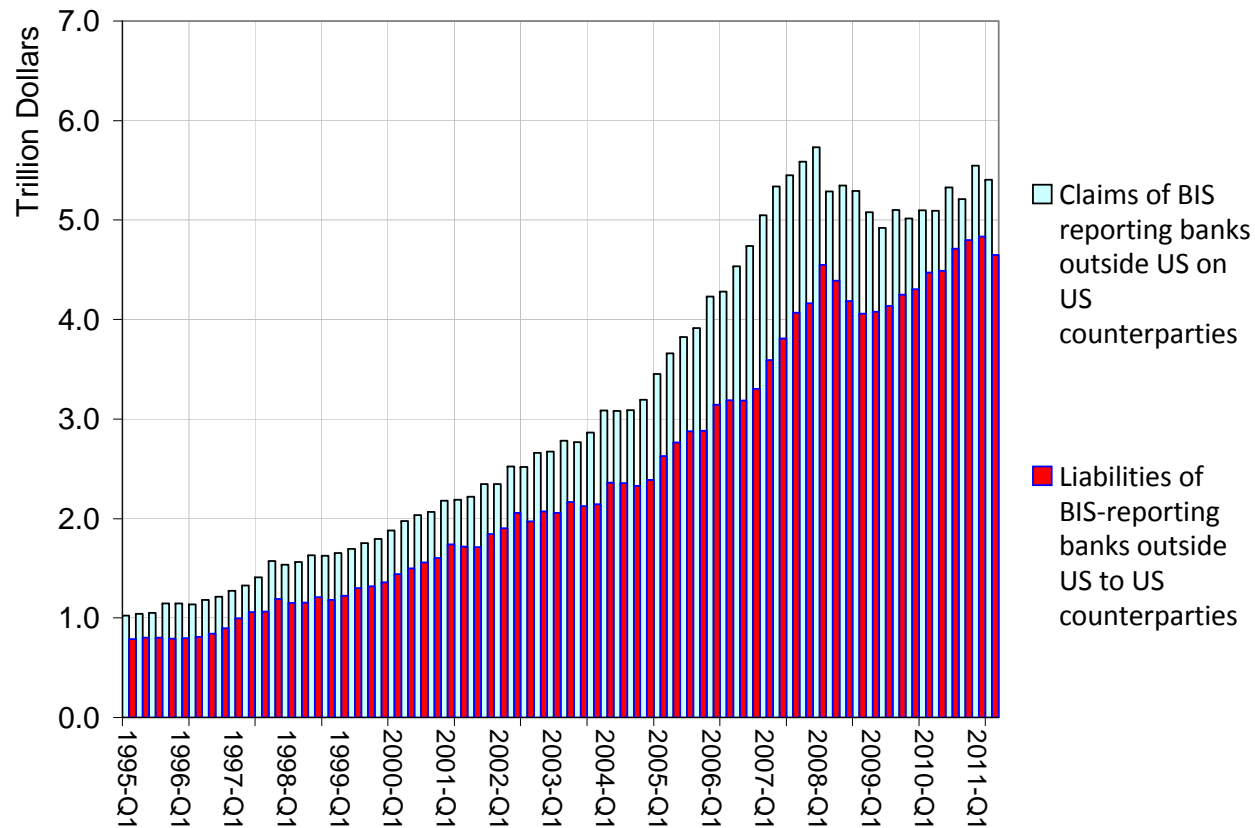


Figure 7: Claims and liabilities of BIS-reporting banks outside US on US counterparties (all currencies) (Source: BIS locational banking statistics, Table 6A)

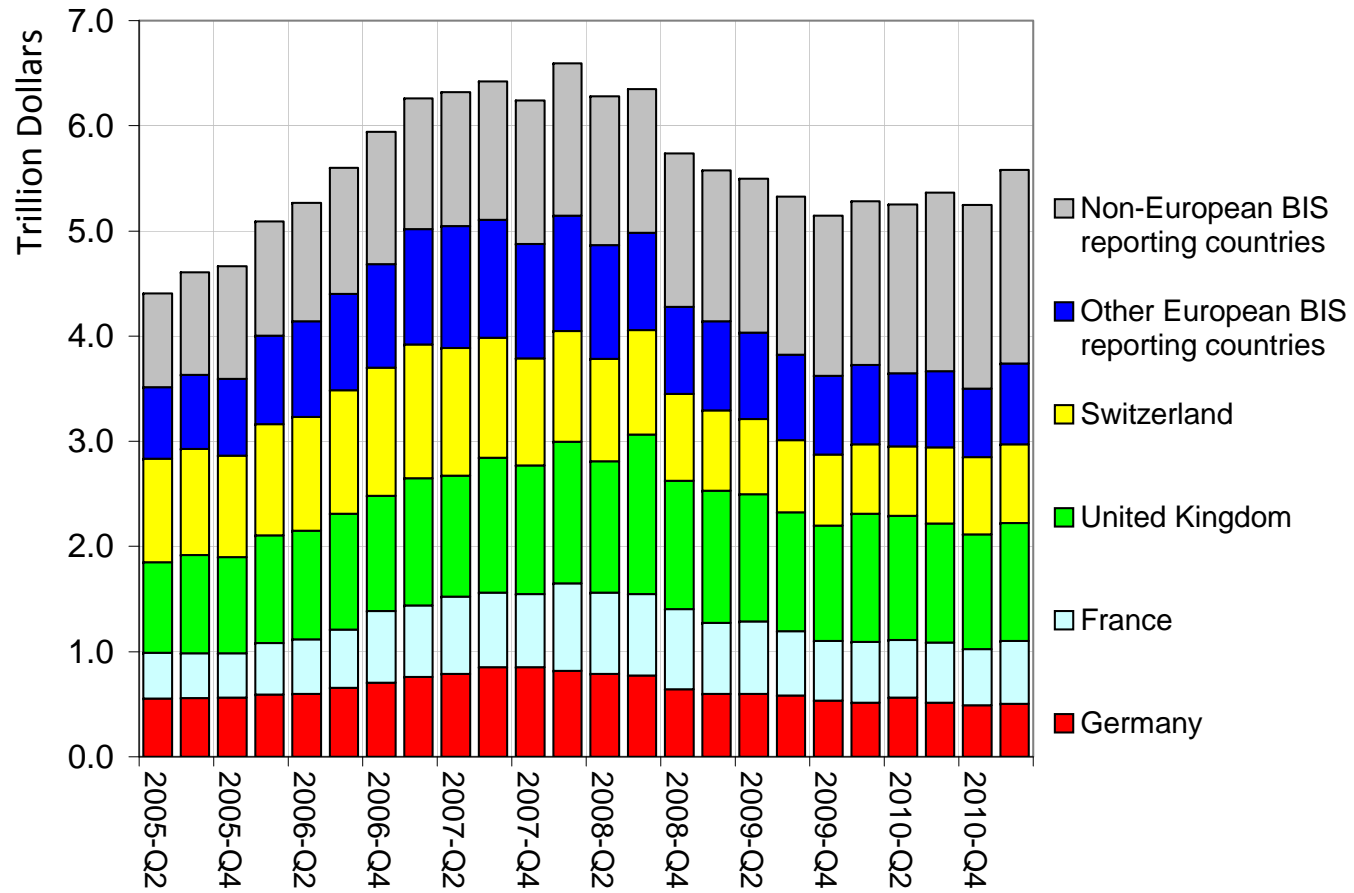


Figure 8: Foreign claims of BIS reporting banks on US counterparties (Source: BIS consolidated banking statistics, Table 9D)

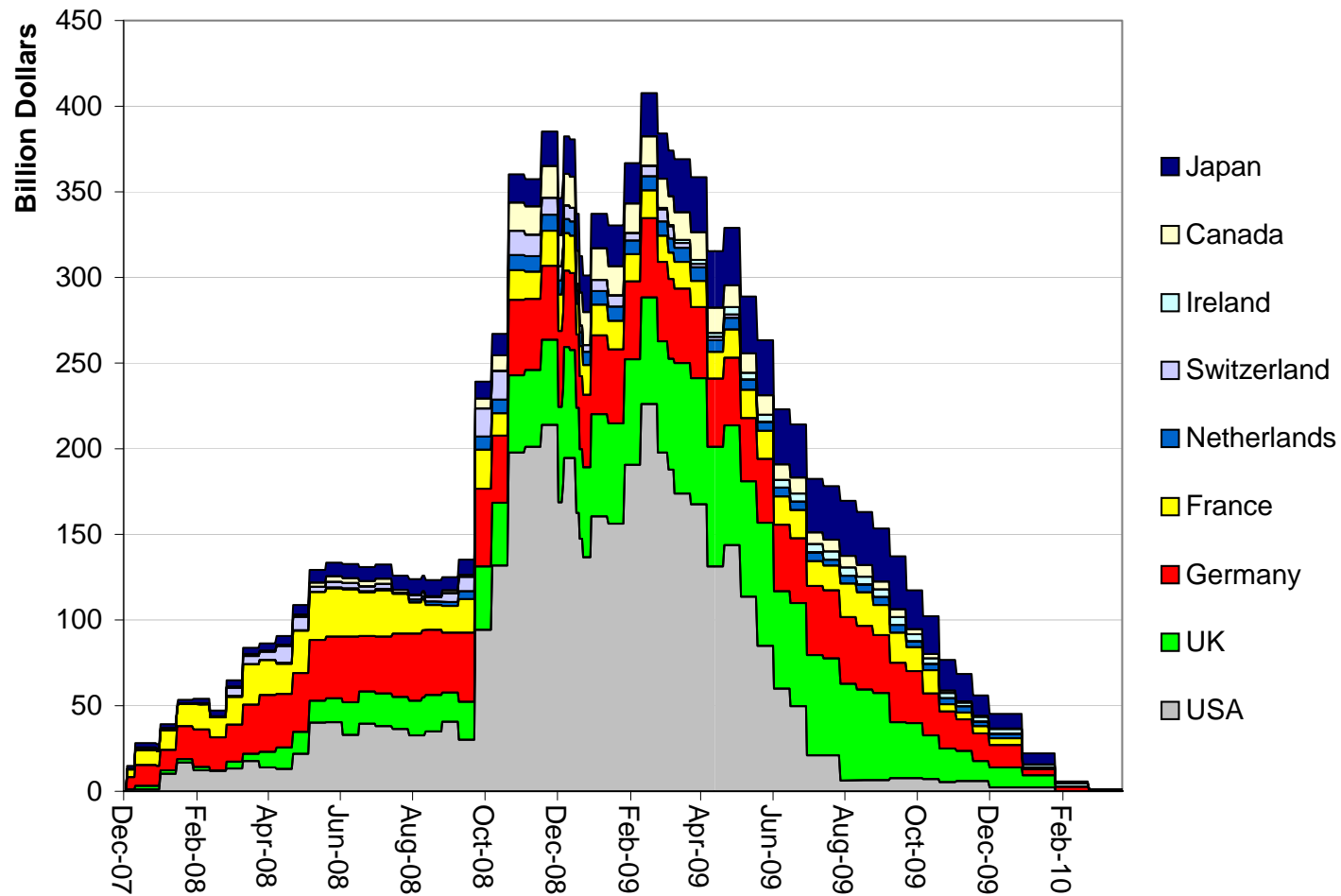


Figure 9: Claims outstanding on Federal Reserve Term Auction Facility (TAF) on US and non-US banks (Source: Federal Reserve disclosures of TAF)

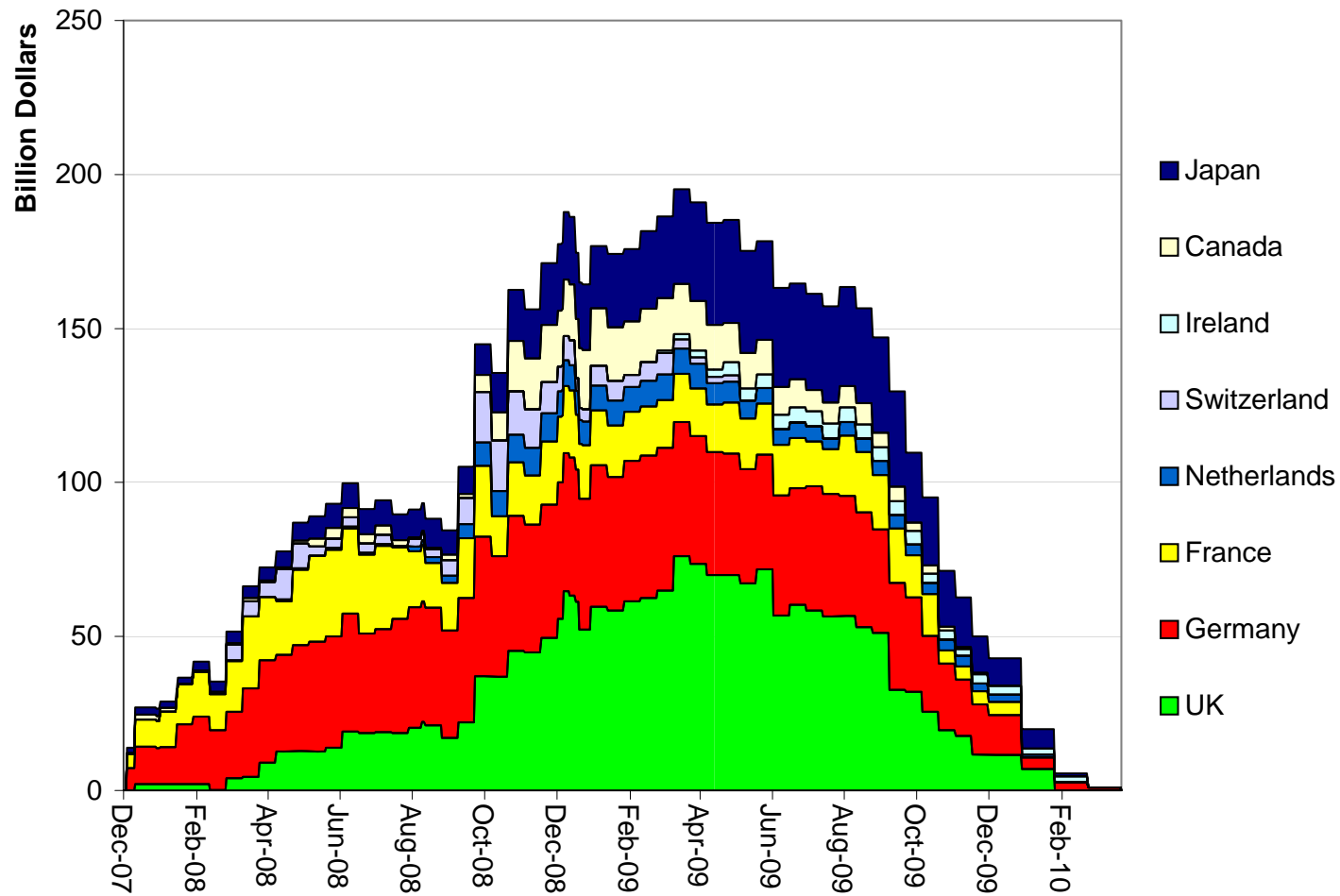


Figure 10: Claims outstanding on Federal Reserve Term Auction Facility (TAF) on non-US banks (Source: Federal Reserve disclosures on TAF) ¹³

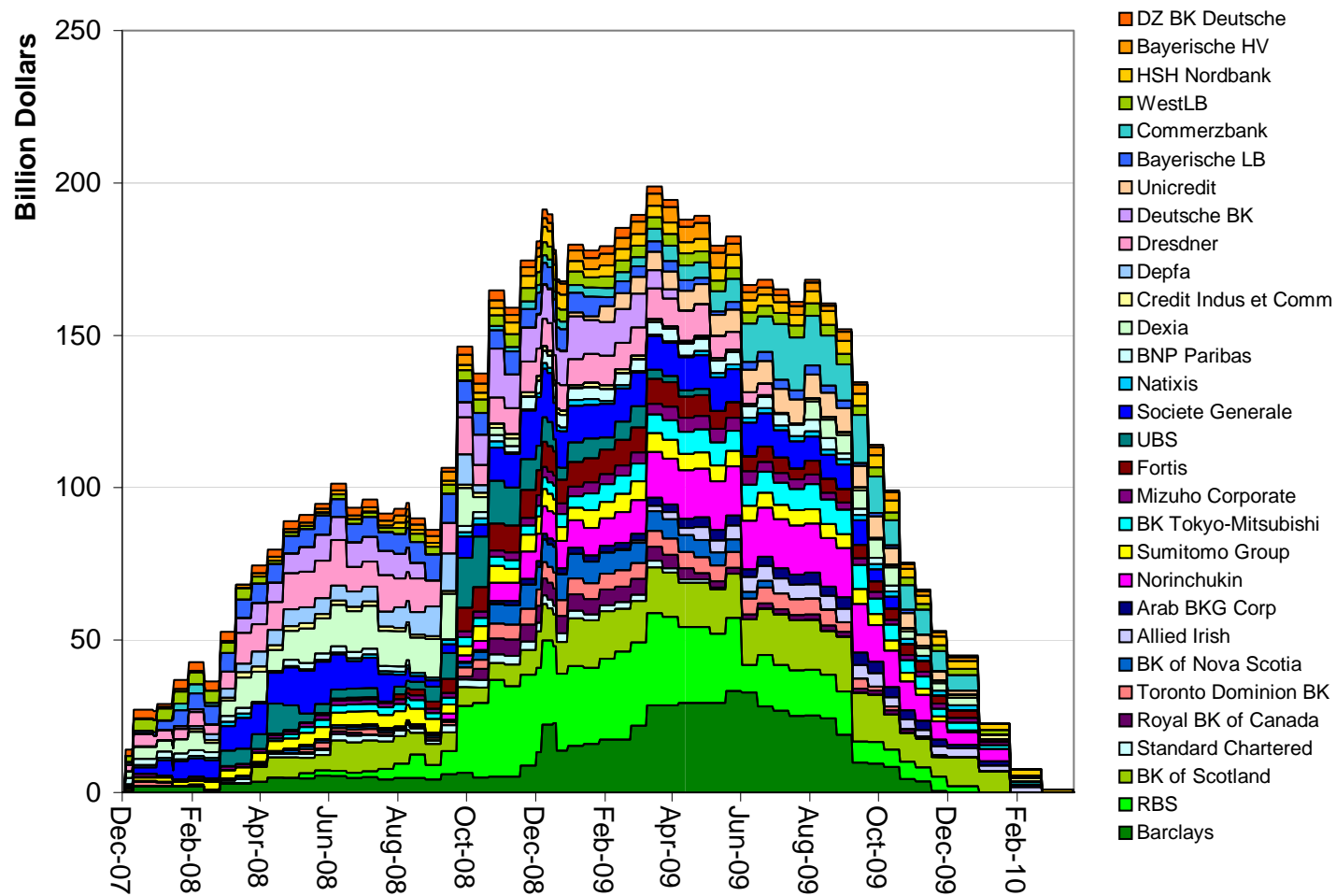


Figure 11: Top 30 claims outstanding on Federal Reserve Term Auction Facility (TAF) on non-US banks (Source: Federal Reserve disclosures of TAF)

