Bubbles, Panics and Crashes: An Introduction to Alternative Theories of Economic Crisis

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Lecture 2
Major Technological Bubbles & Credit Crunch

Major Technology Bubbles & Easy Liquidity Bubbles (Perez 2009)

- Perez argues that major technology bubbles are -in nature and economic consequences- different from excess liquidity bubbles and the following Minsky moments

- A major technology bubble occurs through a long period of time as a new technology that revolutionizes the production process develops
- This happens through continuous market experimentation
- The new technology creates immense opportunities for profits

Table 1. *Five great surges of growth and five major technology bubbles*

1. Big bang: year and core country	2. Great surge	3. Major technology bubbles(s) in installation	4. Collapse year and country	5. Deployment
1771 England	The 'Industrial Revolution' (mechanisation and water transport)	Canal mania	1793 England	Great British leap
1829 UK	The age of steam and iron railways	Railway mania	1847 Great Britain	Victorian boom
1875 UK, USA and Germany	The age of steel and heavy engineering (civil, chemical, electrical and naval). First globalisation	Multiple bubbles from build-up of world infrastructure for global trade in commodities (steel railways, steamships, ports, telegraph, etc.) financed mainly from the City of London	1890–93 Argentina (Baring crisis), Australia, etc.	Belle Époque (Europe) Progressive Era (USA)
1908 USA	The age of the automobile, oil and petrochemicals	Roaring twenties	1929 USA	Post World War II boom
1971 USA	The age of information and digital communications. Second Globalisation	Double bubble: internet mania followed by financial boom of the 2000s	2000 and 2007–08 USA	A sustainable global knowledge society boom?

- Every new technology takes a long gestation period to be successfully installed first and then deployed. During this time, the full potential of the new technology is realised as it gets adopted by all the sectors in the economy.

- The installation period is turbulent and creates a bubble. When the bubble bursts, a new framework is constituted through regulation of finance, and the technology deploys its full potential during the second phase.

- The nature of the technology is independent from the evolution of the change that follows the birth of the technology
- Technological development occurs as revolutions rather than smooth harmonious change due to the *human resistance to change* and *institutional inertia.* Violent competition between new and traditional industries forces the change during the installation period, as increased profits draw more and more companies into the adoption of the new technology.
- This is Schumpeter's creative destruction argument for capitalism.

- During this phase, innovation in the financial sector follows the innovation in the real sector, as the finance industry quickly adopts the new technology.
- Therefore, it quickly invents in order to attract more capital and transfer the available funds to the newly emerging industries
- In the early stages of the development of a new technology, excessive faith in the benefits creates an irrational exuberance, which is justified by soaring stock prices (and therefore capital gains)

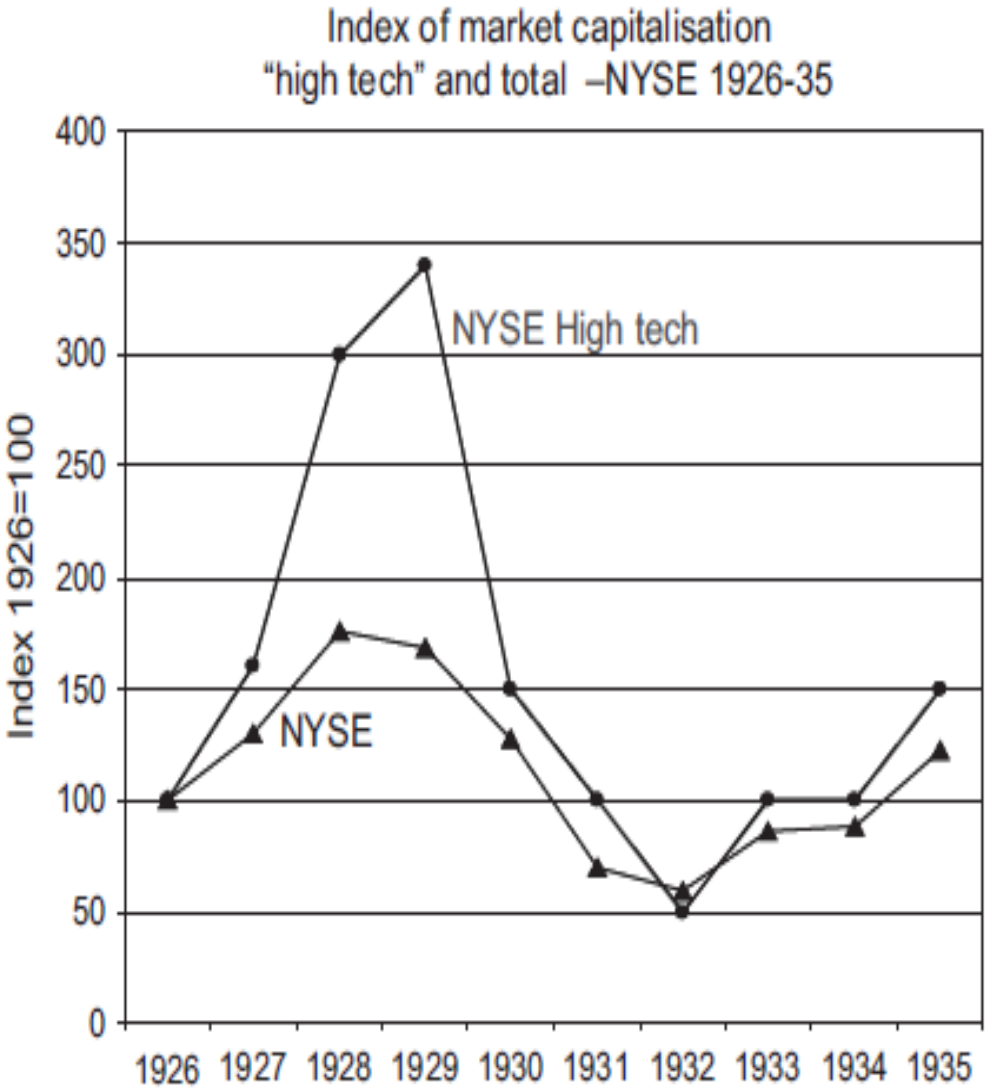


Fig. 3. *The mass production bubble in the 1920s was also concentrated on the high tech stocks.* Source: *For "high tech", data extracted from Eichengreen and Mitchener (2004, fig 12, p. 217) and NYSE for the total.*

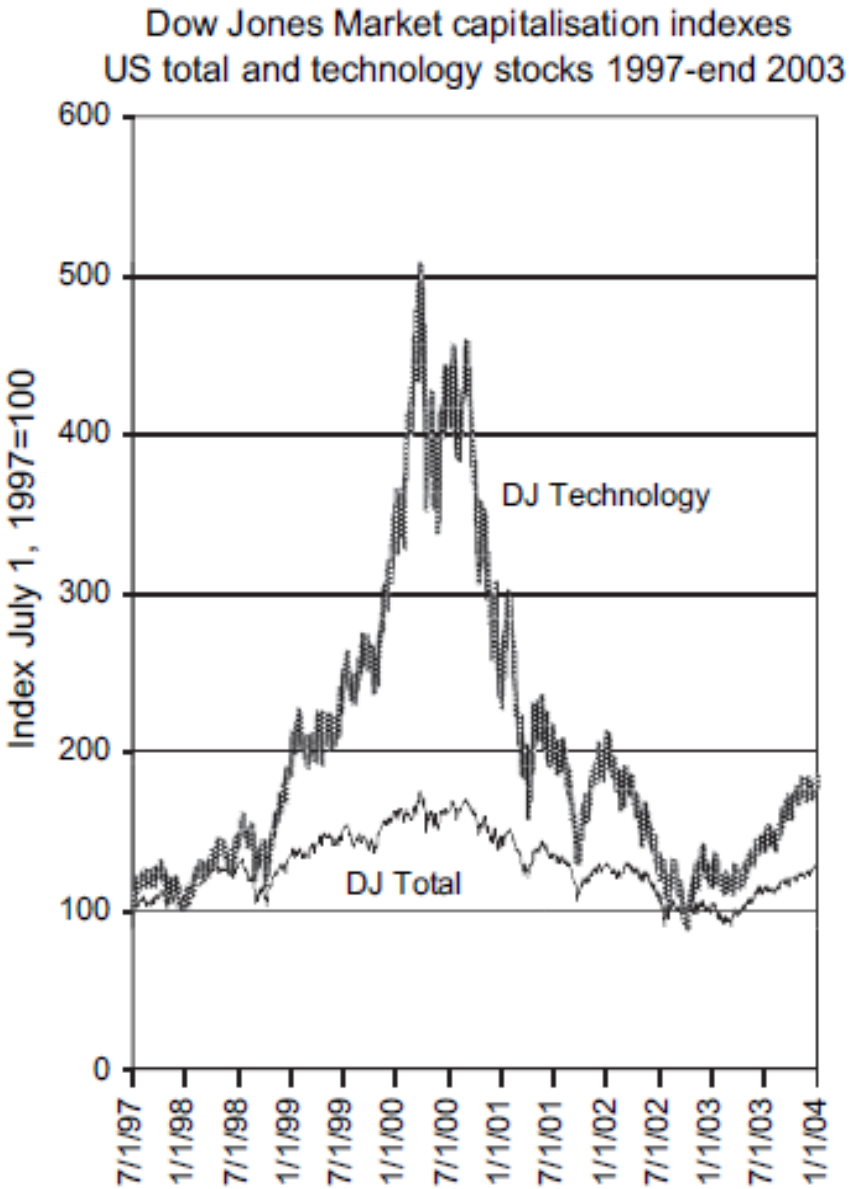


Fig. 2. *Major technology bubbles involve differential asset inflation biased to the 'high tech' stocks—the information technology bubble in the 1990s.*
Source: *Dow Jones.*