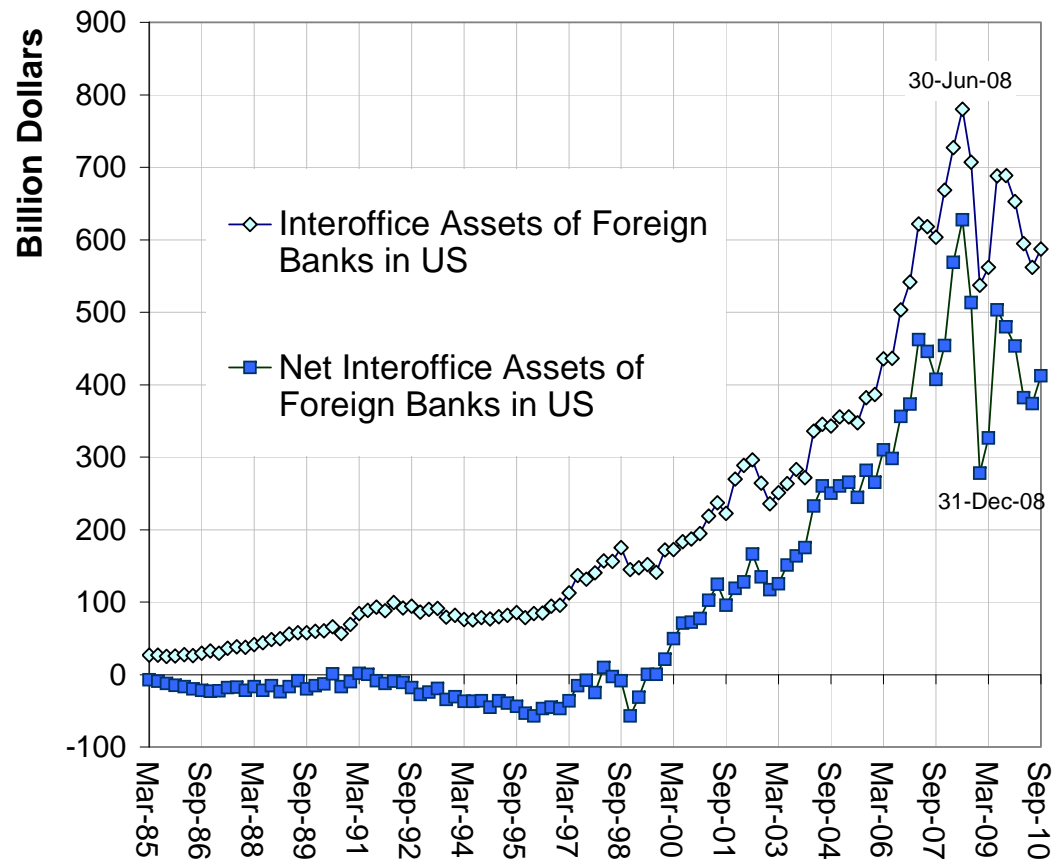


Figure 12: Interoffice assets of foreign banks in the United States (Source: Federal Reserve, series on “Assets and Liabilities of U.S. Branches and Agencies of Foreign Banks”)

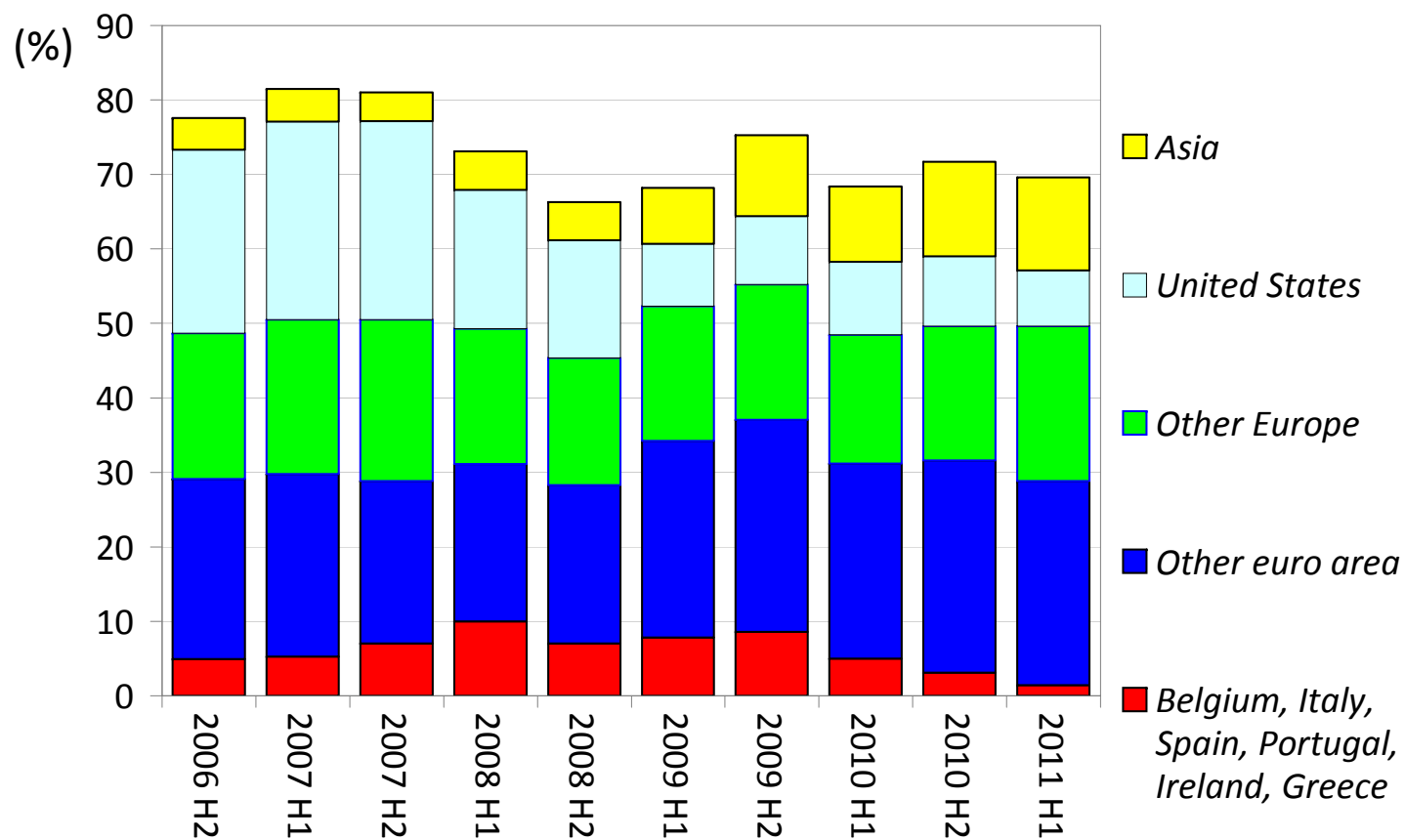


Figure 13: Amount owed by banks to US prime money market funds (% of total), based on top 10 prime MMFs, representing \$755 bn of \$1.66 trn total prime MMF assets (Source: IMF GFSR Sept 2011, data from Fitch).

Amount Owed by European Banks to US Prime Money Market Funds
end-June, 2011 (by nationality of borrowing bank)

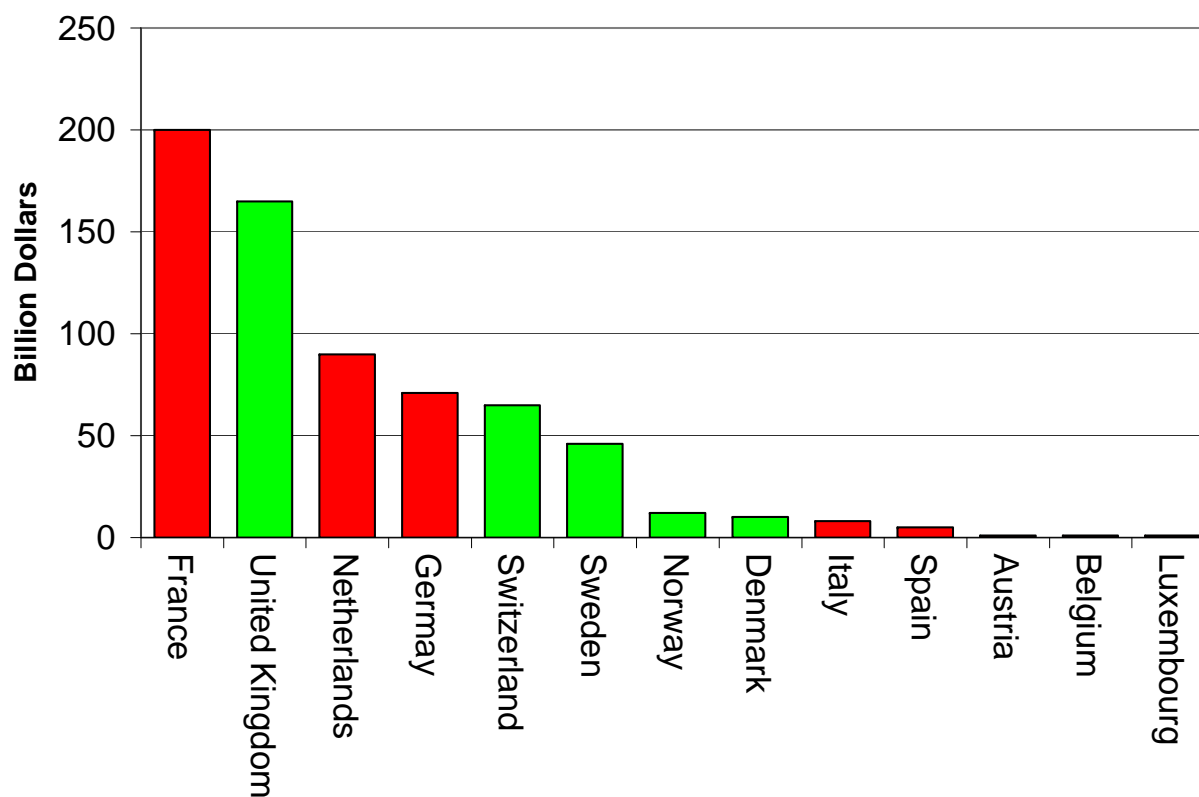


Figure 14: Amount owed by European banks to US prime money market funds by nationality of borrowing bank (end-June 2011) (Source: IMF GFSR September 2011)

ABCP Sponsor Location and Funding Currency (\$ million)

Currency / Sponsor Location	U.S. dollars	Euro	Yen	Other	Total
Belgium	30,473	4,729	0	0	35,202
Denmark	1,796	0	0	0	1,796
France	51,237	23,670	228	557	75,692
Germany	139,068	62,885	0	2,566	204,519
Italy	1,365	0	0	0	1,365
Japan	18,107	0	22,713	0	40,820
Netherlands	56,790	65,859	0	3,116	125,765
Sweden	1,719	0	0	0	1,719
Switzerland	13,082	0	0	0	13,082
United Kingdom	92,842	62,298	0	3,209	158,349
United States	302,054	0	0	2,996	305,050
Total	714,871	219,441	22,941	12,444	969,697

Figure 15: ABCP sponsor location and funding currency January 1, 2007 (Source: Acharya and Schnabel, IMF Economic Review 2009, data from Moody's)

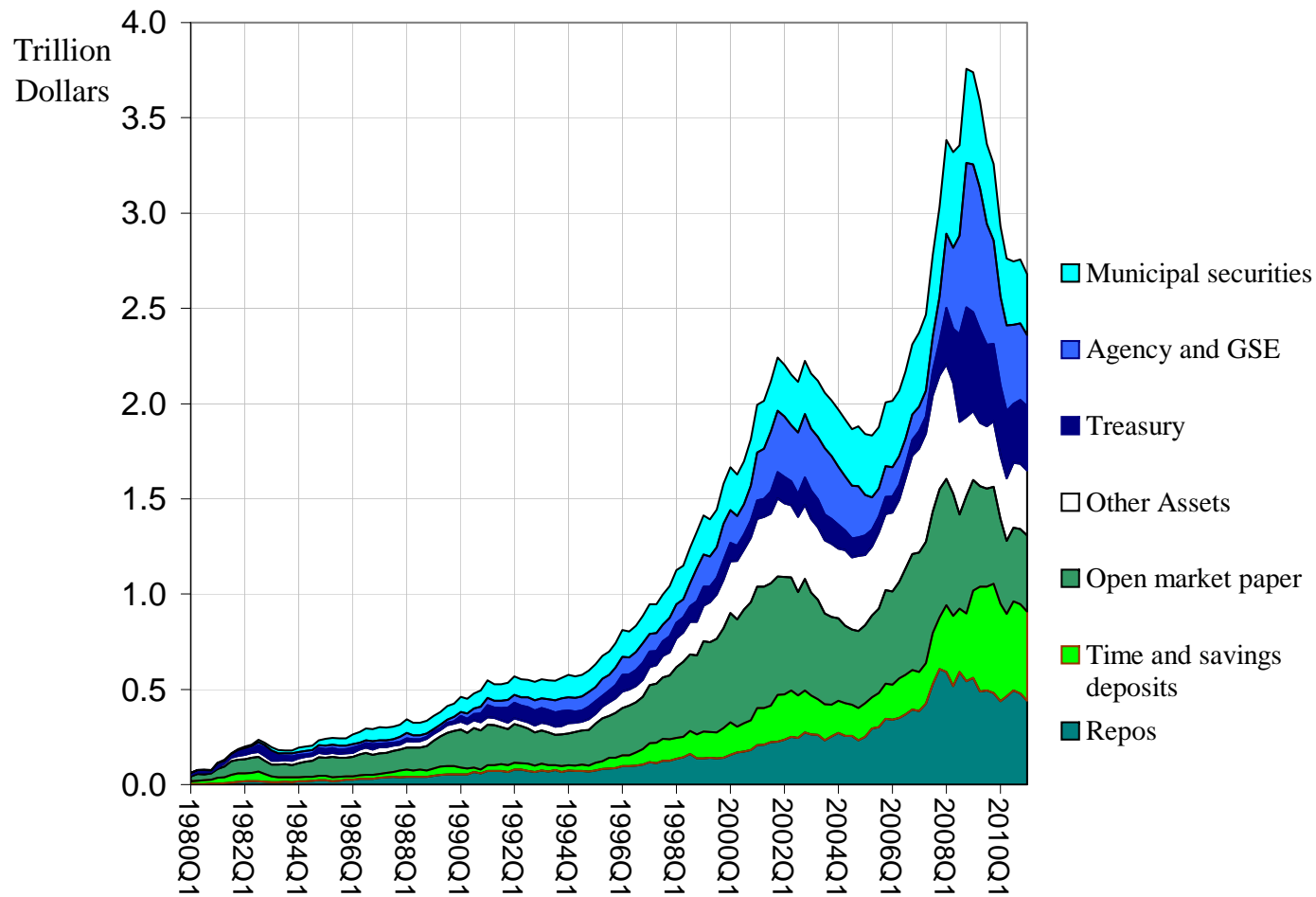


Figure 16: US Money market mutual fund assets (Source: Federal Reserve, Flow of Funds)

Gross Positions versus Net Positions

- Large **gross positions** created by European banks impact on US financial conditions.
- But **net positions** (current account imbalances) are small since assets and liabilities net out.
 - Eurzone has near-balanced current account
 - UK has current account deficit
 - Borio and Disyatat (2011)
- Focusing on **Global Savings Glut** (net positions) misses the **Global Banking Glut** (gross positions)

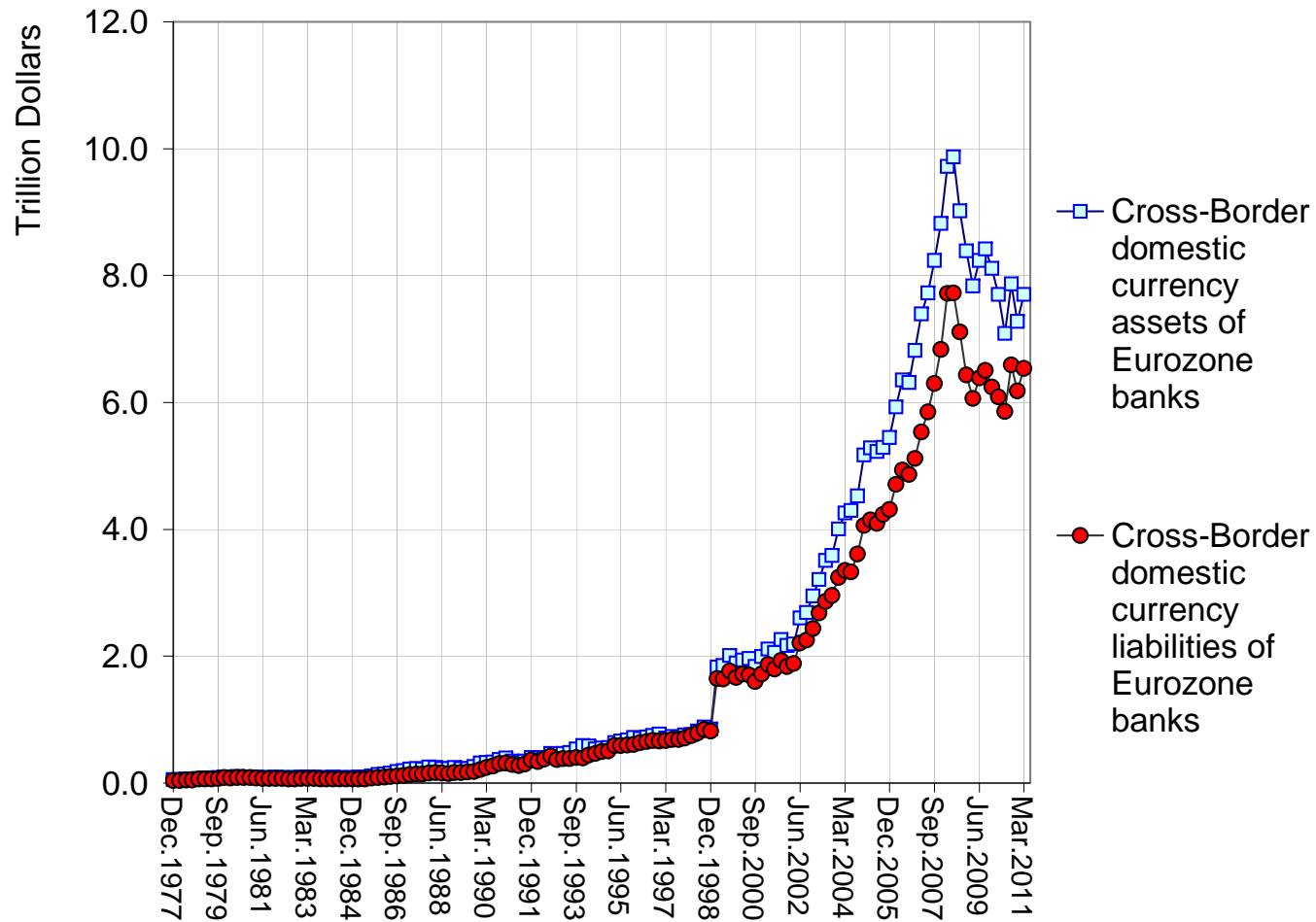


Figure 17: Cross-border domestic currency assets and liabilities of eurozone banks (Source: BIS locational banking statistics, Table 5A)

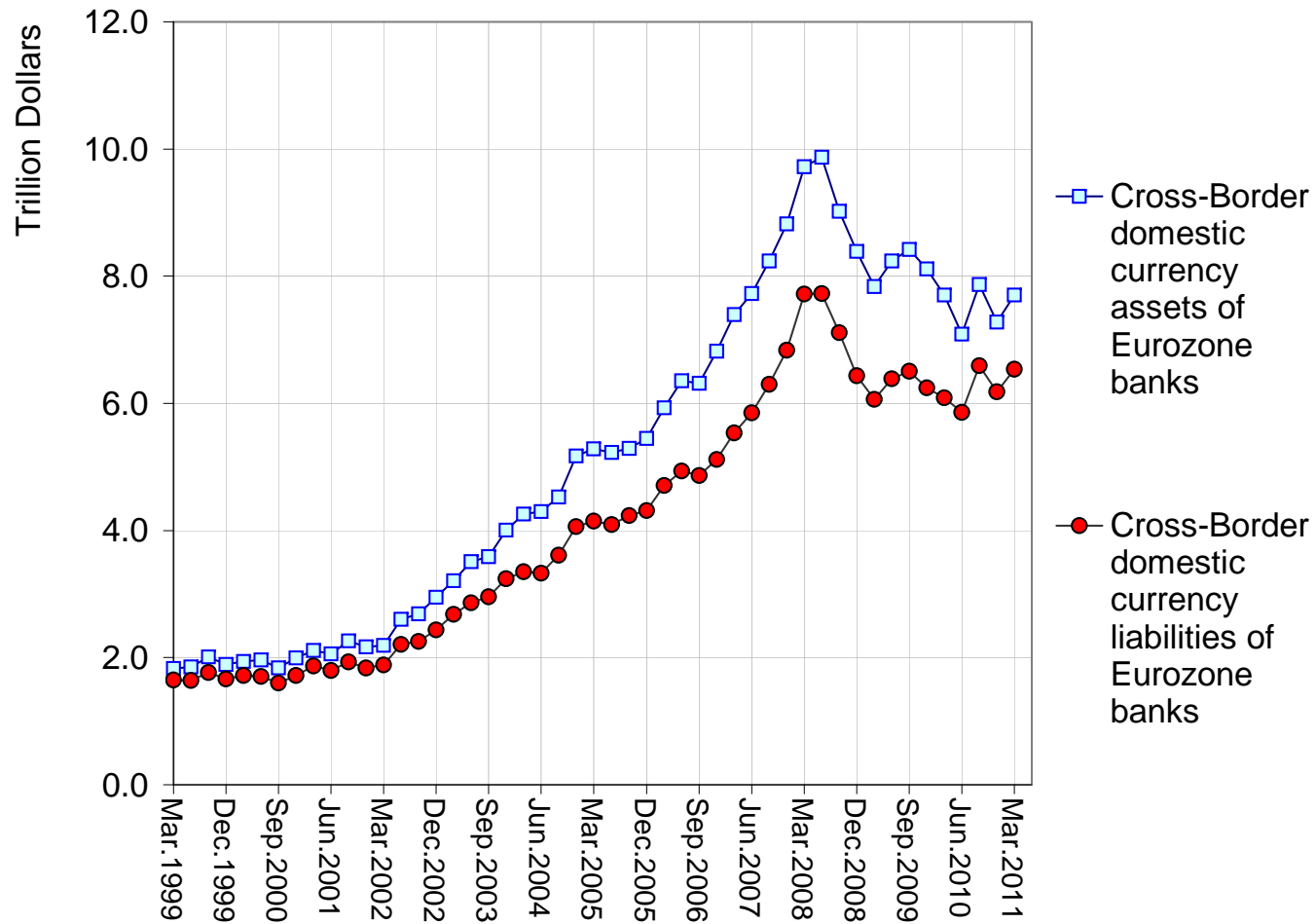


Figure 18: Cross-border domestic currency assets and liabilities of eurozone banks (Source: BIS locational banking statistics, Table 5A)

Claims of European Banks on Counterparties in Spain

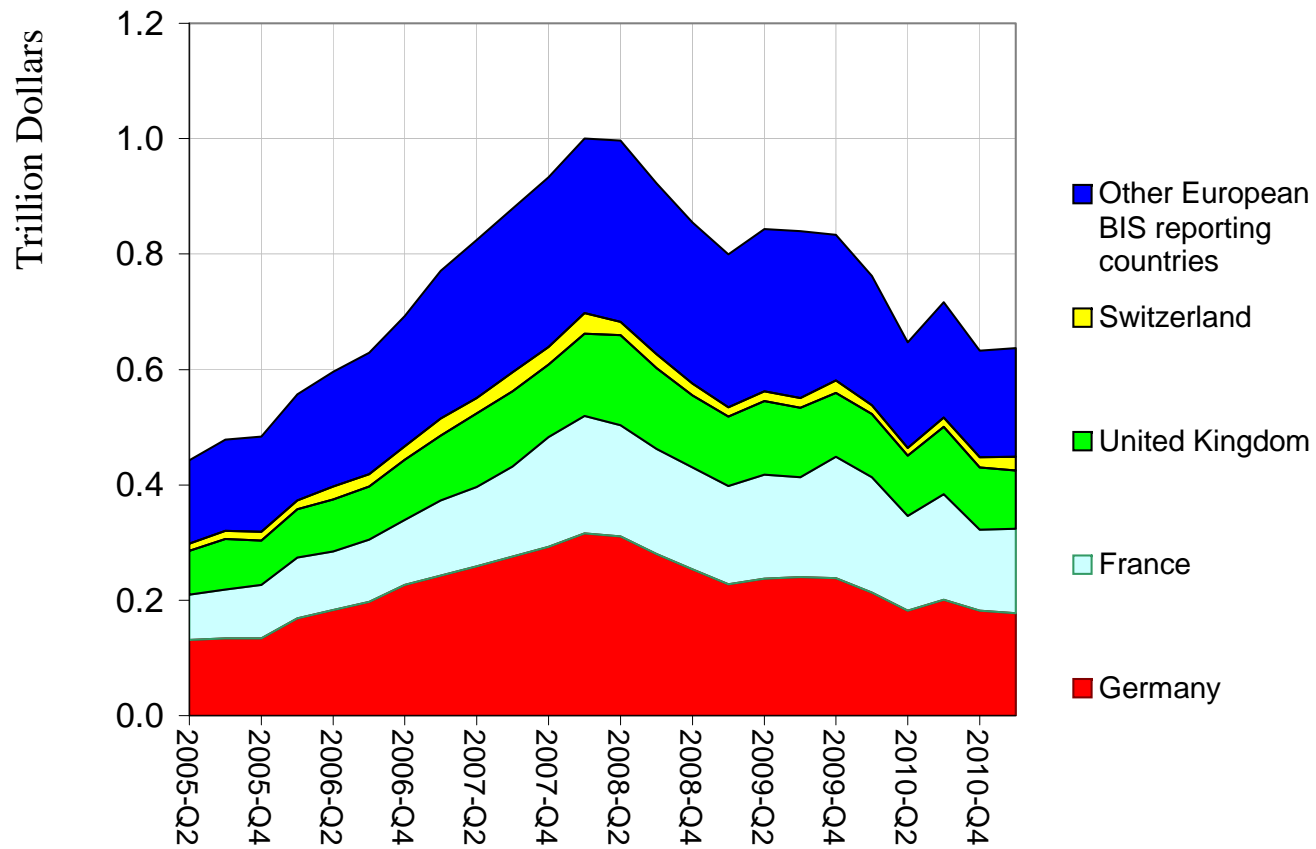


Figure 19: Foreign claims of European BIS-reporting banks on counterparties in Spain (Source: BIS consolidated banking statistics, Table 9D)

Claims of European banks on Counterparties in Ireland

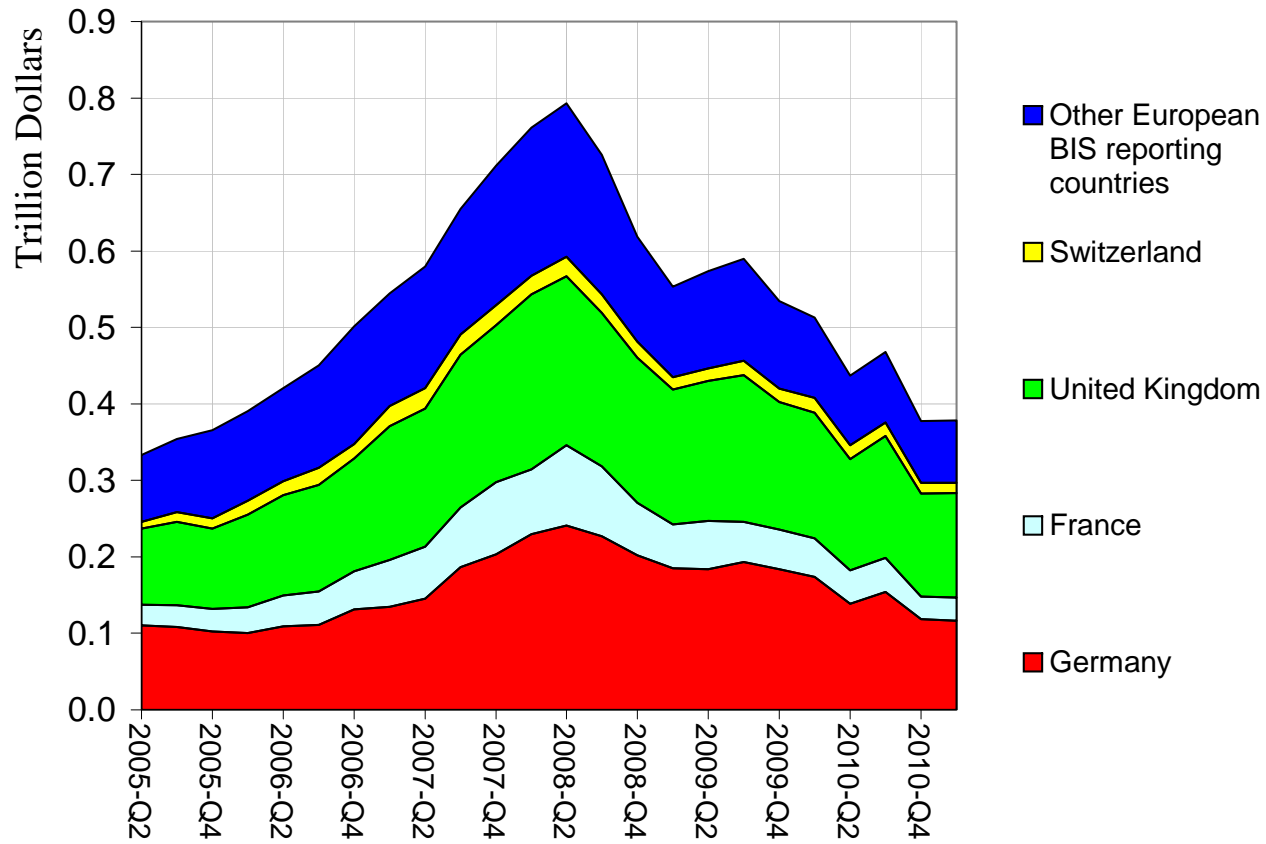


Figure 20: Foreign claims of European BIS-reporting banks on counterparties in Ireland (Source: BIS consolidated banking statistics, Table 9D)

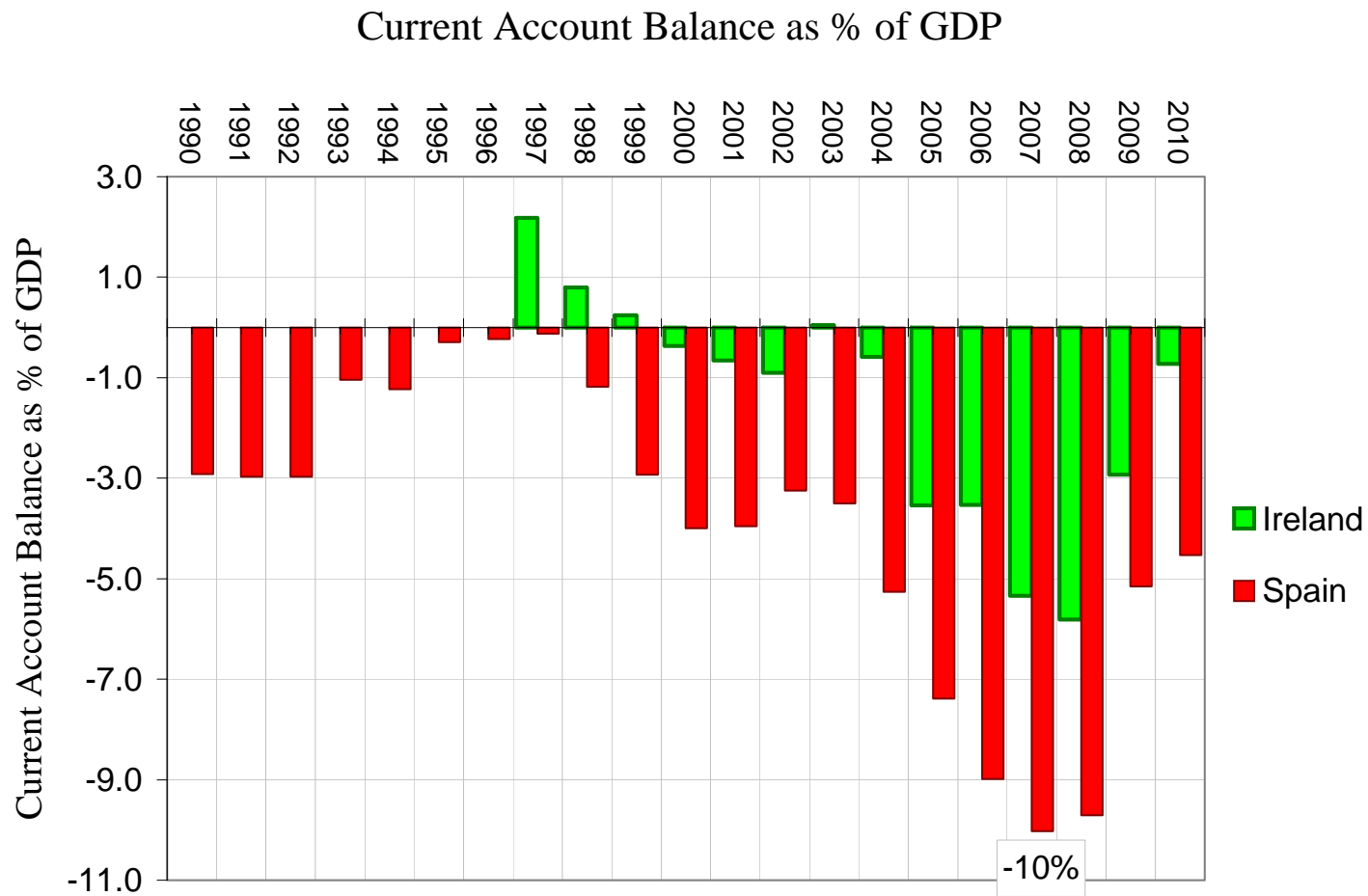


Figure 21: Current account of Ireland and Spain (Source: IMF International Financial Statistics)

Why did European banks expand so much?

Two candidate explanations:

- Regulatory environment: circumvention of Basel I, impending Basel II and EU Capital Adequacy Directive (CAD)
- Advent of Euro opened up cross-border banking market within the eurozone

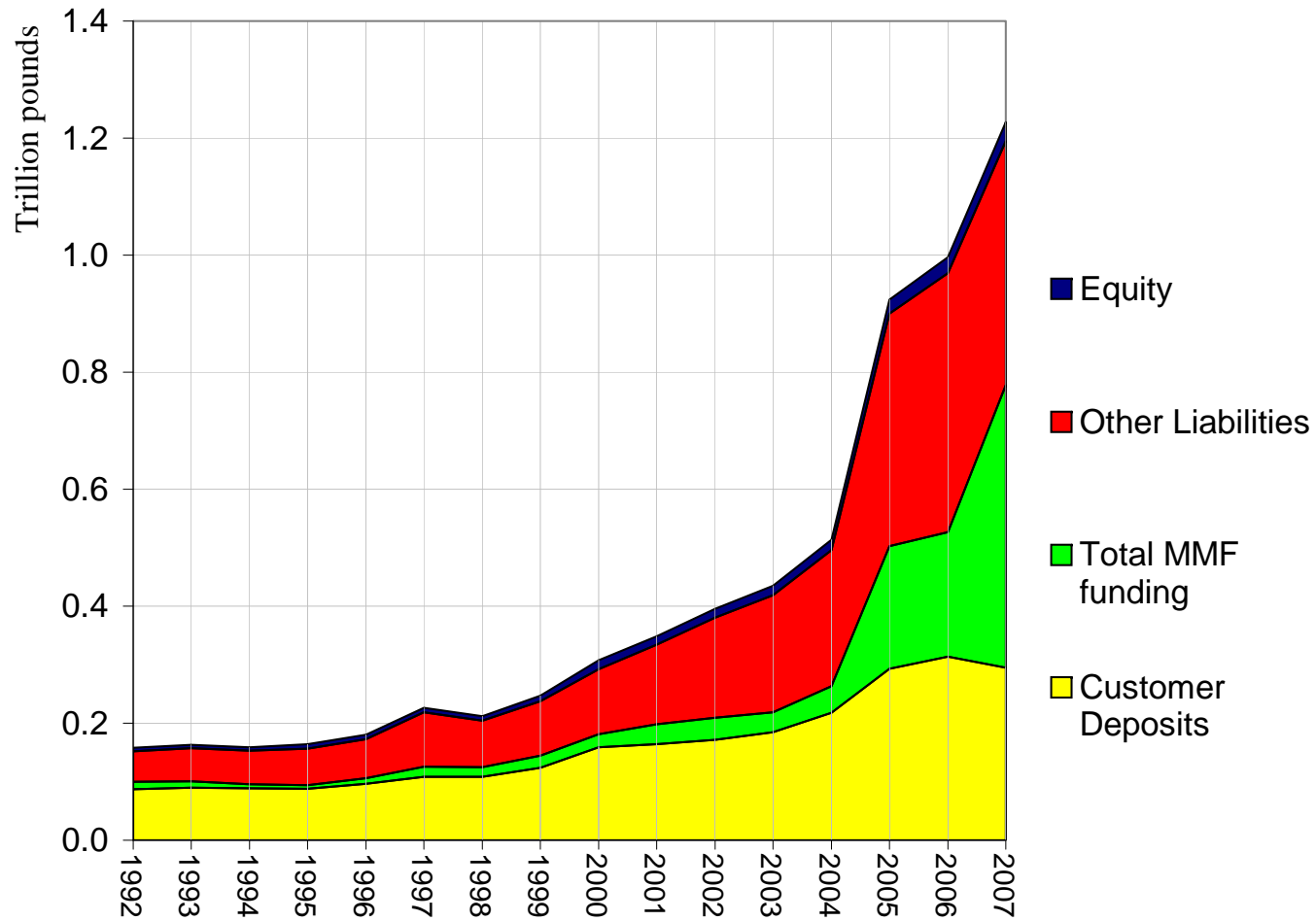


Figure 22: Total Liabilities of Barclays (1992 - 2007) (Source: Bankscope)

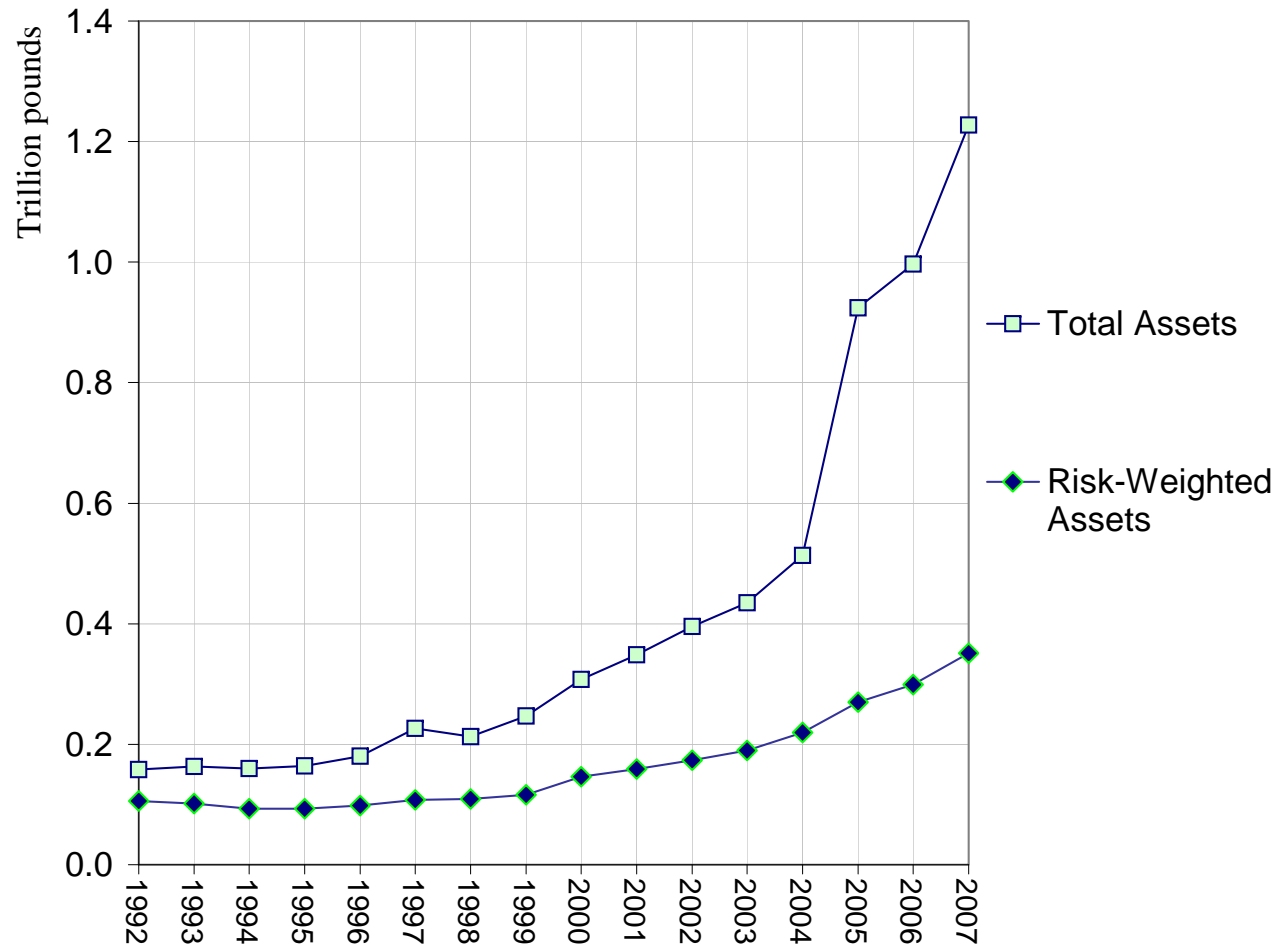


Figure 23: Barclays, risk-weighted assets and total assets (Source: Bankscope)