- Two defining characteristics of an MTB : Concentration in new technologies (infrastructure) and decoupling from the real economy
- While decoupling is common in all bubbles, the new technology aspect is peculiar to MTBs.
- Perez uses Price/Earnings ratios as an indicator of decoupling from the real economy.
- Irrationally high P/E ratios are observed in MTBs, which signal that investors either expect very high future earnings or further increases in stock prices to incur capital gains

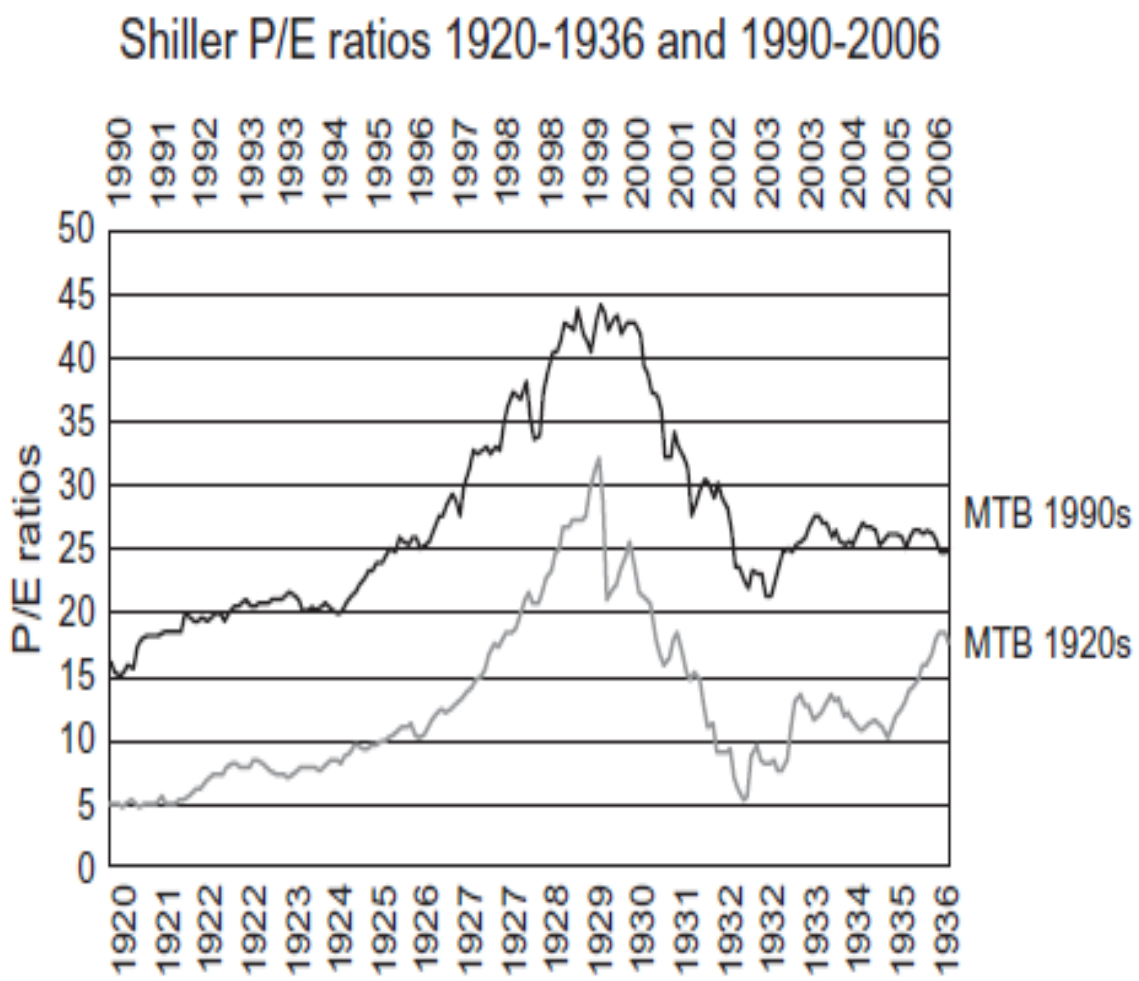


Fig. 5. *The abandonment of fundamentals: not earnings but capital gains.*
Source: *Data extracted from Shiller (2000 [2005]) fig 1.3, p.8) updated in http://www.econ.yale.edu/~shiller/data/ie_data.xls (downloaded August 2008).*

- This is because it is not profits or dividends that determine the flow of investment during an MTB. Rather, it is capital gains through asset inflation.
- Therefore, there is a massive increase in the demand for liquid assets (such as stocks) as the velocity of money and volume of trading increases
- When the development of a new technology increases productivity and profits, the financial sectors begins channelling funds to the new industries rather than traditional clients.

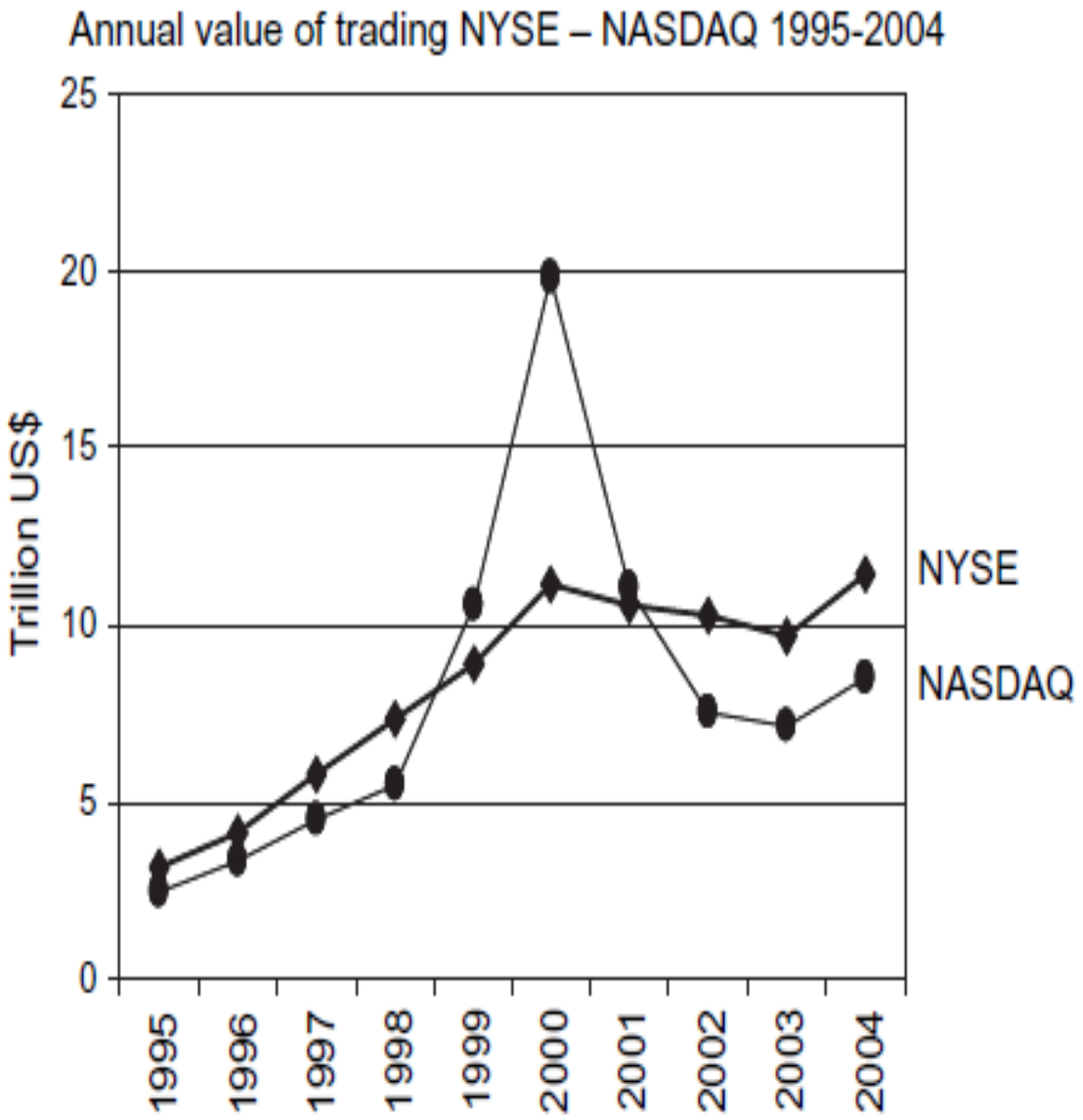


Fig. 4. *At the boom, the NASDAQ overtook the NYSE in volume of trading.* Source: *NYSE.*

- The bubble associated with this channelling of funds leads to an artificial financial success in the early period (as stocks rise) and results in over-investment in the new infrastructure.
- However, at some point, the MTB bursts, leading to a bust. By then, though, the economy is totally modernized and the new infrastructure has been in place. On the other hand, keep in mind that financialization of the economy has also taken place during this period with quick gains through speculation becoming widespread during the bubble

- The success and duration of the deployment period that will follow depends on the ability of the state to restrain the financial sector (or the casino it has turned into) through regulation, so that investment decisions are taken with respect to real economy constraints.
- Therefore, there is a fundamental difference between MTBs and ELBs. MTBs are driven by *opportunity pull* as the thrill of the new technology draws the money into the casino while ELBs are driven by *easy credit push* as the abundance of cheap credit funnels the funds into the casino.

- This can be clearly seen in the last two bubbles, the MTB of the 1990s and the ELB of the first decade of the century.
- The interest rates were very high during the MTB, while they were at historical lows during the ELB.
- The ELB of the first decade of the century was an amplification of the forces that resulted in the decoupling of finance from the real economy during the 1990s. Combined with the historically low interest rates, the magnitude of the bubble was intensified even more.

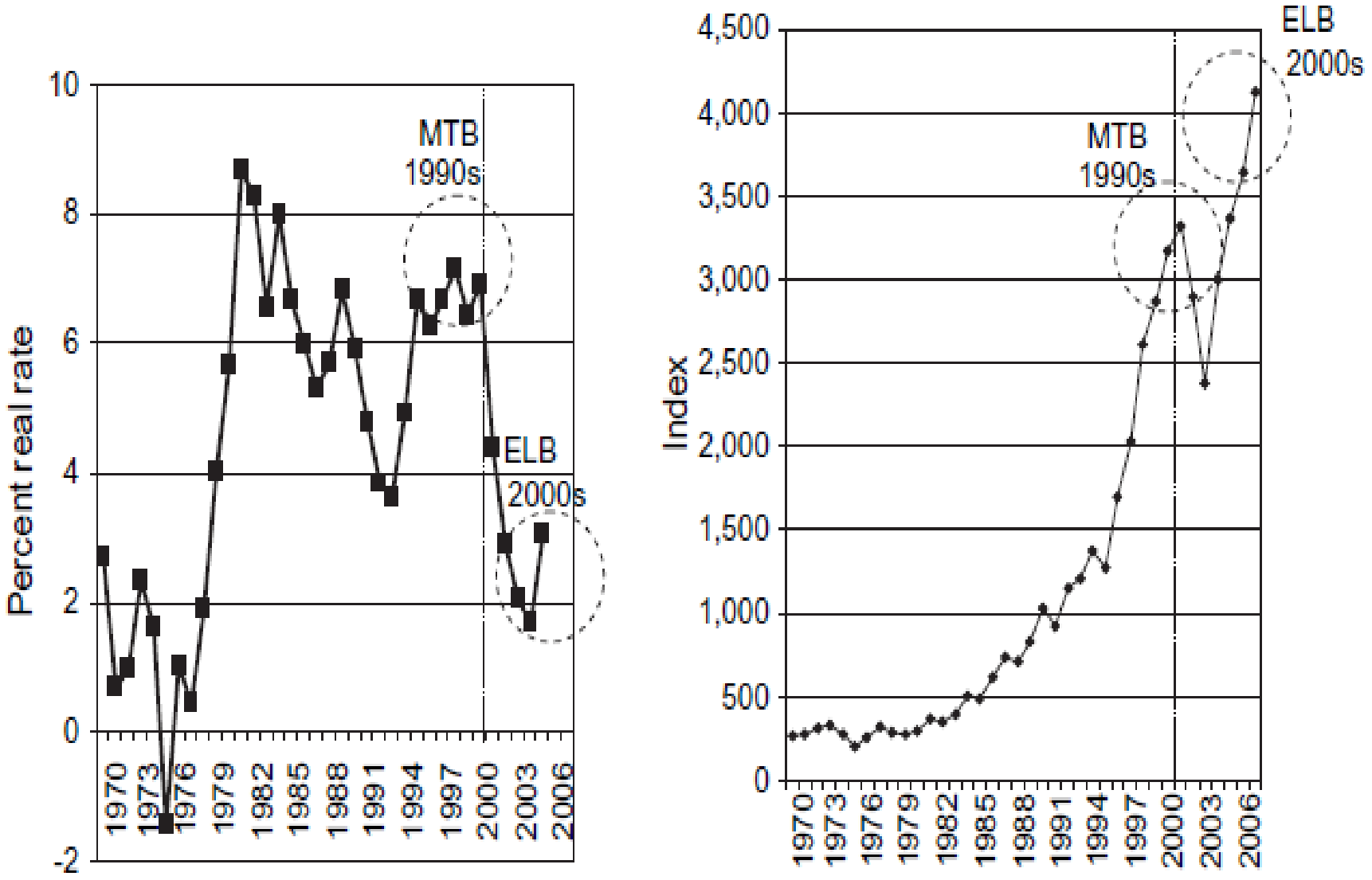


Fig. 16. *The 1990s and the 2000s: very different real interest rates.*
Source: *World Development Indicators for interest rates and Dow Jones for index.*

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Lecture 4
Credit Crunch

Credit Crunch

- Accumulation of reserves in response to the 1997 Asian crisis in order to defend domestic currencies.

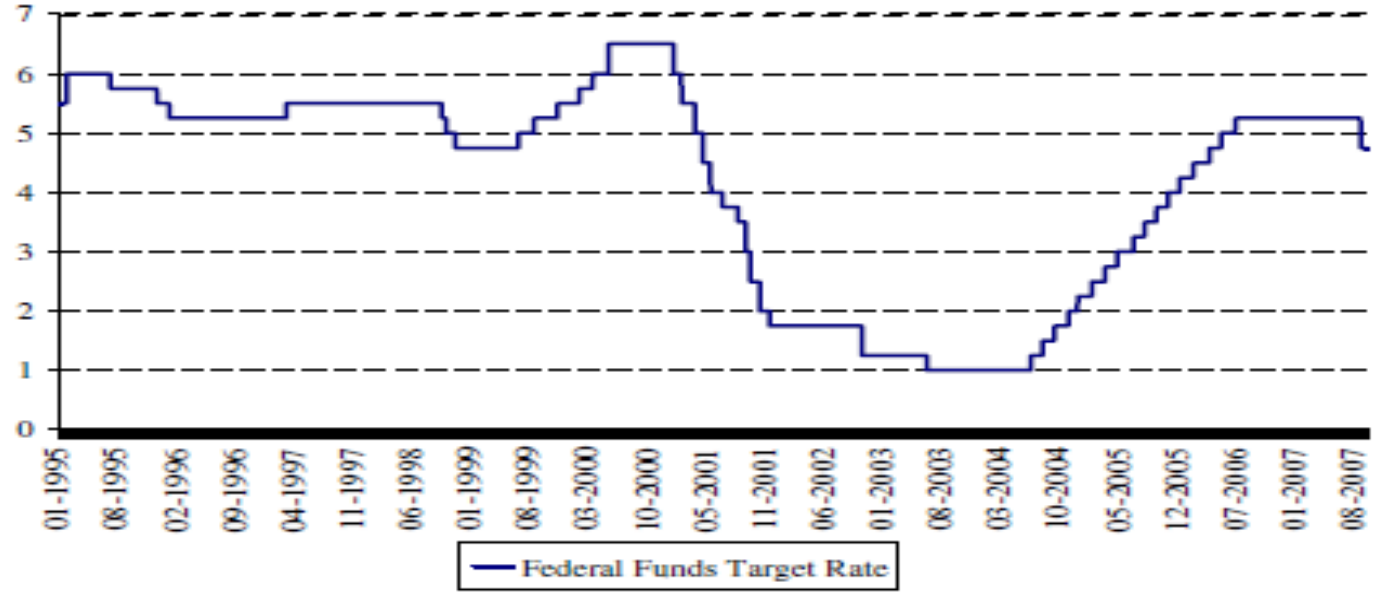
- Very stable macroeconomic conditions, steady economic growth, low inflation and low interest rates. (See Mizen 2008 for detailed analysis)

- Historically low spreads between safe and risky assets, unusually low volatility, very high leverage