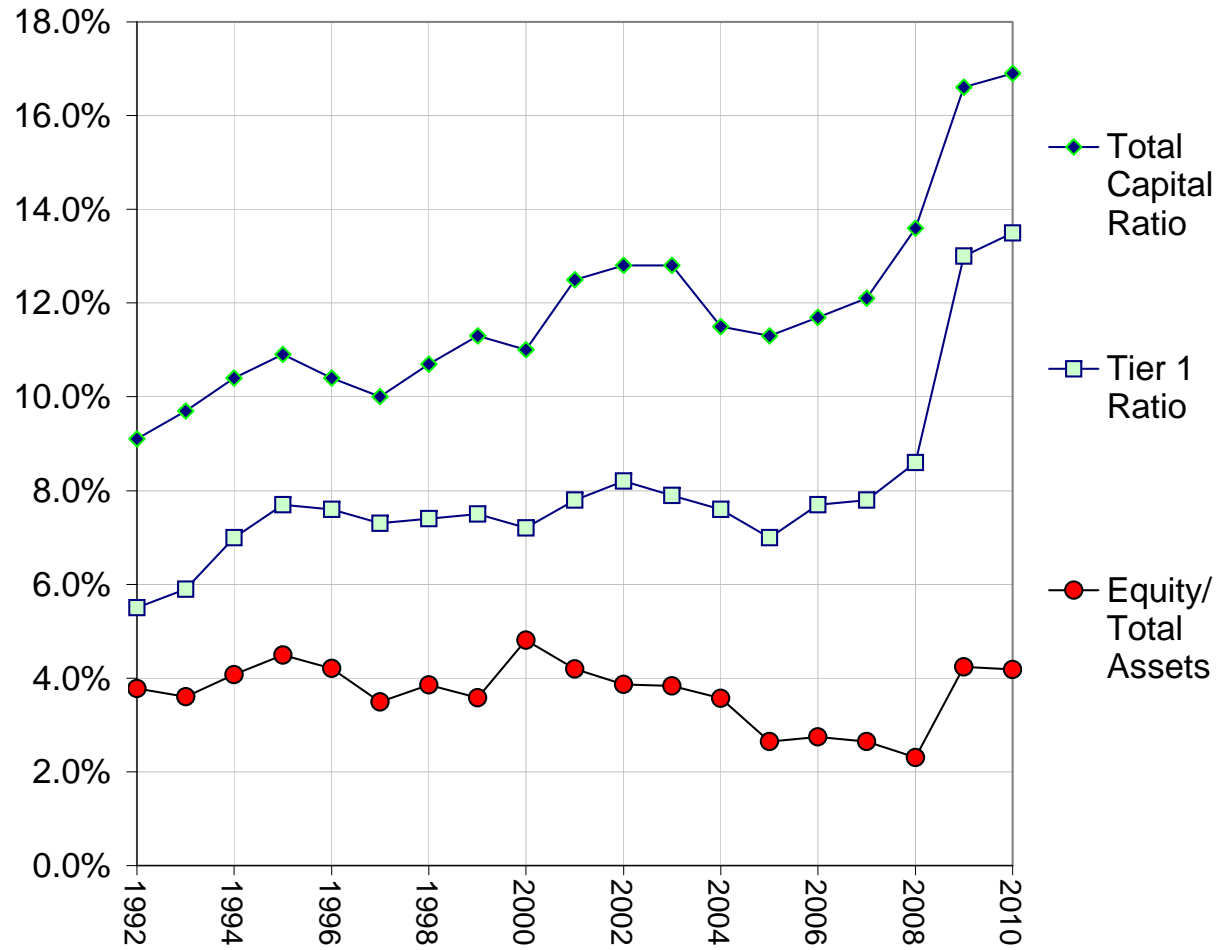


Figure 24: Barclays, capital ratios (Source: Bankscope)

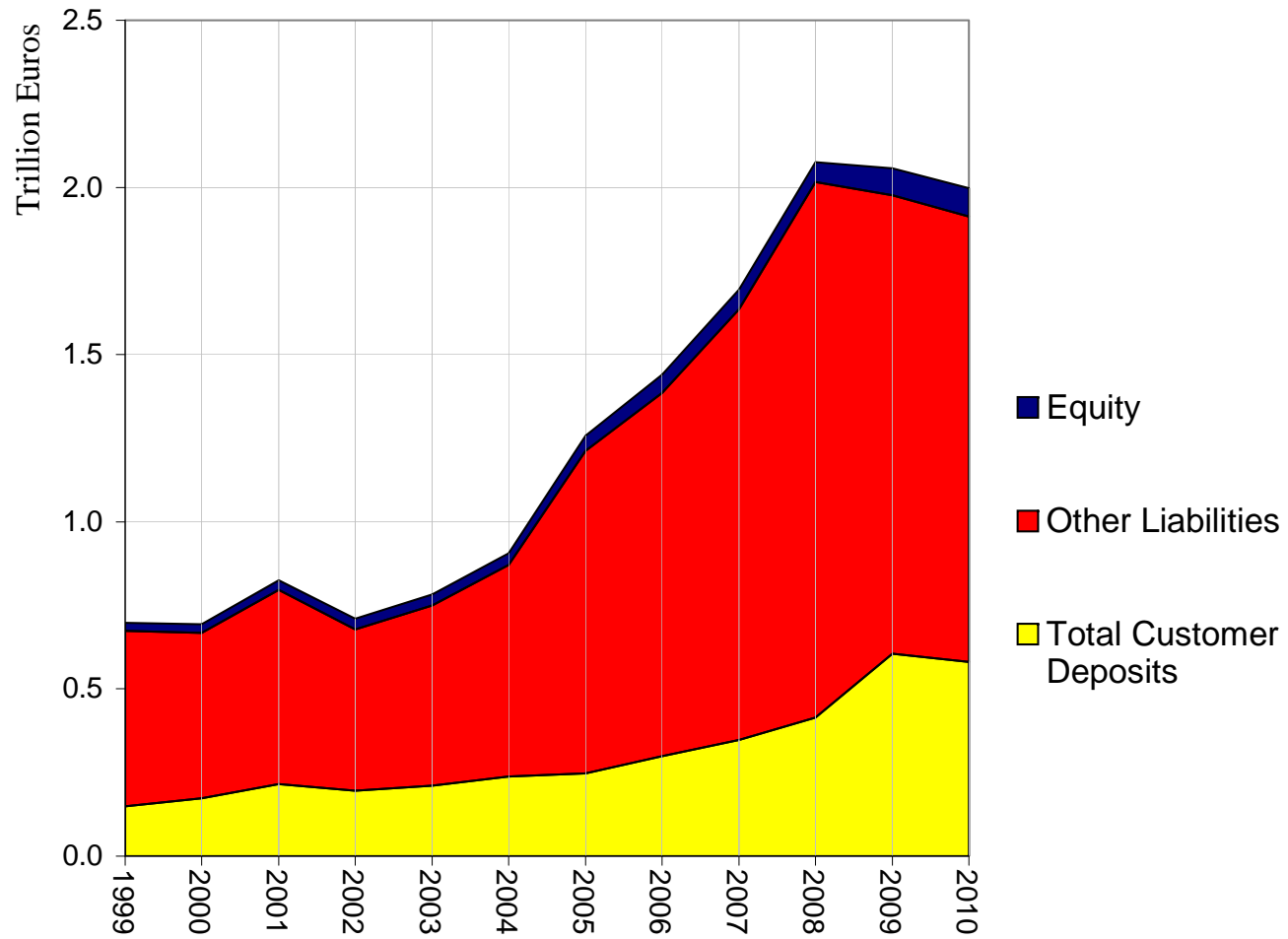


Figure 25: BNP Paribas total liabilities (Source: Bankscope)

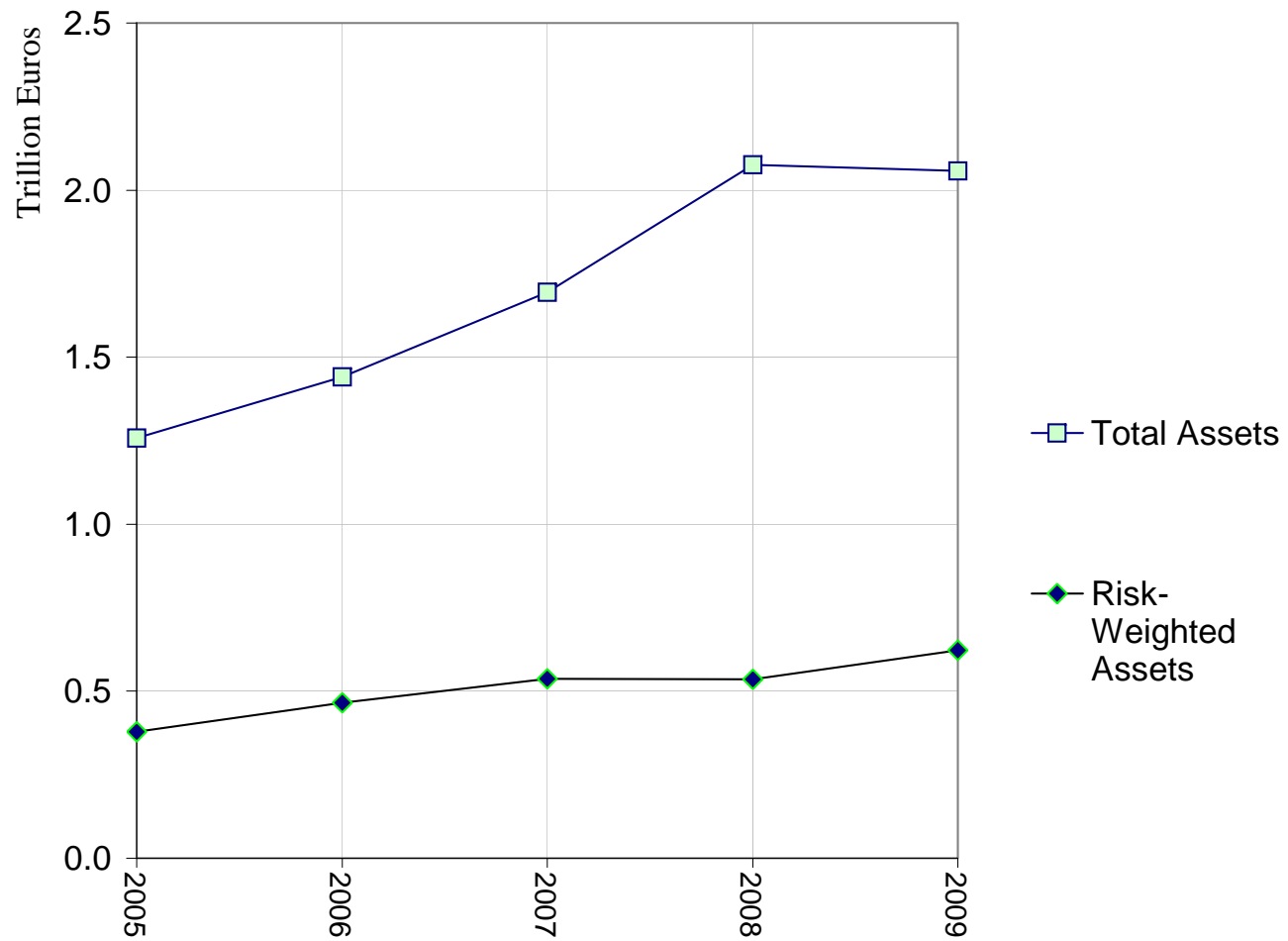


Figure 26: BNP Paribas risk-weighted assets and total assets (Source: Bankscope)

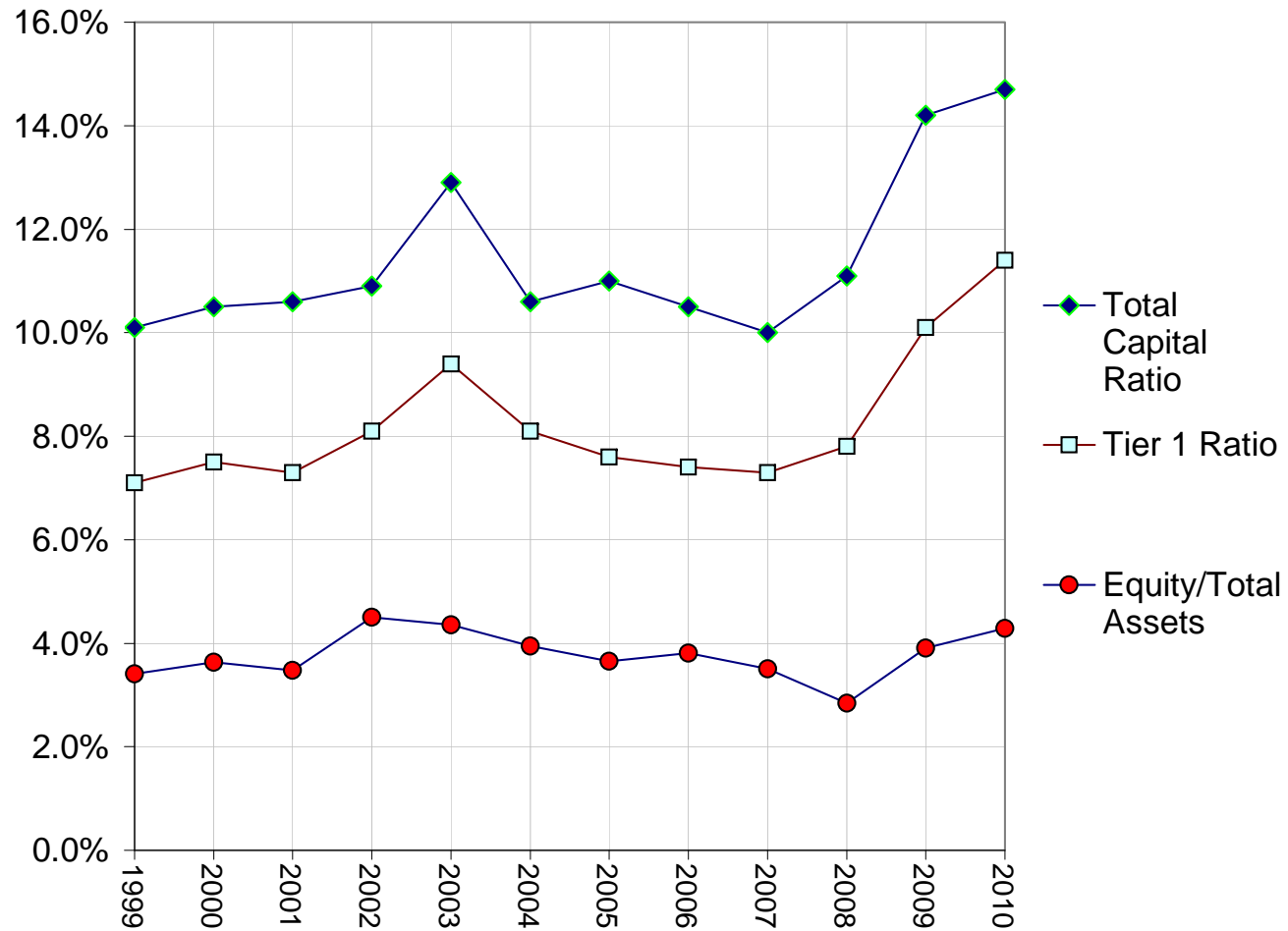


Figure 27: BNP Paribas capital ratios (Source: Bankscope)

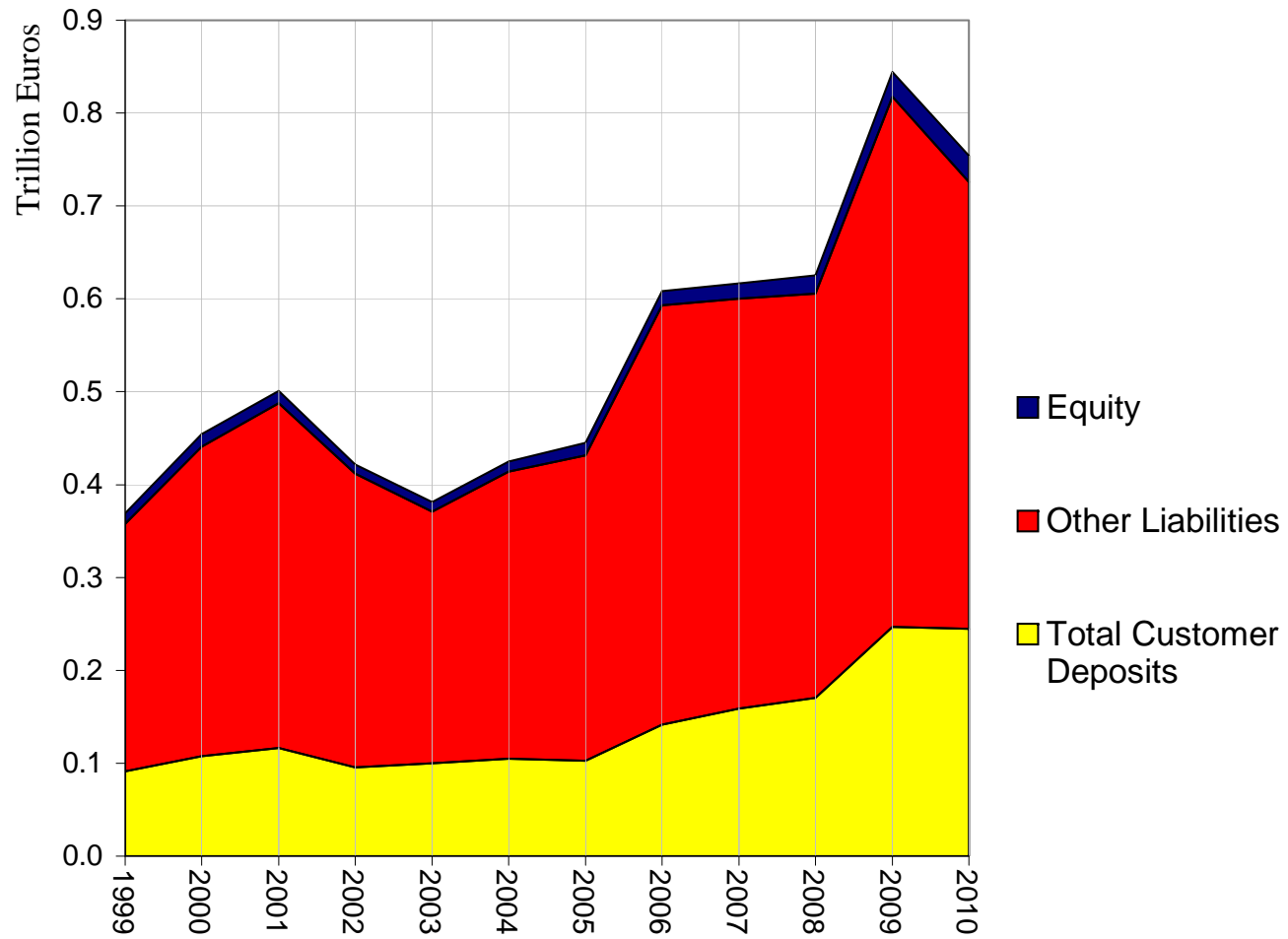


Figure 28: Commerzbank liabilities 1999 - 2010 (Source: Bankscope)