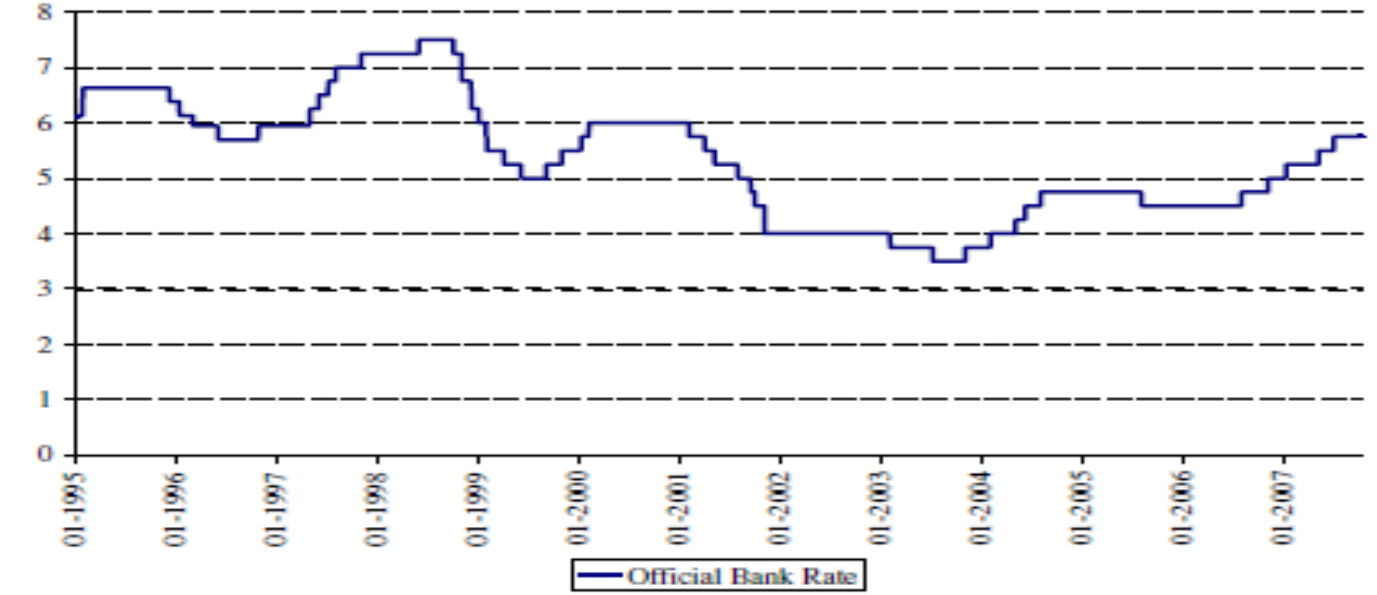
- The bursting of the dot.com bubble at the end of the 1990s caused the central banks to reduce interest rates in order to mitigate the affects of the coming recession. (to suppress the possible deflationary pressures)

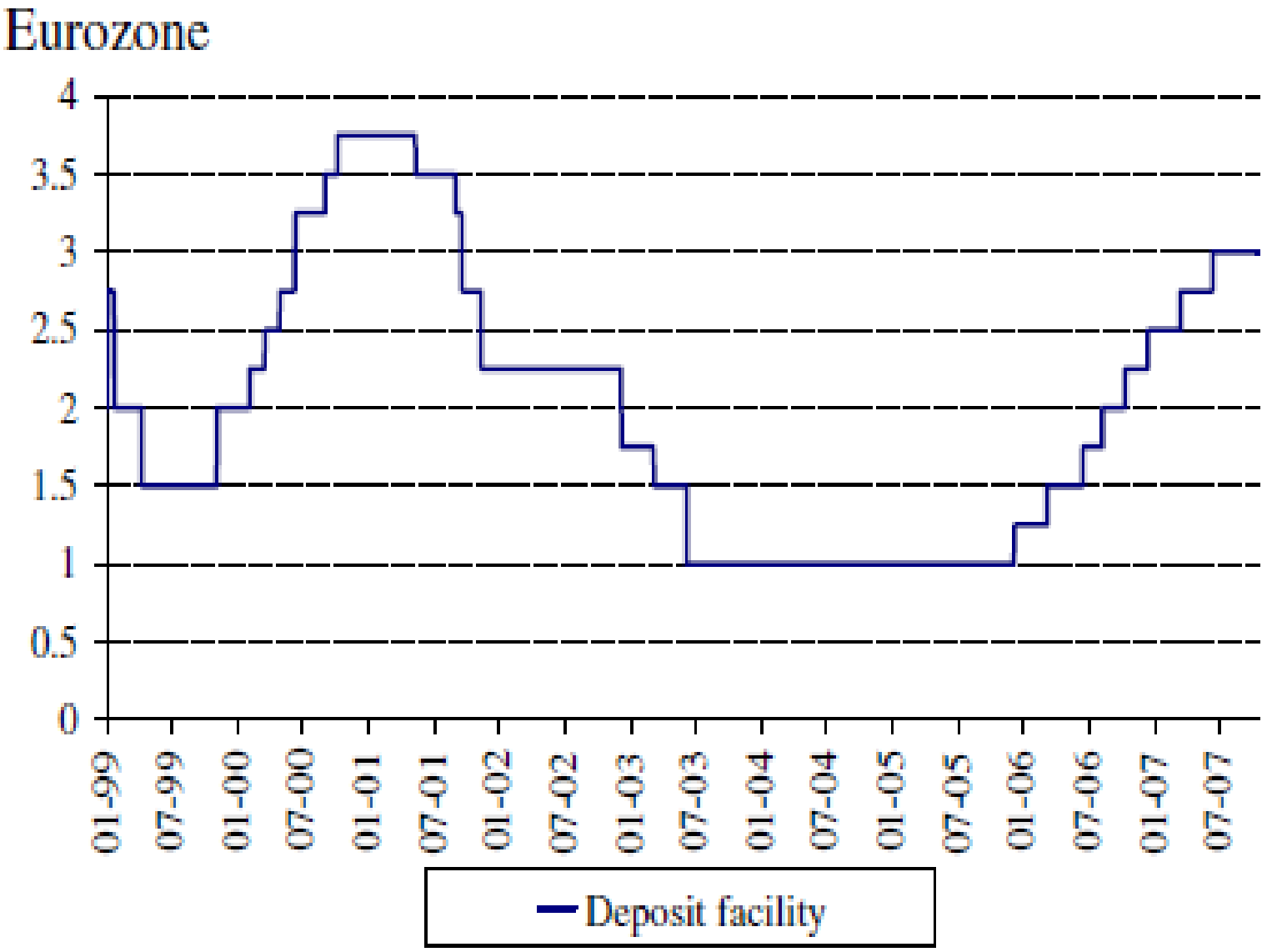
- Expansionary monetary policy accommodated the low interest rates as the money supply in industrial countries increased dramatically.

USA


7
6
5
4
3
2
1
0
01-1995
08-1995
02-1996
09-1996
04-1997
11-1997
06-1998
01-1999
08-1999
03-2000
10-2000
05-2001
11-2001
06-2002
01-2003
08-2003
03-2004
10-2004
05-2005
12-2005
07-2006
01-2007
08-2007
Federal Funds Target Rate

UK


8
7
6
5
4
3
2
1
0
01-1995
01-1996
01-1997
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01-2006
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Official Bank Rate

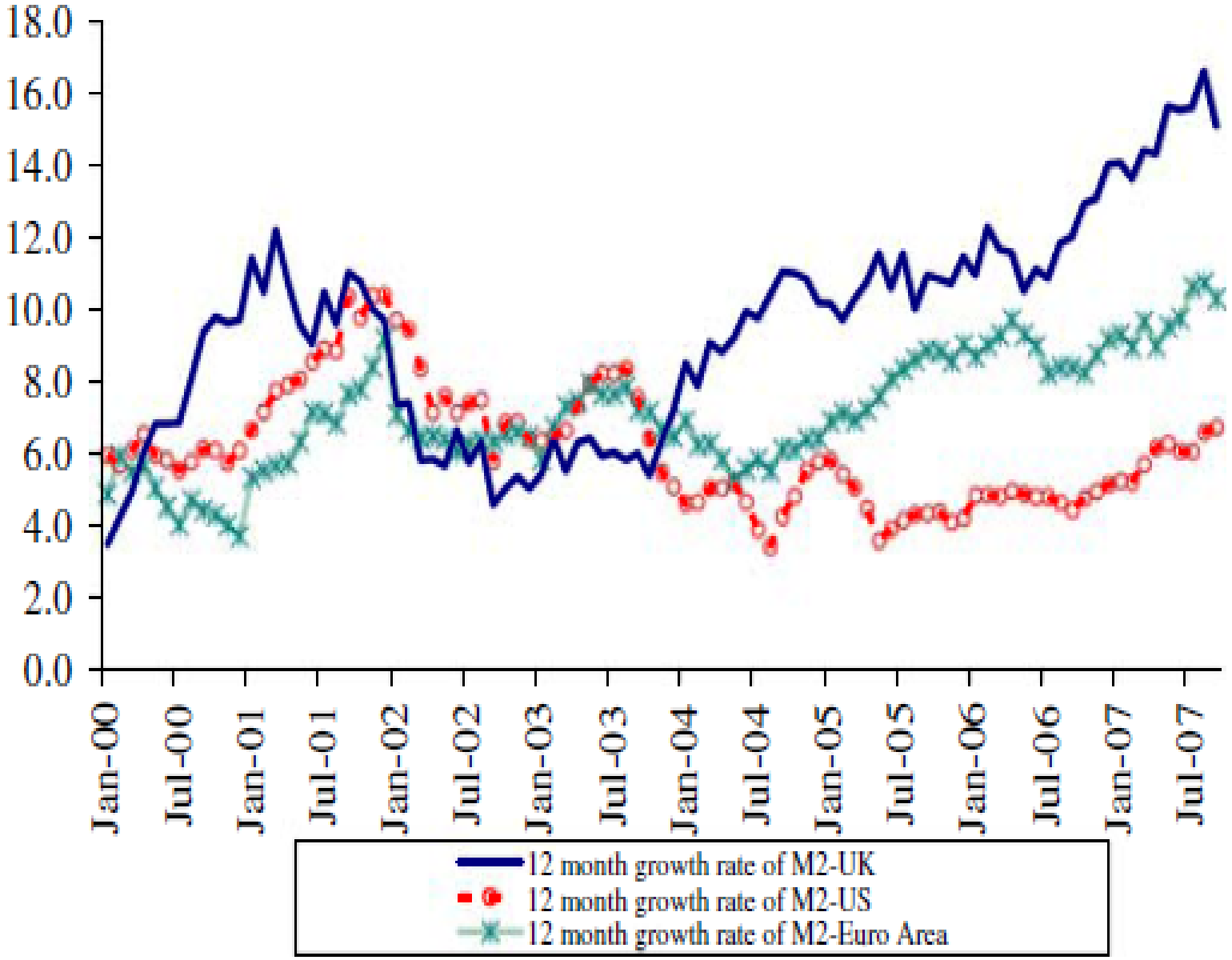

Eurozone
4
3.5
3
2.5
2
1.5
1
0.5
0
01-99
07-99
01-00
07-00
01-01
07-01
01-02
07-02
01-03
07-03
01-04
07-04
01-05
07-05
01-06
07-06
01-07
07-07
Deposit facility

- The Great Moderation in the U.S (Bernanke 2005)- The Great Stability in the U.K

- Inflation kept at very low levels and in line with the target rates, as well as very low output volatility. (In general, this is not the case, as keeping inflation under control comes along with large fluctuations in output in general)

- The well-known Phillips curve relationship between inflation-employment seemed to have disappeared.

Money supply growth rates (Goodhart 2008)



- ‘Greenspan put’: No downward risk in financial markets, leading to excessive risk-taking (see Heinemann 2008 for how current structure of financial system necessarily implies this)

- There was widespread belief that the FED would not allow the markets to fall below certain thresholds and take immediate action by reducing interest rates and pumping up of liquidity.

- The result was a clear underpricing of risk in financial markets.

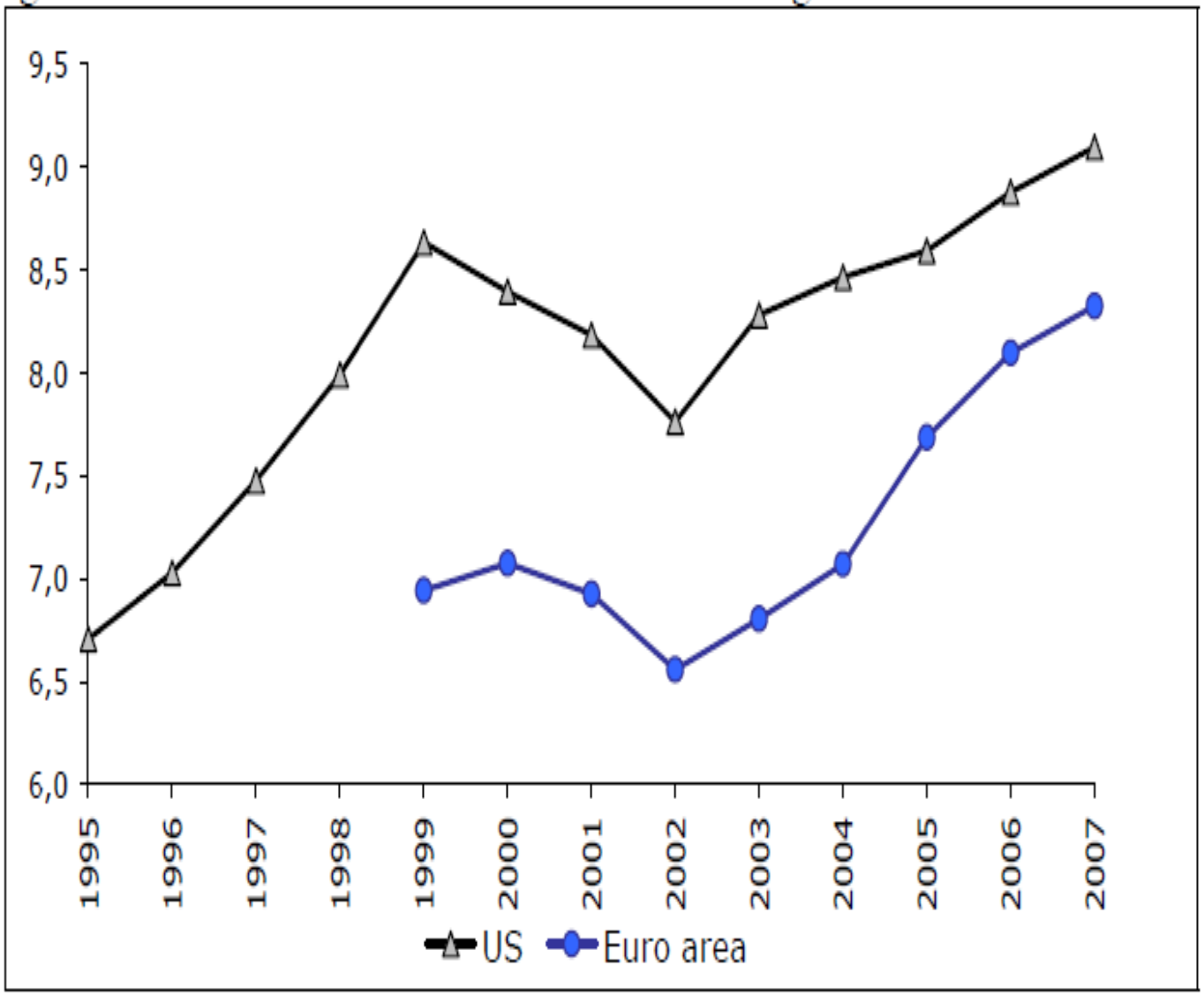
- “(D)evelopment of financial products, such as asset-backed securities, collateral loan obligations, and credit default swaps, that facilitate the dispersion of risk… These increasingly complex financial instruments have contributed to the development of a far more flexible, efficient, and hence resilient financial system than the one that existed just a quarter-century ago.“ (Greenspan, 2005)

- “there is little systematic evidence to support widely cited claims that financial globalization by itself leads to deeper and more costly crises.” (IMF 2006, Financial Stability Report)

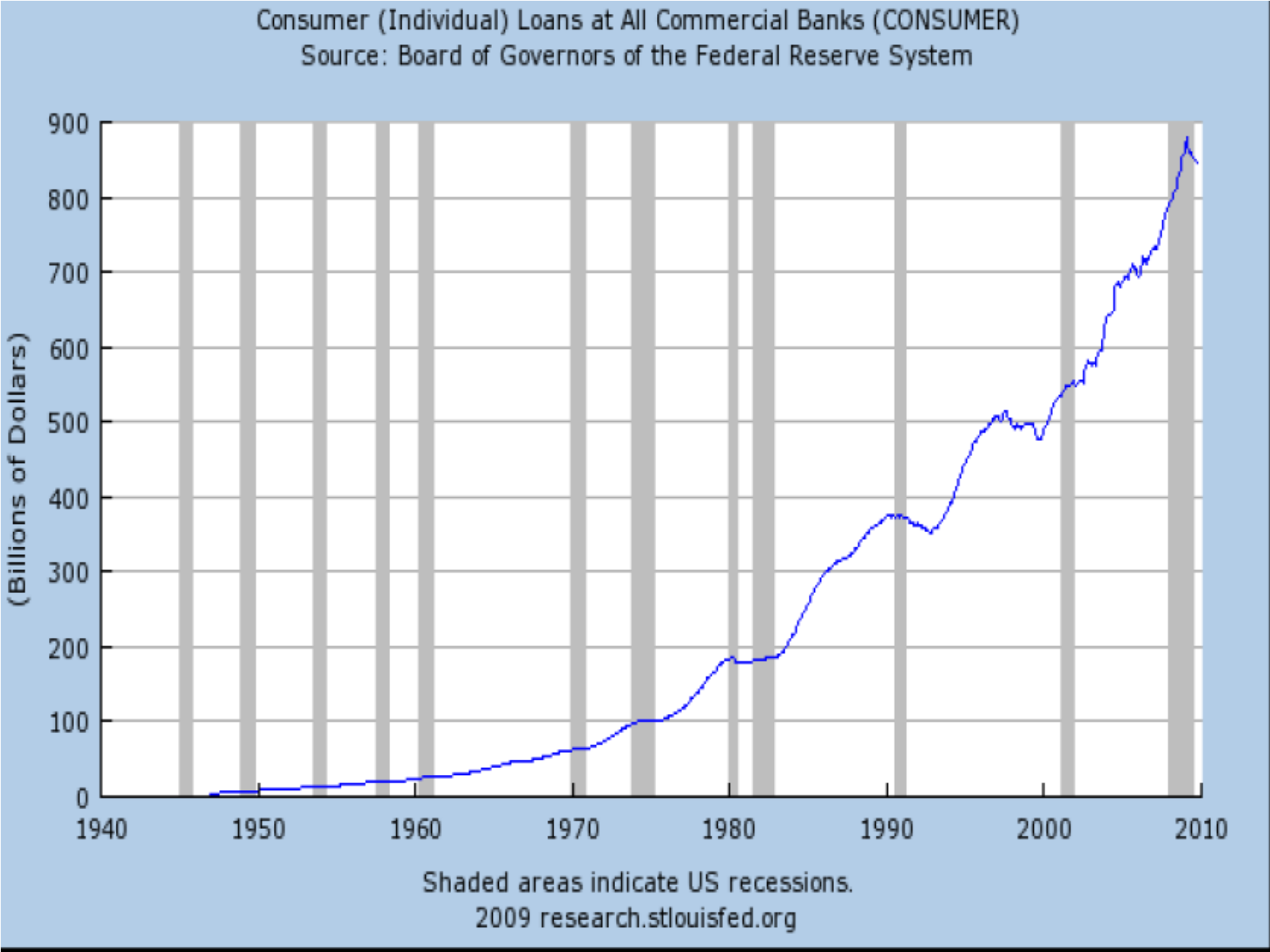
- As a result of these conditions, it was argued that the economy is now much less vulnerable to shocks. (‘No return to boom and bust’ in Gordon Brown’s words)