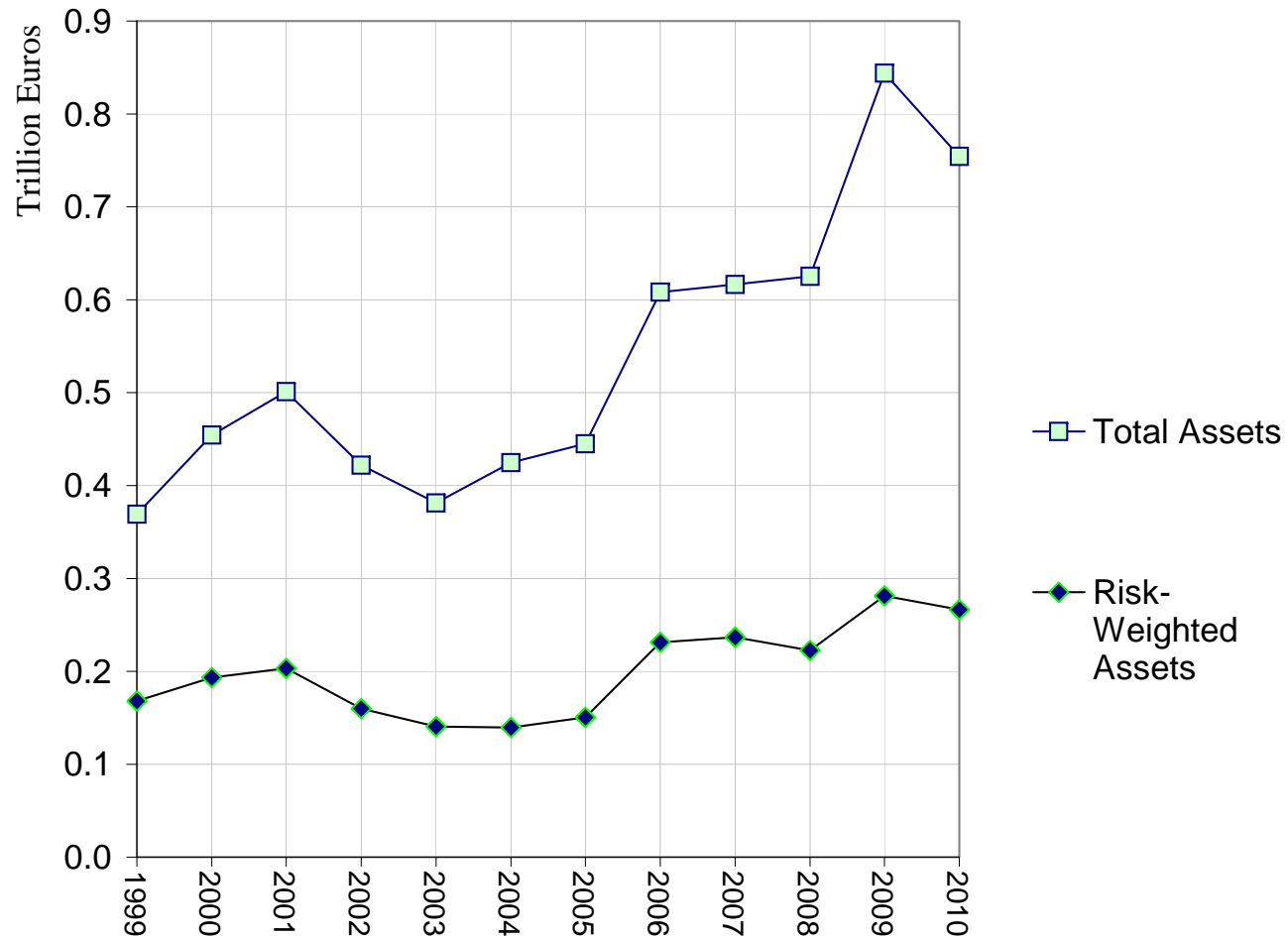


Figure 29: Commerzbank risk-weighted assets and total assets 1999 - 2010
 (Source: Bankscope)

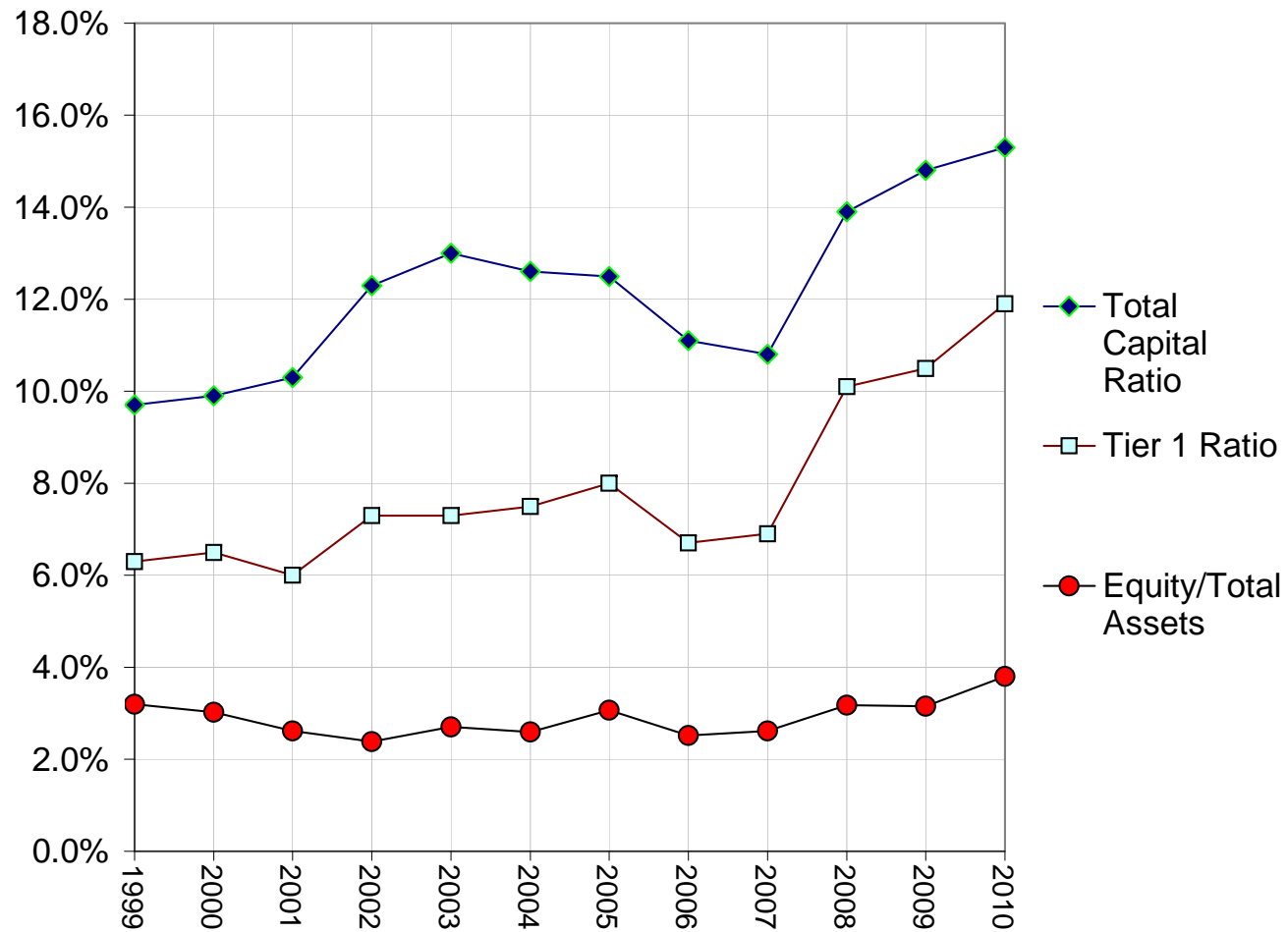


Figure 30: Commerzbank capital ratios 1999 - 2010 (Source: Bankscope)

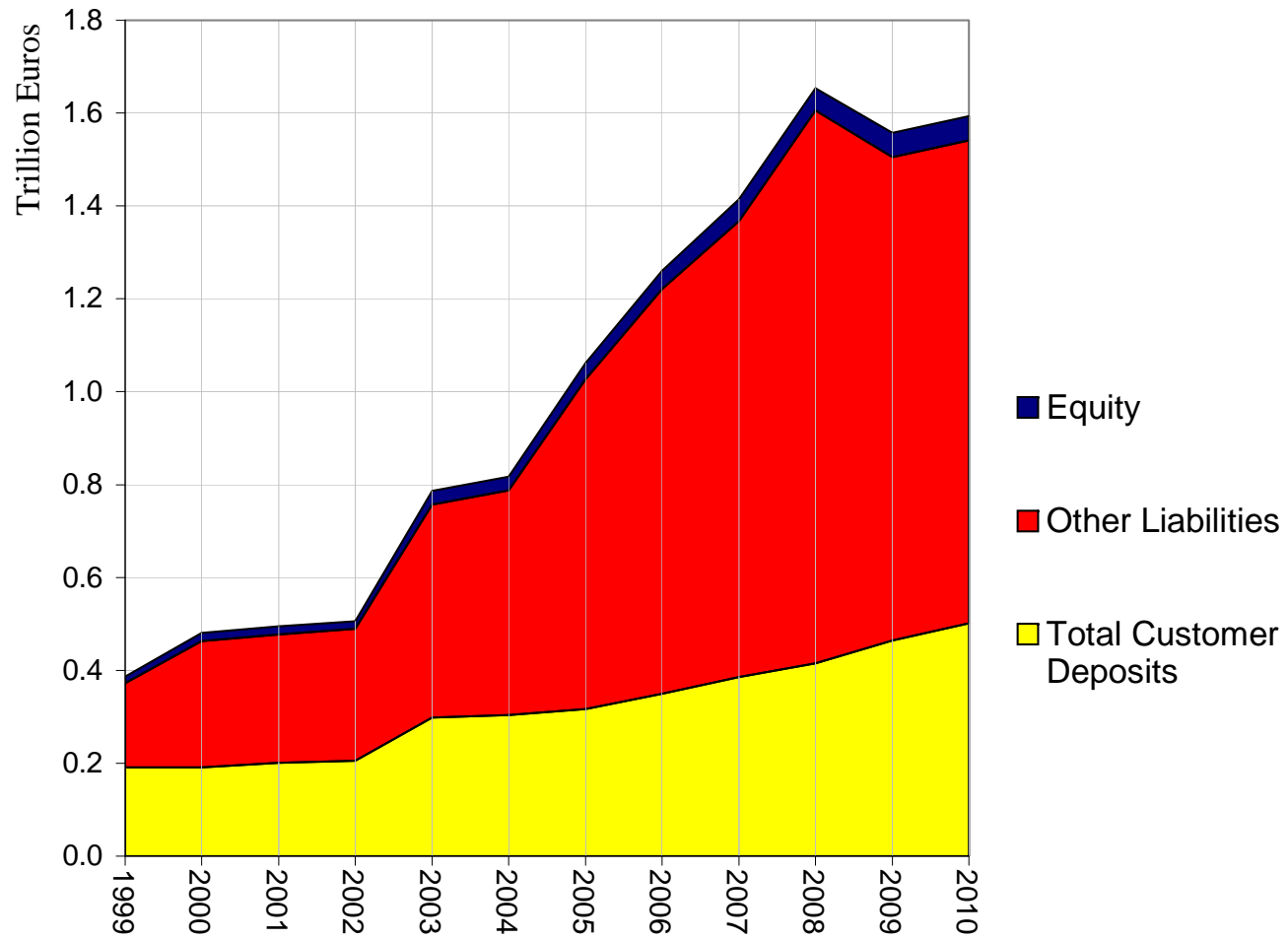


Figure 31: Credit Agricole liabilities 1999 - 2010 (Source: Bankscope)

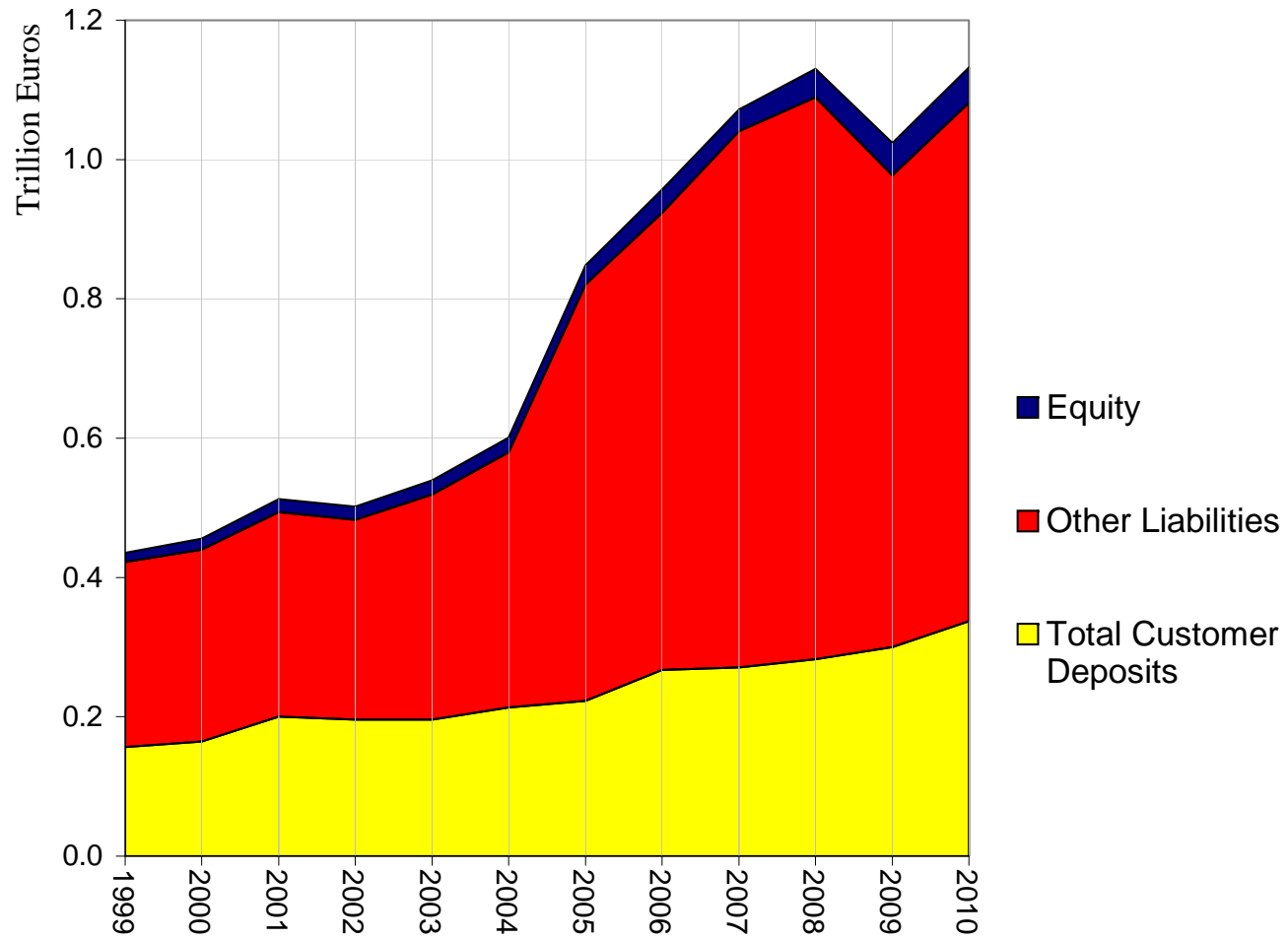


Figure 32: Société Générale liabilities 1999 - 2010 (Source: Bankscope)

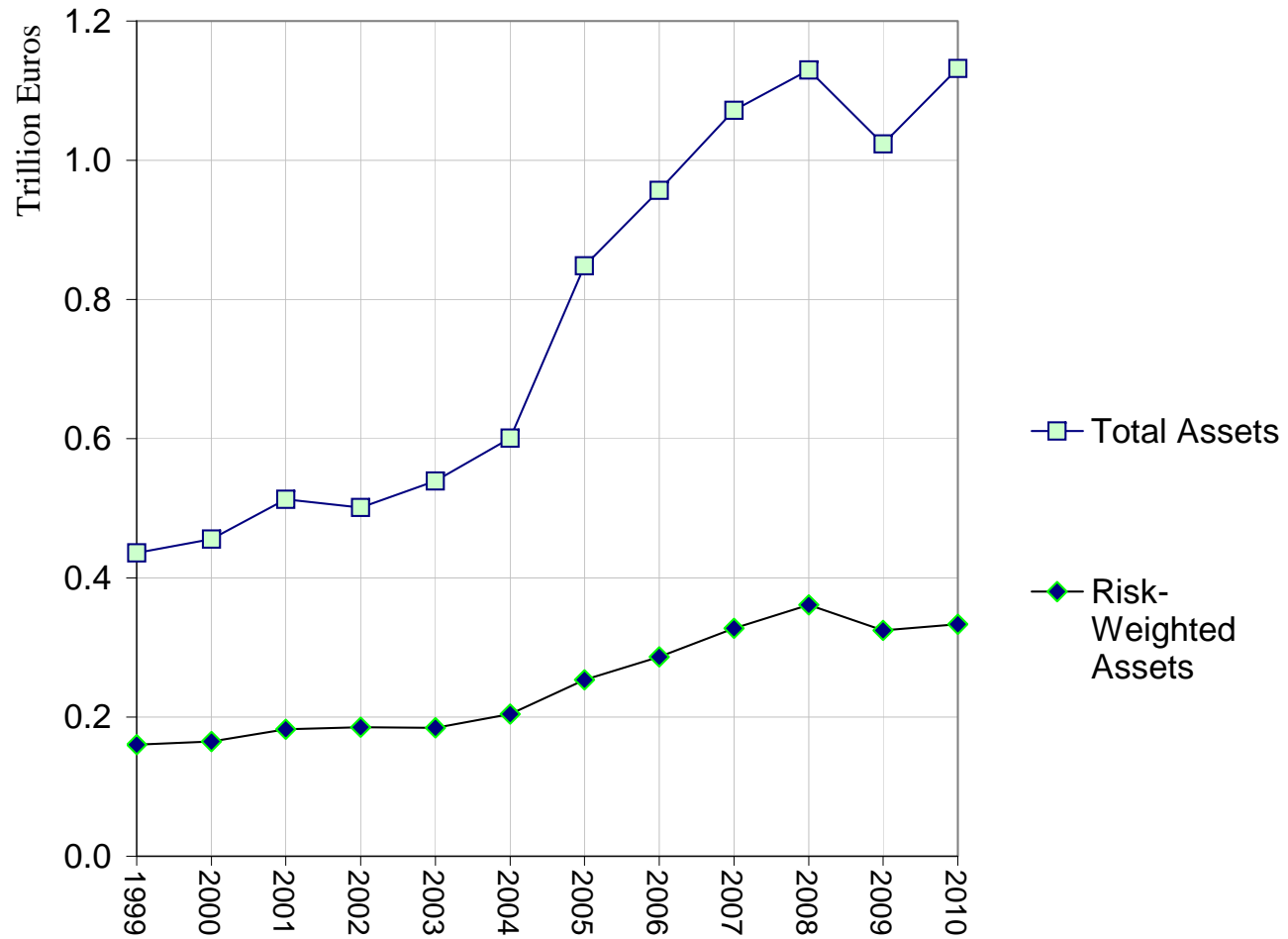


Figure 33: Société Générale risk-weighted assets and total assets (1999 - 2010) (Source: Bankscope)

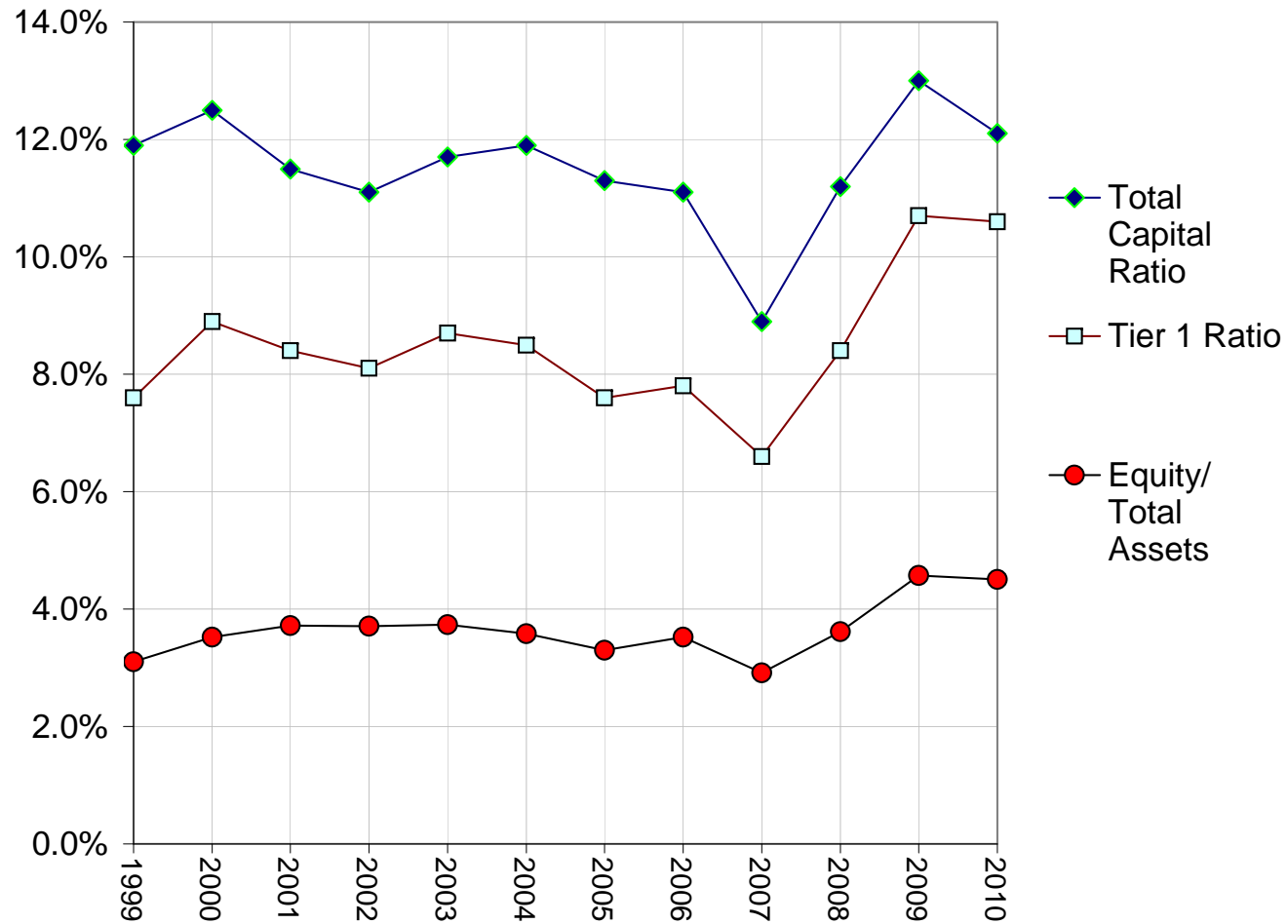
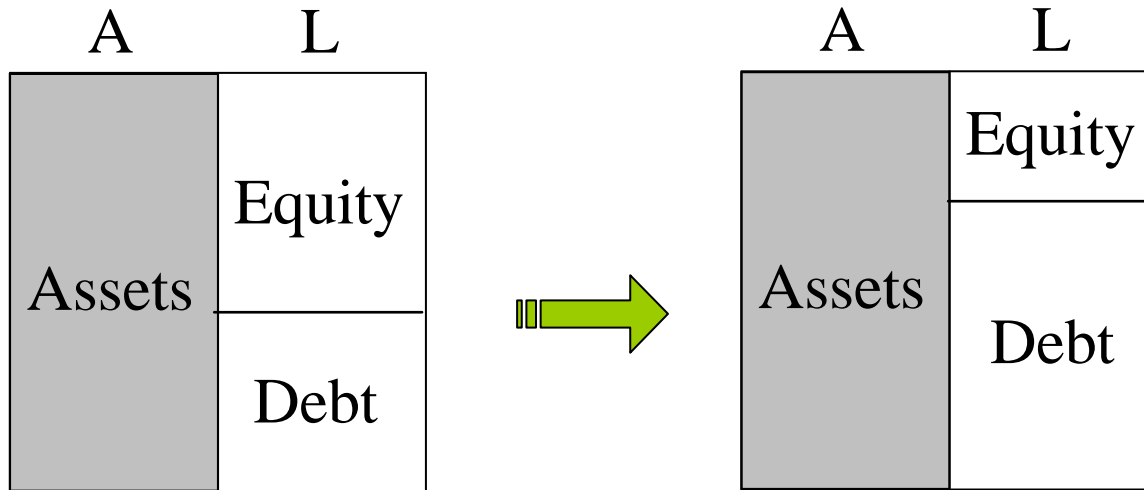
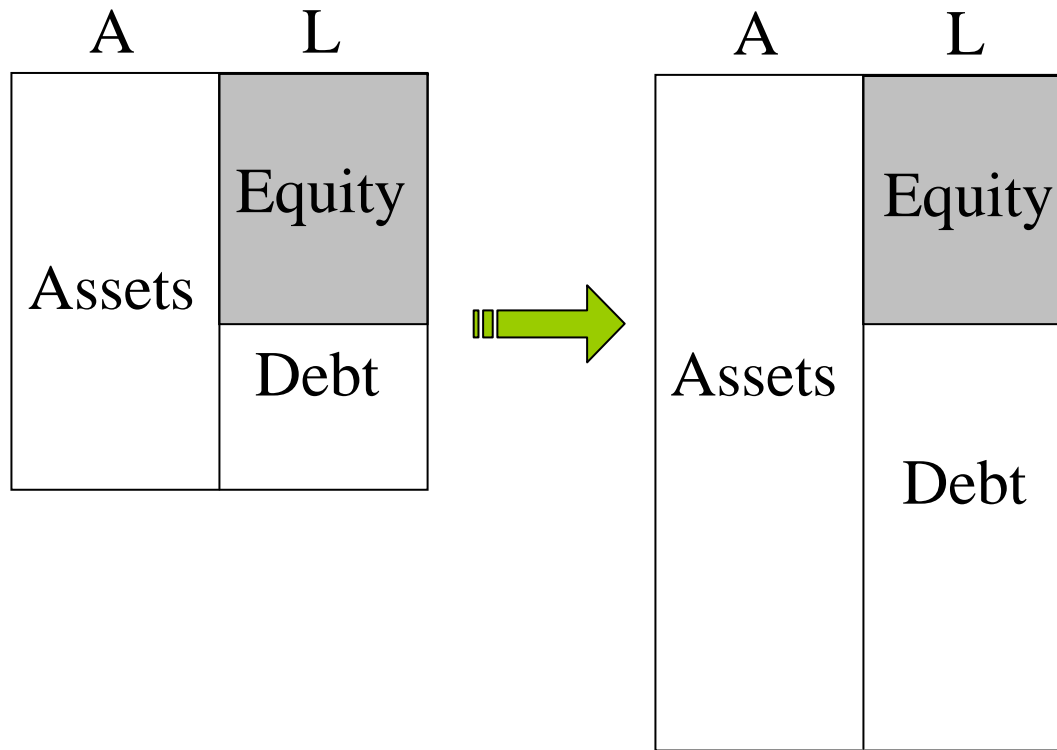


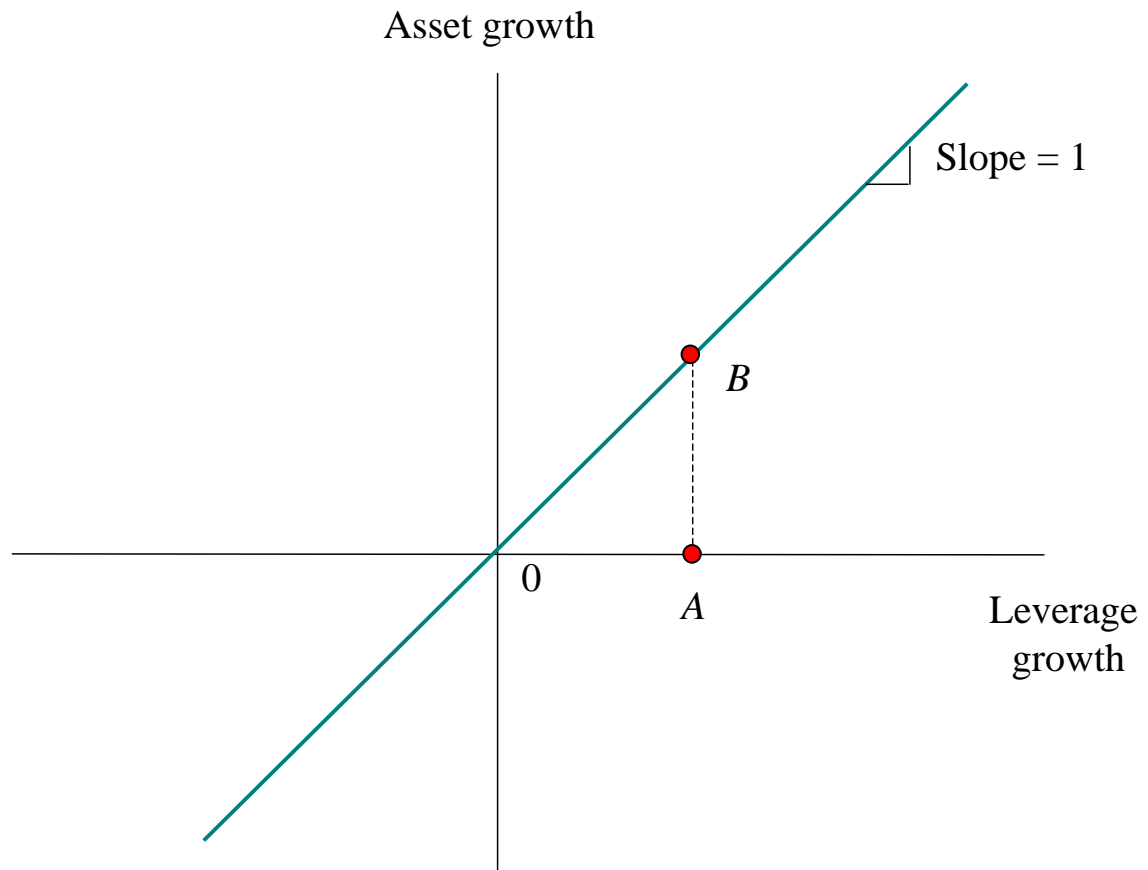
Figure 34: Société Générale capital ratios 1999 - 2010 (Source: Bankscope)

Corporate Finance of Banking

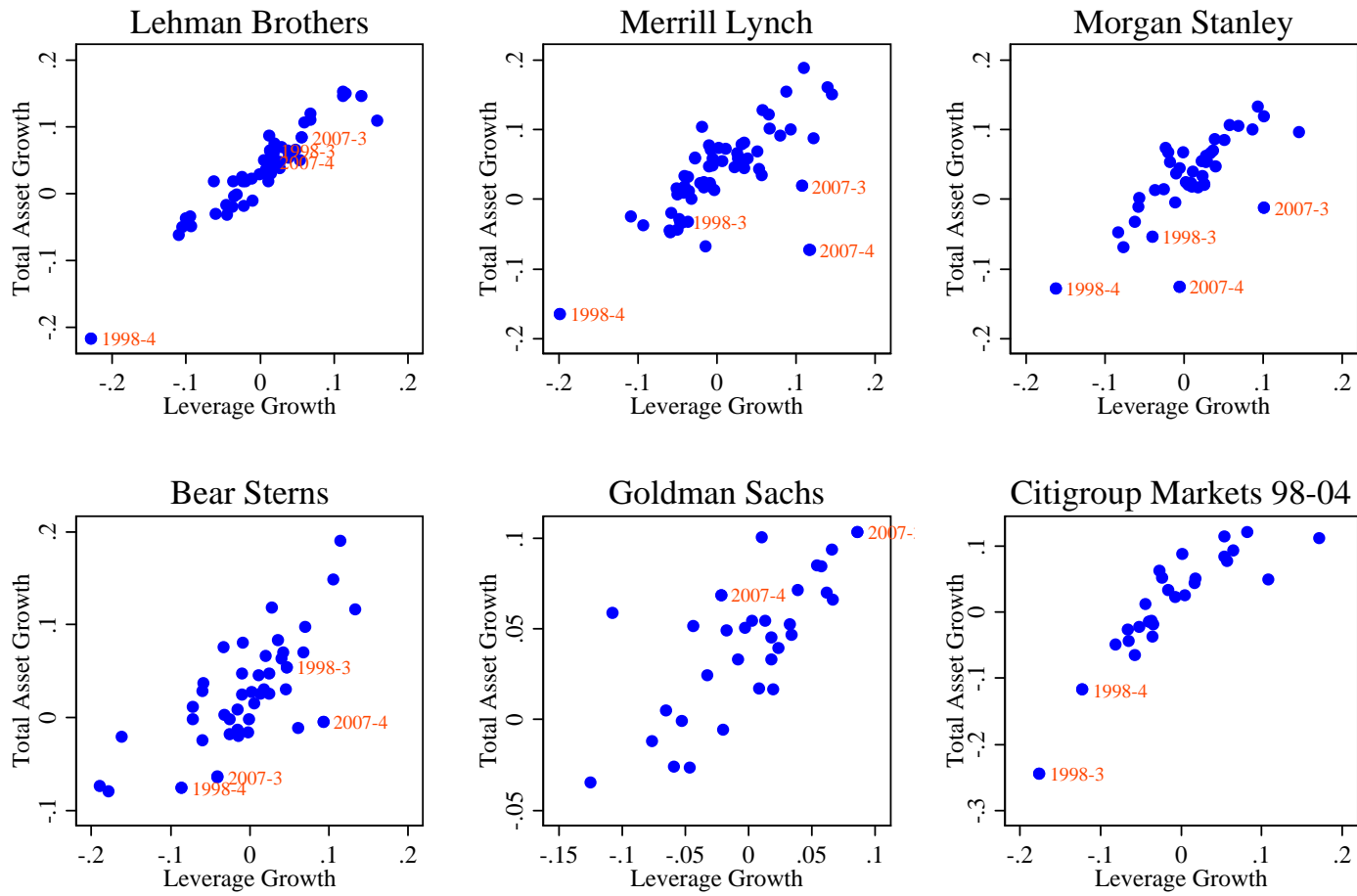
A	L
Assets	Equity
	Debt



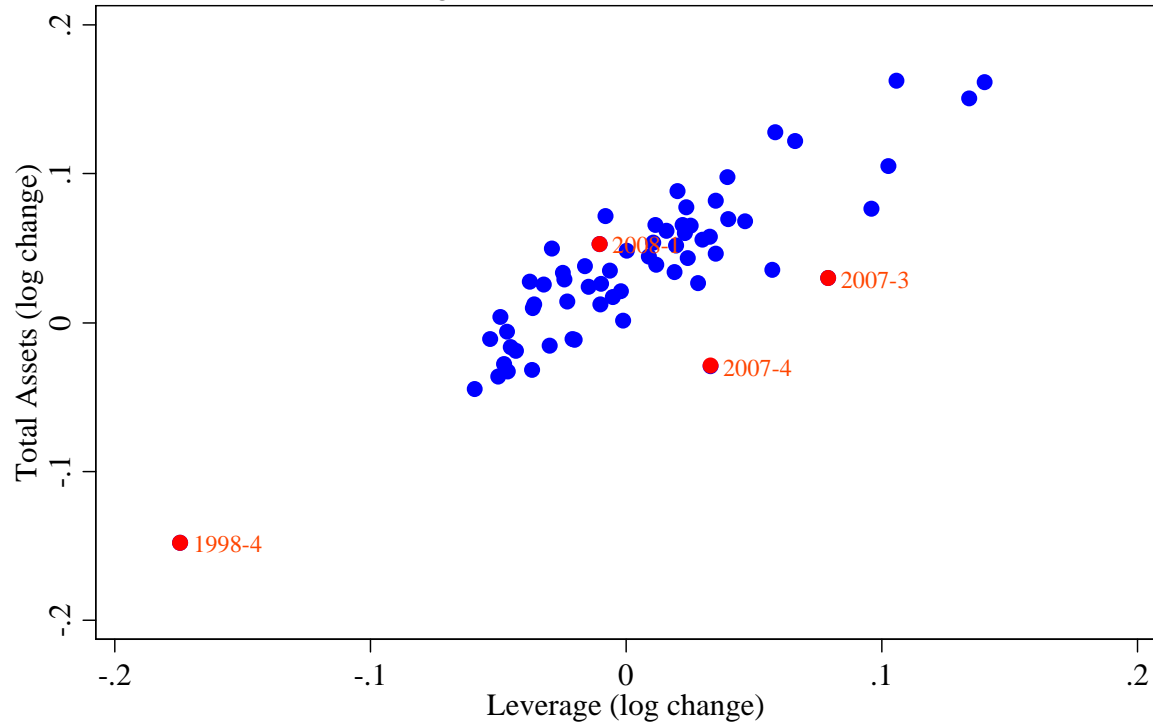




Total Assets and Leverage



Leverage and Total Assets Growth
Asset weighted, 1992Q3-2008Q1, Source: SEC



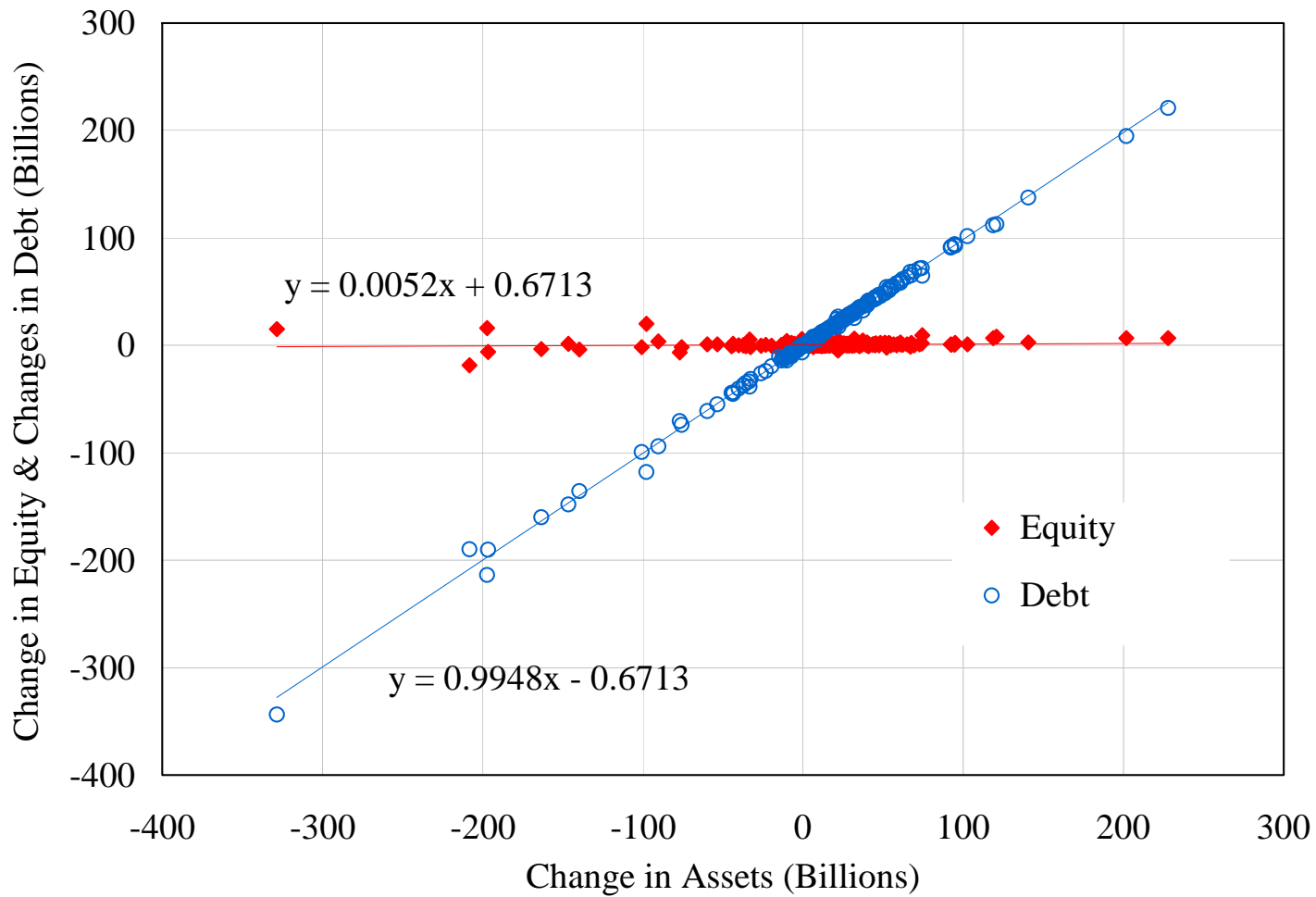
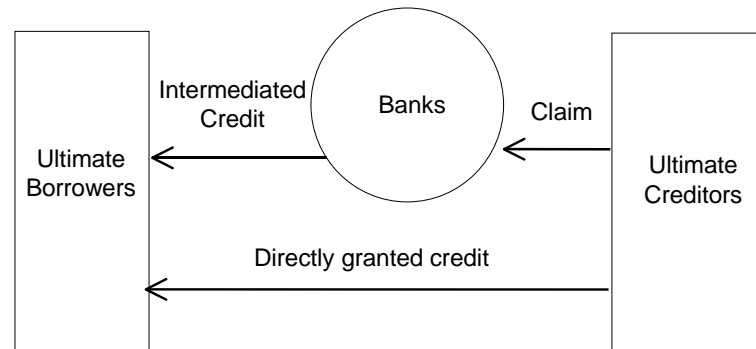