- Significant fall in personal saving rates and increase in Debt/Income ratios in the developed world.
- Very low interest rates fuelled the demand for housing and consumer goods due to cheap credit, leading to sustained increase in house prices. (particularly in U.S, U.K and Southern Europe)
- Median house prices in U.S for example increased by 40% between 2000 and 2006.
- A significant increase in the ratio of total financial assets/GDP in U.S and Europe, indicating greater total indebtedness of the private sector, particularly households.

Figure 1 - Total financial assets/GDP – Excluding rest of the world



Sources - For US: Flow of Funds Accounts of the United States, Board of Governors of the Federal Reserve System, Washington D.C. 20551. For Euro Area: Quarterly Euro Area Accounts


Consumer (Individual) Loans at All Commercial Banks (CONSUMER)
Source: Board of Governors of the Federal Reserve System
(Billions of Dollars)
900
800
700
600
500
400
300
200
100
0
1940
1950
1960
1970
1980
1990
2000
2010
Shaded areas indicate US recessions.
2009 research.stlouisfed.org

- Increased surpluses from China, Japan, Germany and oil-exporting countries as the counterpart to deficits in U.S, U.K and Southern Europe. (The Savings Glut as it is called in the mainstream literature)

- As mentioned before, part of this was due to hedging against domestic currency devaluation after the bitter experience of the Asian Crisis.

- However, competitive exchange rate policy to enhance exports also played a major role.

- Of particular importance is the relation between China and U.S (and partly Europe)

- The pegging of Yuan to the U.S $ and Chinese monetary policy implied a circular relationship between China and U.S
- Increased consumption of U.S consumers based on cheap credit. (monetary expansion in U.S)
- Massive U.S imports from China leading to excessive supply of U.S $ in China (as well as destroying domestic industry in U.S, as well as Europe, though to a lesser extent)
- Pegging of Yuan requires the CB of China to drain this excess supply of $ to prevent the appreciation of the Yuan

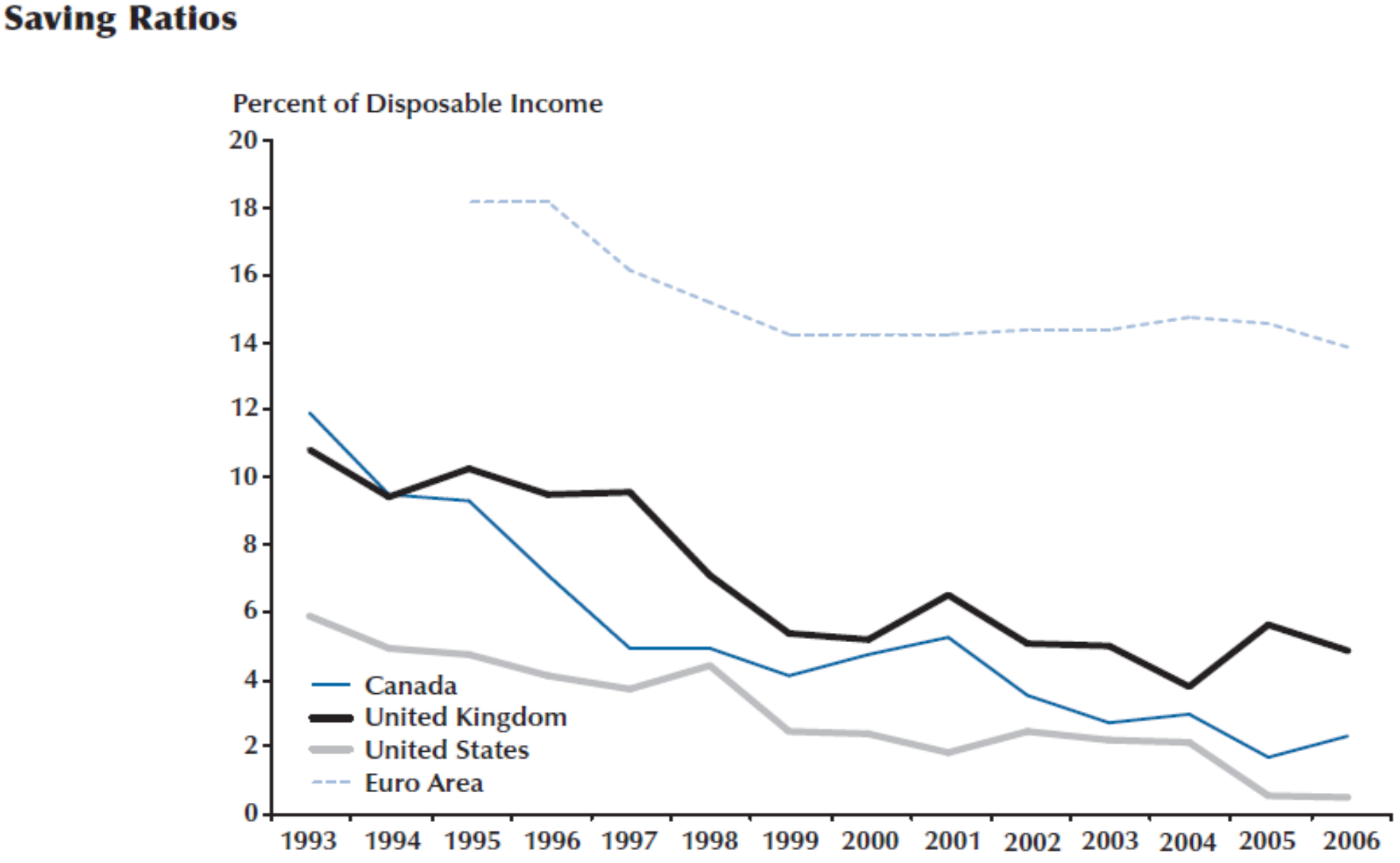
- These U.S $ invested back in U.S government bonds and Treasury bills

- As of 2006, out of the $ 5 trillion U.S debt, 44% was held by foreigners, with Japan being the largest holder followed by China.

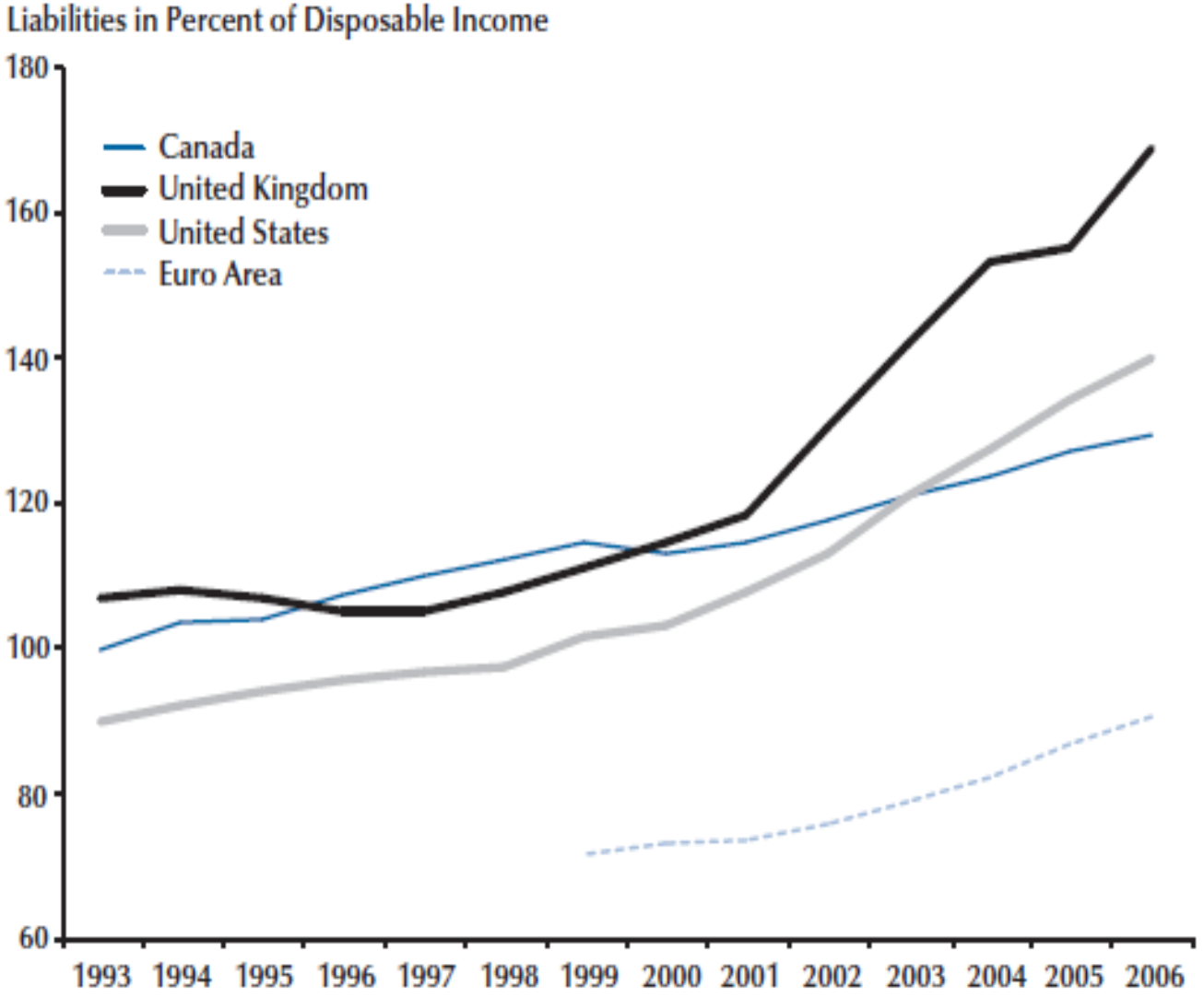
- In April 2010, China exceeded Japan and became the largest holder. (In November 2010, FED outpaced China and now is the official largest holder of U.S debt)