Figure 35: Scatter chart of $\{(\Delta A_{it}, \Delta E_{it}), (\Delta A_{it}, \Delta D_{it})\}$ of Five Wall Street Investment Banks

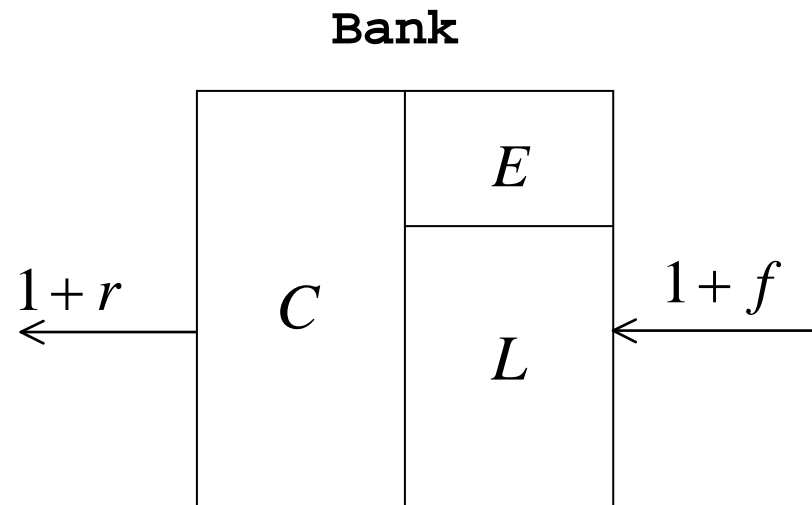
Model of Direct and Intermediated Finance



- Banking sector (aggregate US and offshore European into one)
- Mean-variance investors who hold portfolio of (i) cash (ii) bank liabilities (iii) risky loans

Bank Credit Supply

Notation for balance sheet of bank



Credit Risk

Vasicek (2002) model, backbone of Basel capital requirements.

Project j succeeds when $Z_j > 0$, where

$$Z_j = -\Phi^{-1}(\varepsilon) + \sqrt{\rho}Y + \sqrt{1-\rho}X_j$$

$\Phi(\cdot)$ c.d.f. of standard normal, Y and $\{X_j\}$ independent standard normals

$$\begin{aligned}\Pr(Z_j < 0) &= \Pr\left(\sqrt{\rho}Y + \sqrt{1-\rho}X_j < \Phi^{-1}(\varepsilon)\right) \\ &= \Phi\left(\Phi^{-1}(\varepsilon)\right) = \varepsilon\end{aligned}$$

Bank diversifies away idiosyncratic risk

Conditional on Y , defaults are independent.

Keep C fixed but diversify: increase number of borrowers, reduce face value of individual loans

In the limit, realized value of assets is function of Y only

$$\begin{aligned}w(Y) &\equiv (1+r)C \cdot \Pr(Z_j \geq 0|Y) \\ &= (1+r)C \cdot \Pr\left(\sqrt{\rho}Y + \sqrt{1-\rho}X_j \geq \Phi^{-1}(\varepsilon) | Y\right) \\ &= (1+r)C \cdot \Phi\left(\frac{Y\sqrt{\rho} - \Phi^{-1}(\varepsilon)}{\sqrt{1-\rho}}\right) \quad (*)\end{aligned}$$

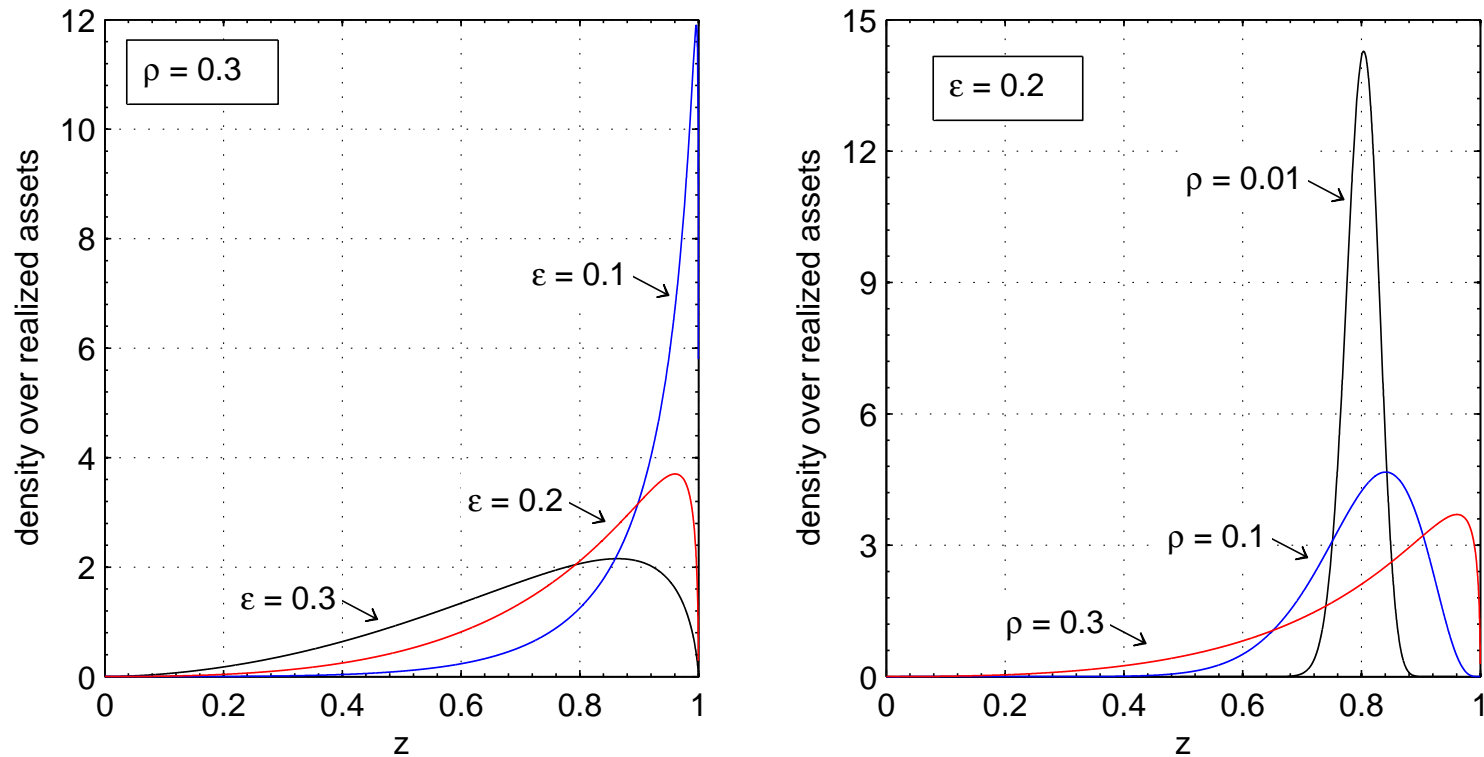


Figure 36: The two charts plot the densities over realized assets when $C(1+r) = 1$. The left hand charts plots the density over asset realizations of the bank when $\rho = 0.1$ and ϵ is varied from 0.1 to 0.3. The right hand chart plots the asset realization density when $\epsilon = 0.2$ and ρ varies from 0.01 to 0.3.

Turning Credit Risk Model on Its Head

- Turn credit risk model on its head and think of it as credit supply model
 - Fix E . Determine credit supply C_S

$$C_S = \frac{E}{1 - \frac{1+r}{1+f}\varphi(\rho, \alpha, \varepsilon)}, \quad \varphi \in (0, 1)$$

φ is ratio of **notional assets** to **notional debt** to be derived below.

From (*), the c.d.f. of w is

$$\begin{aligned} F(z) &= \Pr(w \leq z) \\ &= \Pr(Y \leq w^{-1}(z)) \\ &= \Phi(w^{-1}(z)) \\ &= \Phi\left(\frac{1}{\sqrt{\rho}}\left(\Phi^{-1}(\varepsilon) + \sqrt{1-\rho}\Phi^{-1}\left(\frac{z}{(1+r)C}\right)\right)\right) \end{aligned}$$

Common risk factor ρ determines shape of the density, with larger ρ implying fatter tail.

Value-at-Risk (VaR) rule: keep enough equity to limit insolvency probability to $\alpha > 0$

Bank credit supply C determined from

$$\Pr(w < (1 + f) L) = \Phi \left(\frac{\Phi^{-1}(\varepsilon) + \sqrt{1 - \rho} \Phi^{-1} \left(\frac{(1 + f)L}{(1 + r)C} \right)}{\sqrt{\rho}} \right) = \alpha$$

$$\frac{\text{Notional liabilities}}{\text{Notional assets}} = \frac{(1 + f) L}{(1 + r) C} = \Phi \left(\frac{\sqrt{\rho} \Phi^{-1}(\alpha) - \Phi^{-1}(\varepsilon)}{\sqrt{1 - \rho}} \right) \quad (1)$$

where

$$\varphi(\alpha, \varepsilon, \rho) \equiv \Phi \left(\frac{\sqrt{\rho} \Phi^{-1}(\alpha) - \Phi^{-1}(\varepsilon)}{\sqrt{1 - \rho}} \right)$$

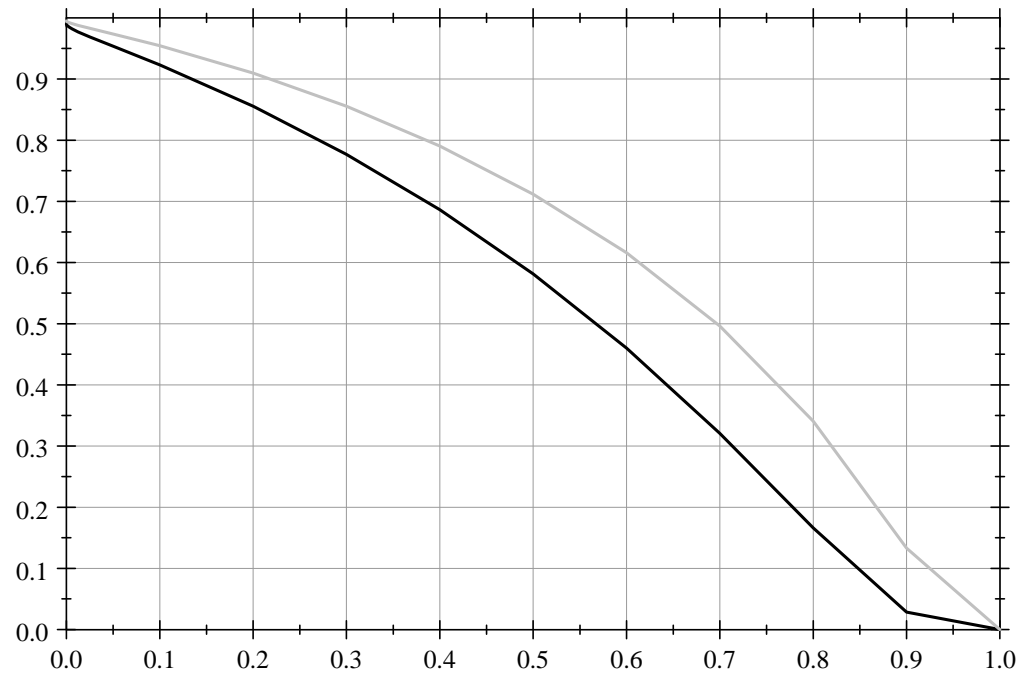


Figure 37: **Plot of notional debt to assets ratio** $\varphi(\alpha, \varepsilon, \rho)$. This chart plots φ as a function of ρ with $\alpha = 0.001$. Dark line is when $\varepsilon = 0.01$. Light line is when $\varepsilon = 0.005$.

Supply of Credit by Bank

Credit supply C and demand for funding L is obtained from (1) and balance sheet identity $C = E + L$

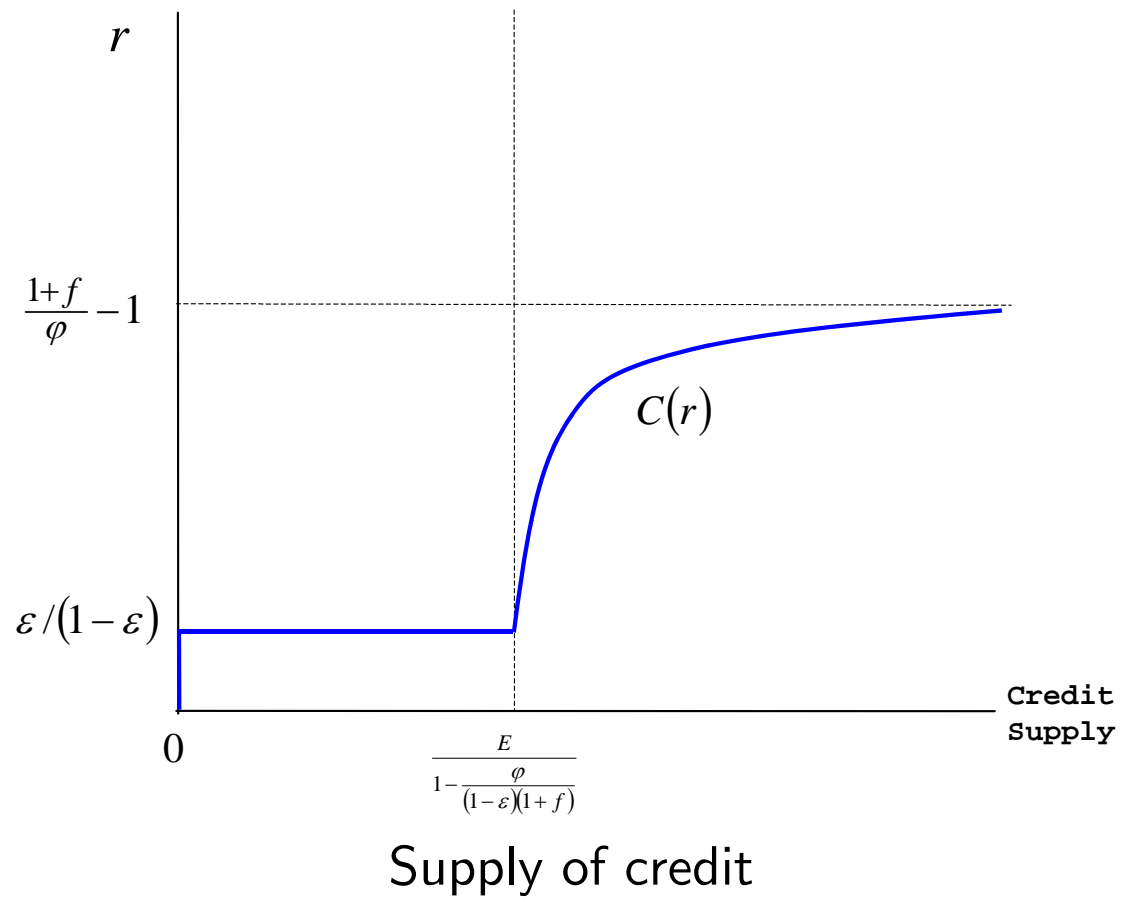
$$C = \frac{E}{1 - \frac{1+r}{1+f} \cdot \varphi}, \quad L = \frac{E}{\frac{1+f}{1+r} \cdot \frac{1}{\varphi} - 1}$$

Aggregation holds due to proportionality

$$\text{Leverage} = \frac{1}{1 - \frac{1+r}{1+f} \cdot \varphi}$$

Risk premium is well-defined

$$\text{Risk premium} = (1 - \varepsilon)(1 + r) - 1$$



Mean-Variance Investors

Loans are packaged into bonds that diversify away idiosyncratic risk.

Demand for bonds (supply of credit) by mean-variance investor with risk tolerance τ

$$\frac{\tau [(1 - \varepsilon) (1 + r) - 1]}{\sigma^2 (1 + r)^2}$$

where σ^2 is variance of $w(Y)$. There are N mean-variance investors, and $T = \tau N$. Aggregate supply of credit from mean-variance sector is

$$C_H = \frac{T [(1 - \varepsilon) (1 + r) - 1]}{\sigma^2 (1 + r)^2}$$

We need to work out σ^2 .