- Therefore, the entire discussion of revaluation of Yuan.

Individual Savings Rates out of Disposable Income in Developed Countries (Goodhart 2008)

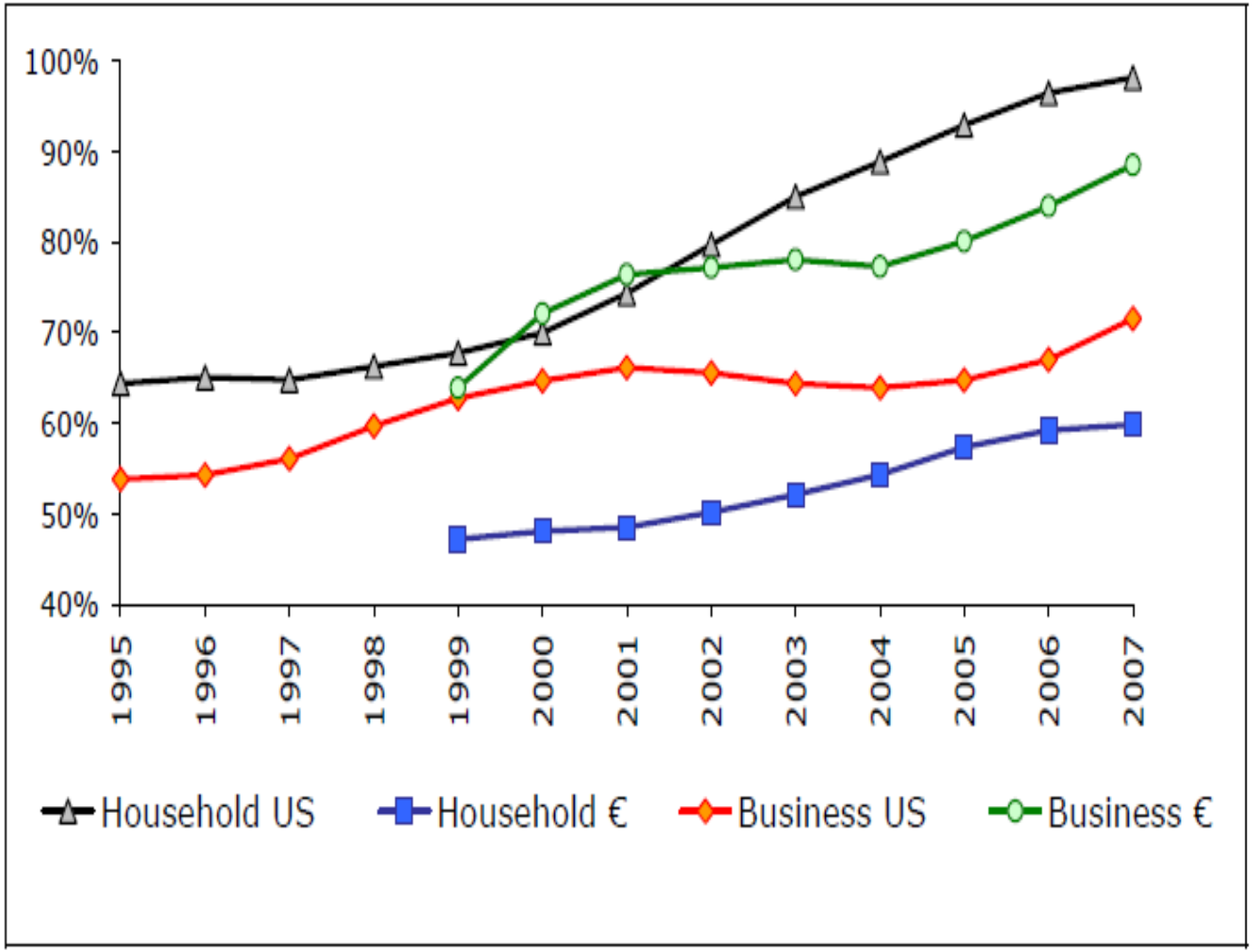


Debt to Income Ratios



SOURCE: OECD Economic Outlook and ECB/Haver Analytics.

Credit to private sector (loans plus securities as a percentage of GDP)



Sources - For US: Flow of Funds Accounts of the United States, Board of Governors of the Federal Reserve System, Washington D.C. 20551. For Euro Area: Quarterly Euro Area Accounts

- Massive increase in capital flows to developing countries, some as foreign direct investment but a large portion as speculative financial capital, as stock markets all over the world soared, and national currencies of developing countries experienced large appreciation episodes.

- Very high rates of growth in developing economies between 2001-2007 particularly, as well as the developed world. Low volatility of output growth

- However, this came at the expense of large current account deficits on a continuous basis in U.S ,U.K and Spain in Euro-zone.

- These deficits were matched by massive current account surpluses in export economies such as China, Japan, Germany and oil-exporting countries. (Remember the Yuan-devaluation debate going on for years)

• Massive currents account deficits in U.S and U.K funded by massive surpluses in export economies. (China, Japan, India and oil-exporters..)

Table 1: GDP Growth rates during two cycles and sub-periods (%)

	1989-1997	1989-1992	1993-1997	1998-2007	1998-2001	2002-2007
World	3.0	2.5	3.3	3.9	3.2	4.3
Metropole	2.7	2.7	2.8	2.6	2.8	2.5
Periphery	3.3	2.3	4.1	5.7	3.9	6.9

Source: IMF, *World Economic Outlook* (WEO) April 2008 Database.

Notes: "Metropole" and "periphery" include "advanced" and "developing" economies of IMF's grouping. Exponential growth rates are derived from IMF's weighted annual growth rates based on constant local prices.

Boratav (2009) has the cumulative numbers for oil exporting countries

Current Account Balance

	2002	2003	2004	2005	2006	2007
China	2.4	2.8	3.6	7.2	9.5	11.0
Japan	2.9	3.2	3.7	3.6	3.9	3.8
UK	-1.7	-1.6	-2.1	-2.6	-3.3	-2.7
U.S	-4.3	-4.7	-5.3	-5.9	-6.0	-5.2
France	1.4	0.8	0.6	-0.6	-0.8	-1.0
Germany	2.0	1.9	4.7	5.1	6.1	7.5
Spain	-3.3	-3.5	-5.3	-7.4	-8.9	-10.1

Boratav (2009) and IMF WEO Database

Table 2: Capital Flows to the Periphery. Current Billion $s & %

	1989	1992	1997	2001	2007
IMF, GFSR	**73.4***	**166.8**	**480.7**	**182.7**	**1929.4**
IIF	---	**162.4**	**339.5**	**169.3**	**918.6**