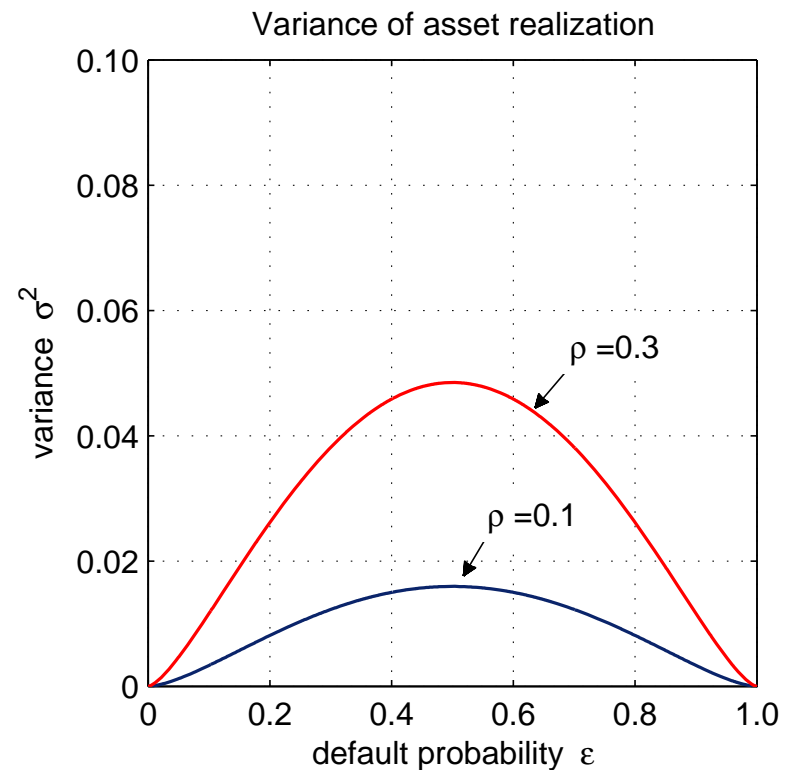
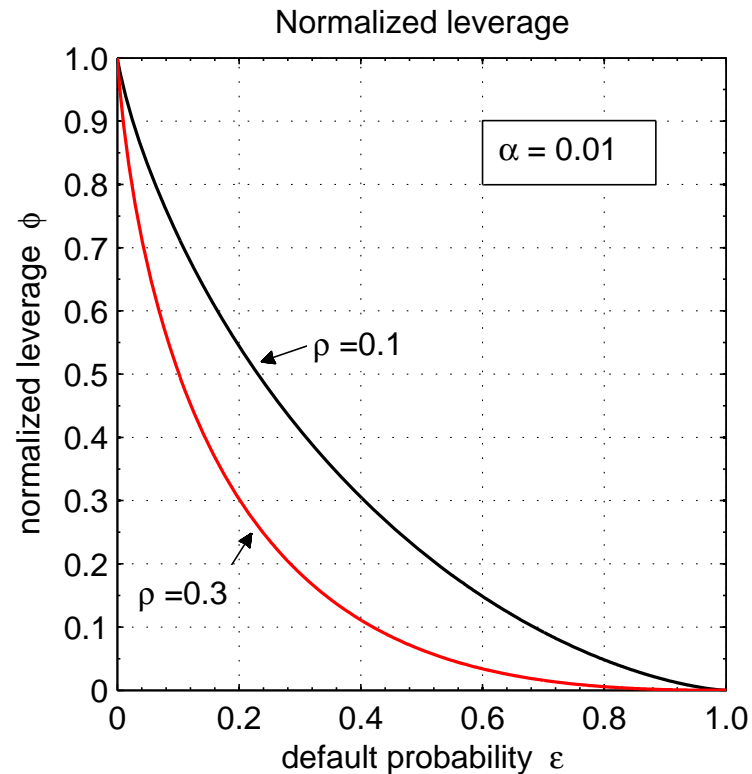


Figure 38: Left hand panel plots the normalized leverage ratio ϕ as a function of ε . The right hand panel plots the variance σ^2 as a function of epsilon for two values of ρ .

Market Clearing

$$\underbrace{\frac{E}{1 - \frac{1+\pi}{1-\varepsilon}\varphi}}_{C_B} + T \underbrace{\frac{(1-\varepsilon)^2 \pi}{\sigma^2 (1+\pi)^2}}_{C_H} = K(\pi)$$

Gross and Net Capital Flows

Change in bank liabilities ΔL is gross outflow of capital from the US

Additional credit ΔC granted by the European bank is gross capital *inflow*

As long as E is fixed, we have (by the balance sheet identity $C = E + L$)

$$\overbrace{\Delta L}^{\text{outflow}} - \overbrace{\Delta C}^{\text{inflow}} = 0 \quad (2)$$

Gross flows may be large, but net flow is zero.

Bank Iso-Lending Curves

Points in (ε, π) -space with C_B constant

$$\pi(\varepsilon) = \left(1 - \frac{E}{C_B}\right) \frac{1 - \varepsilon}{\varphi(\varepsilon)} - 1 \quad (3)$$

Slope of the iso-lending curve tends to $+\infty$ as $\varepsilon \rightarrow 0$

$$\pi'(\varepsilon) = - \left(1 - \frac{E}{C_B}\right) \left[\frac{1 - \varepsilon}{\varphi^2} \varphi'(\varepsilon) + \frac{1}{\varphi} \right] \quad (4)$$

since $\varphi'(\varepsilon) \rightarrow -\infty$ as $\varepsilon \rightarrow 0$

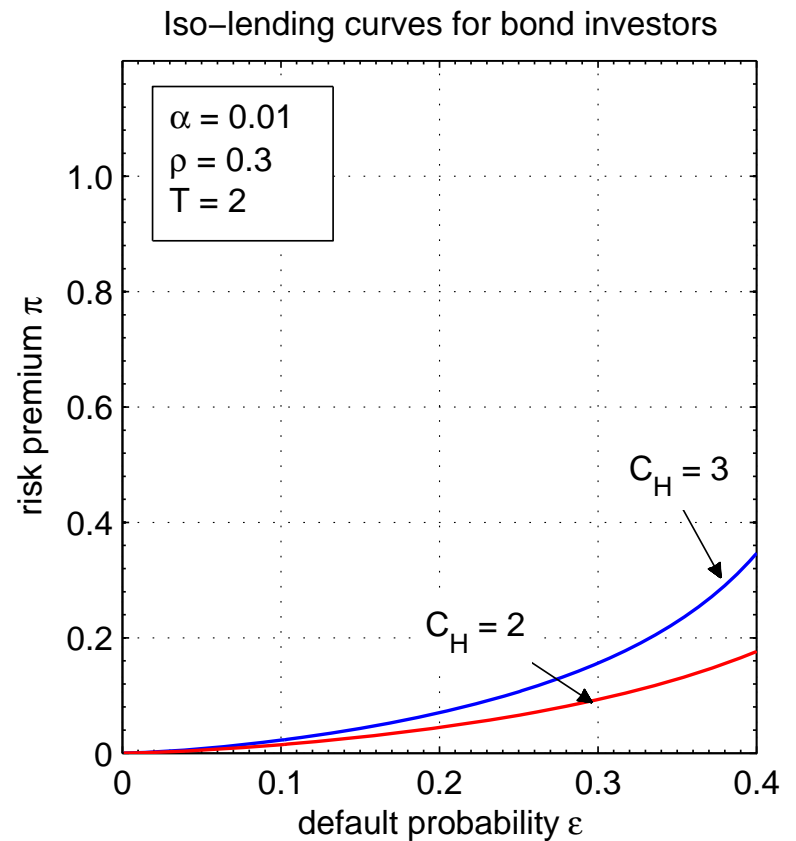
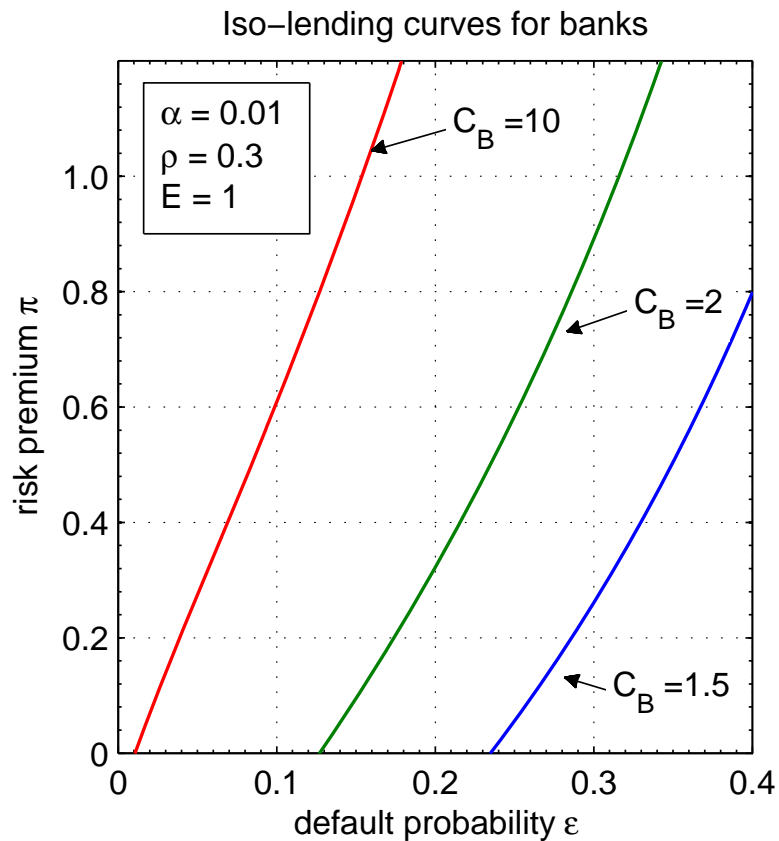


Figure 39: Iso-lending curves in (ε, π) -space for banks (left panel) and bond investors (right panel). Parameter values are as indicated in the boxes.

Tranquil Times Compress Risk Premium

Proposition 1. *Under mild regularity conditions, the market risk premium π is strictly increasing in ε .*

Role for Specialized Monetary Aggregates

Corollary 2. *As default probability ε varies, aggregate bank liabilities L increase if and only if the market risk premium π decreases.*

Beware of Banking Glut

Proposition 3. *For demand for credit not too elastic, a decline in ε is associated with an increase in banking sector assets, both in absolute terms and as a proportion of the total credit received by borrowers.*

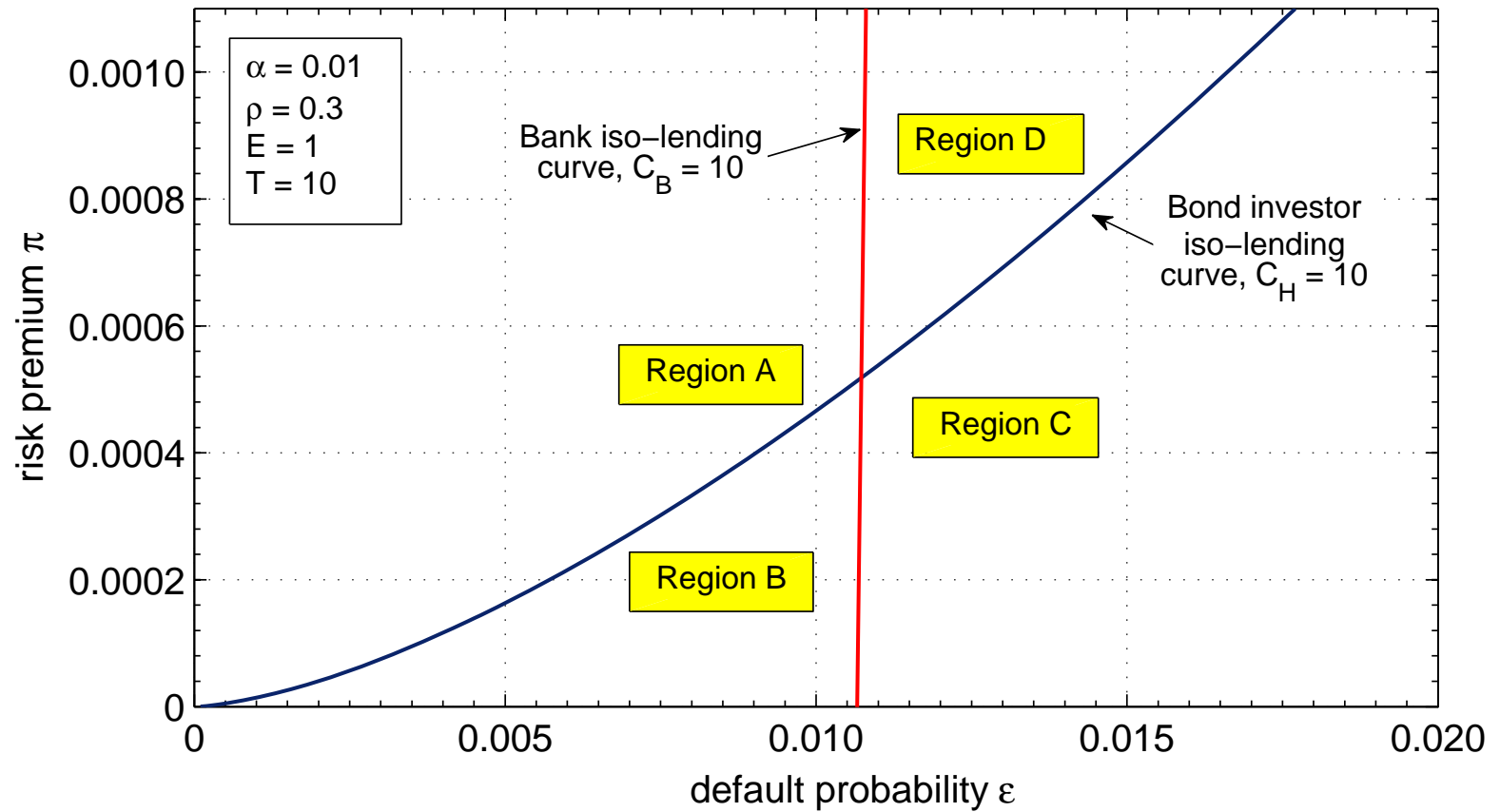


Figure 40: Crossing point for the iso-lending curves of banks and households.

Credit to Non-Financial Firms (Flow of Funds, Table L102)

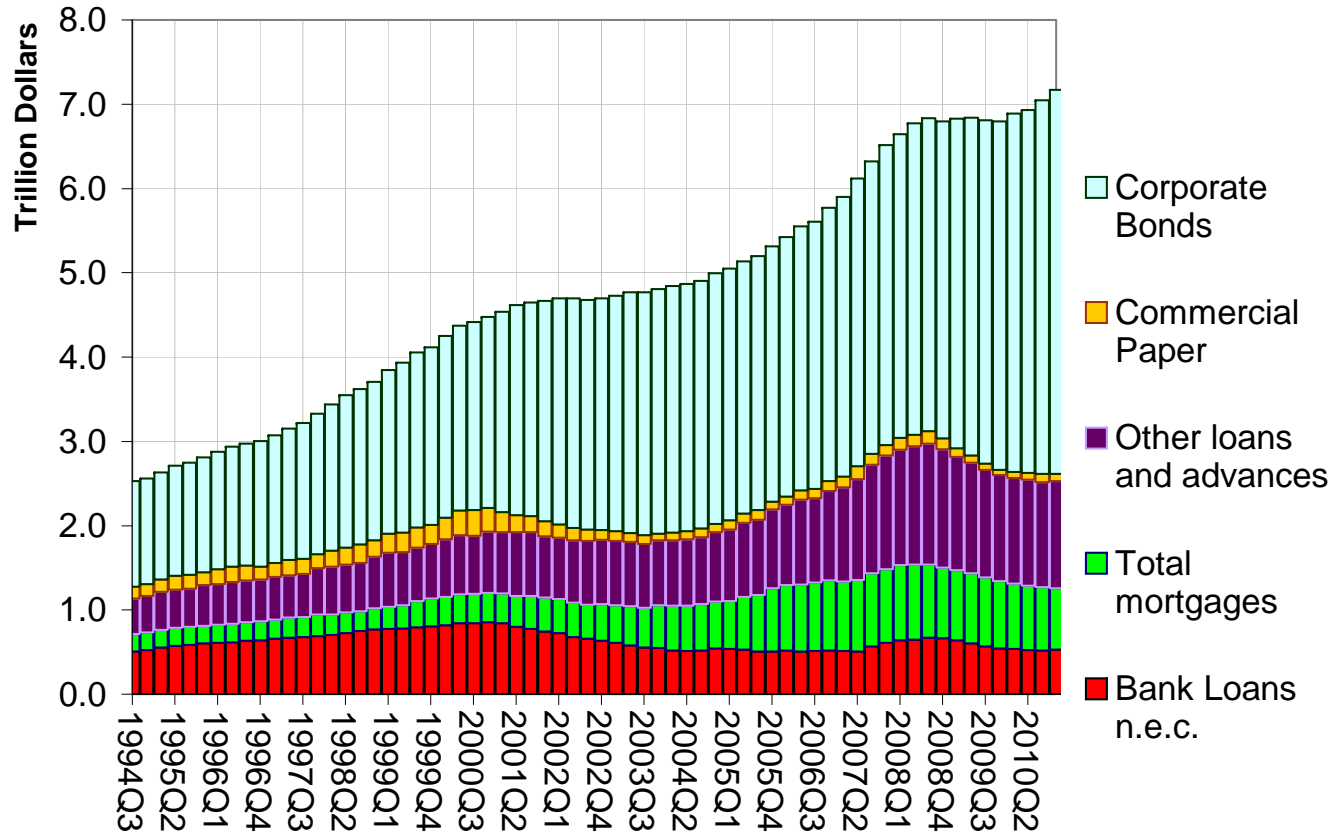


Figure 41: Total credit to the US non-financial corporate sector (Source: US Flow of Funds, Table L102)

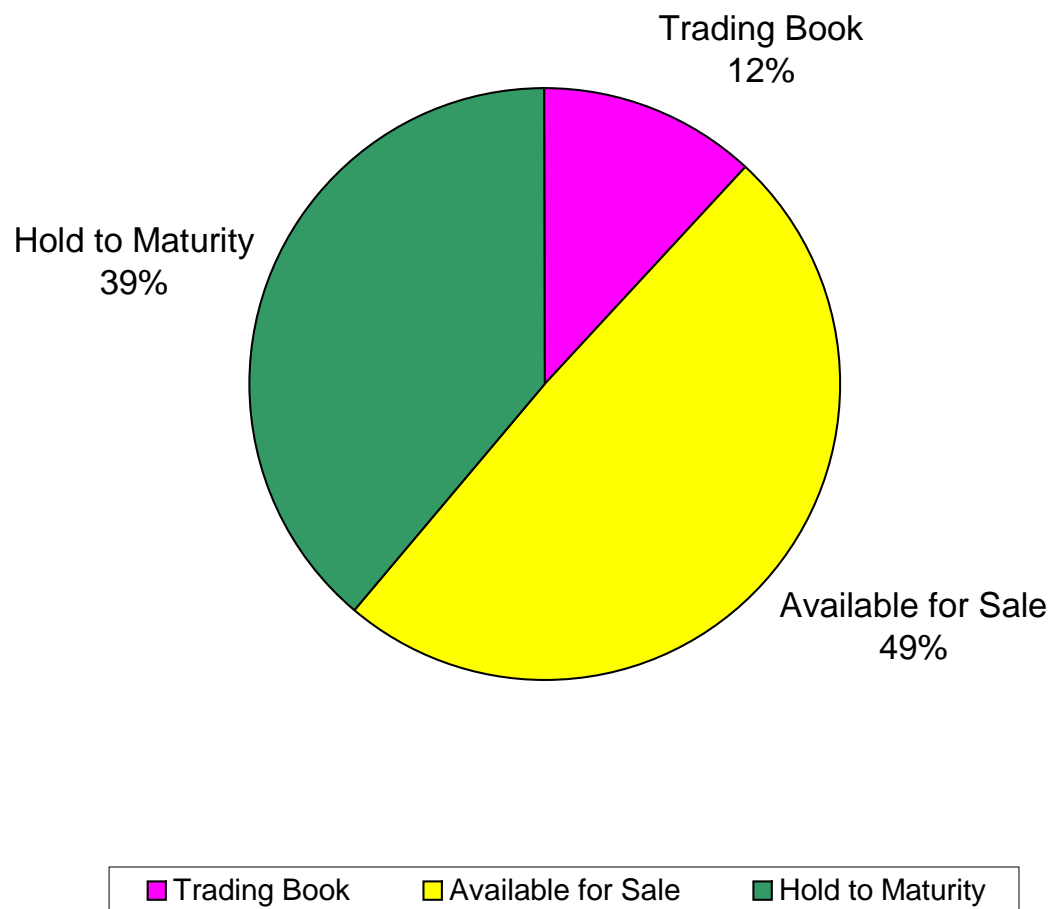


Figure 42: Accounting classifications of European Banks' holding of European sovereign debt (Source: IMF GFSR September 2011)

Current Conjuncture in Europe

- Europe has a **twin crisis**, combining **banking crisis** with **sovereign debt crisis**
 - Emerging economy crises of 1990s were **twin crises**, combining **banking crisis** with **currency crisis**
- Deleveraging by European banks will impact not only eurozone, but also
 - US shadow banking system
 - Capital flows to emerging economies