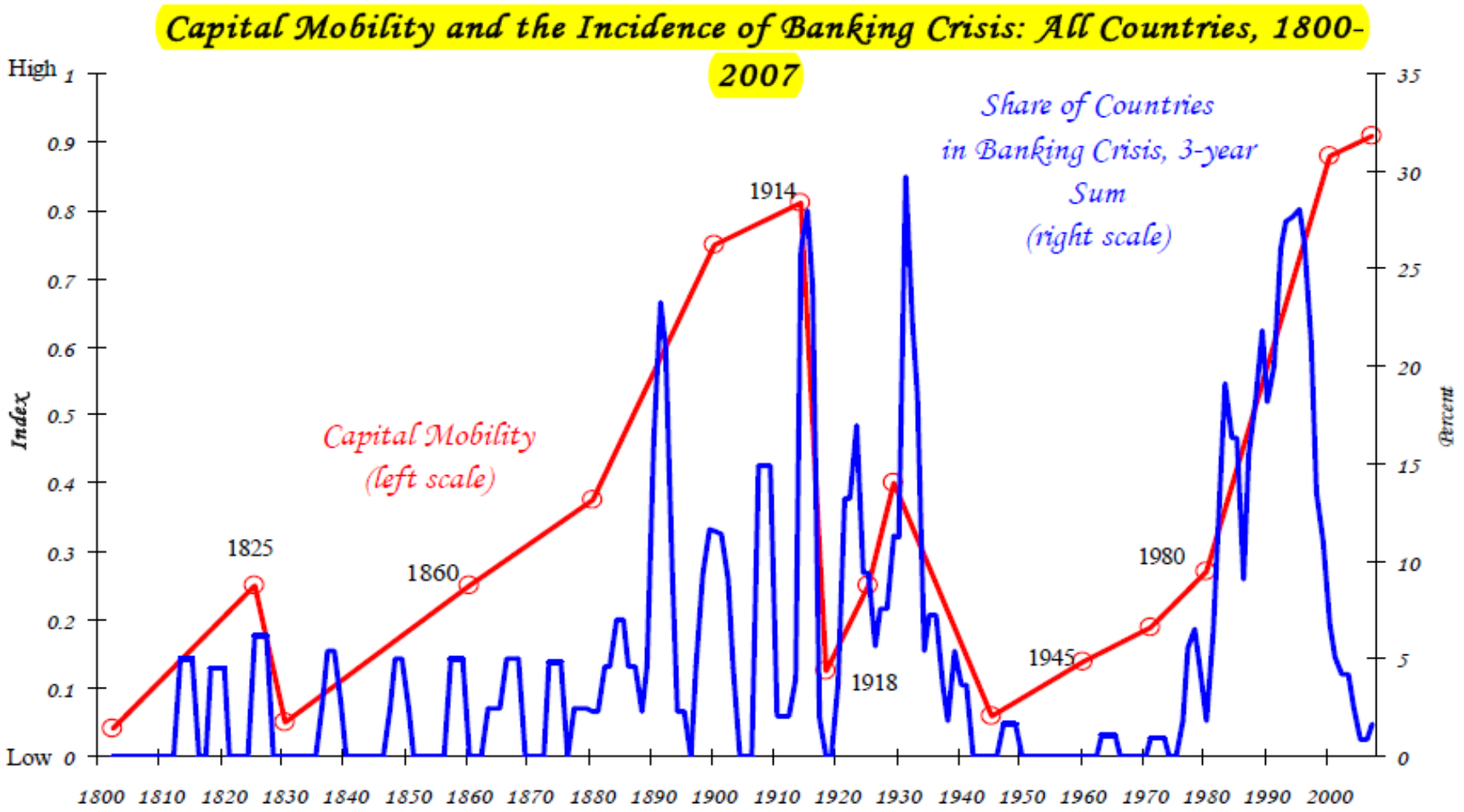
Notes: (*): IMF, WEO, October 1997, Table A33, "net external financing" for developing countries. *First row*: IMF, *Global Financial Stability Report*, various isues, ending with October 2008, Table 1. *Second row* (which covers only thirty large emerging economies): Institute of International Finance, *Capital Flows to Emerging Market Economies,* various issues, ending with October 12, 2008, Table 1.

Table 3:Capital Flows, constant (1988) $s to the periphery: Annual rates of change (%)

	1990-1997	1990-1992	1993-97	1998-2007	1998-2001	2002-2007
IMF, WEO	**24.3**	107.3	6.1	**7.2**	-26.5	19.9
IMF, GFSR	**24.8***	60.0**	21.9	**15.4**	-10.9	45.6
IIF	---	---	12.8	**9.4**	-14.7	34.0

Notes: (*):1992-1997; (**). 1992. *Row 1:* IMF, WEO, October 1997 and other issues, "net external financing" for developing countries. The figures pertain to "net" capital flows to developing economies. *Row 2 and 3:* Same source as Table 2. The deflator used is USA CPI based on 1988 IMF, WEO, April 2008 Database.

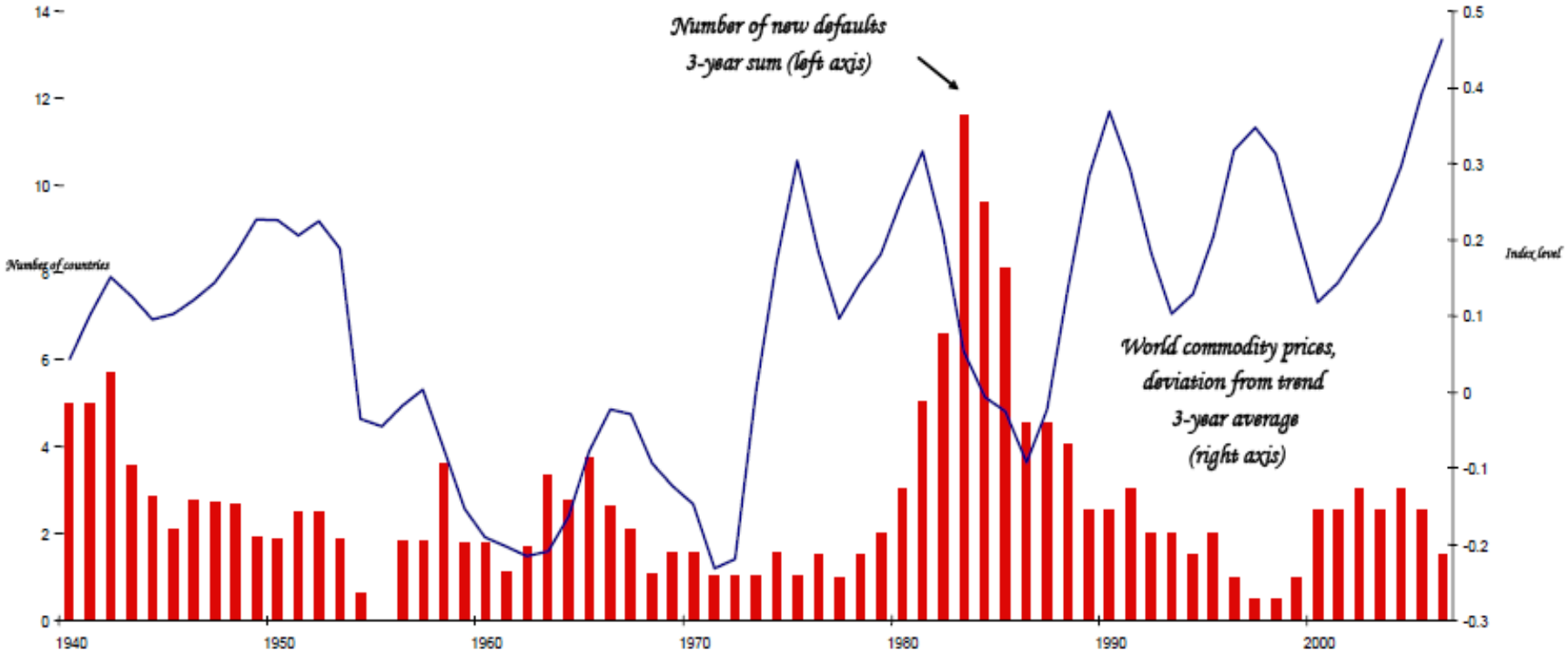
- Reinhart and Rogoff (2008) show that historically, periods of greater capital mobility are followed by banking crisis.
- Although they do not provide a reason for this phenomenon, the crises are in general triggered by sudden stops – reversals of capital flows.
- One other observation by Reinhart and Rogoff is that emerging market borrowing tends to be pro-cyclical and dependent on commodity prices.
- Spikes in commodity prices are followed by waves of sovereign defaults.



Sources: Bordo et al. (2001), Caprio et al. (2005), Kaminsky and Reinhart (1999), Obstfeld and Taylor (2004), and these authors.

Notes: As with external debt crises, sample size includes all countries, out of a total of sixty six listed in Table 1 that were independent states in the given year. On the right scale, we updated our favorite index of capital mobility, admittedly arbitrary, but a concise summary of complicated forces. The smooth red line shows the judgmental index of the extent of capital mobility given by Obstfeld and Taylor (2003), backcast from 1800 to 1859 using their same design principle.

1940–2006



Sources: Boughton (1991), *The Economist,* Gayer, Rostow, and Schwartz (1953), *World Economic Outlook,* IMF and the authors' calculations based on the sources listed in Table AI.9. For external default, see Appendix I.

Notes: New external defaults refer to the first year of default. Because of the marked negative downward drift in commodity prices during the sample period, prices are regressed against a linear trend, so as to isolate the cycle.

- Most of the success in macroeconomic environment was attributed to

  - Better monetary policy that managed to reduce the swings in the business cycle
  - Globalization of the world economy in general and finance in particular
  - Improvements in information technology enabling better communication and risk assessment
  - Securitization that enables to spread the risk
  - Derivatives that enabled hedging against risk

Securitization: The Beginning of the End?

- Securitization is the process of pooling together future cash flows (such as loan payments) and transferring them to another entity which sells these future cash flows to investors and pays them as these flows are realized.

- Was forbidden the U.S until 1980. (Glass-Steagall Act) Banks were allowed to engage in some securitization in 1980, in 1999, the restriction was removed and originators of loans were allowed to sell the loans to issuers for securitization. (See Davidson 2008)

- The full process (Fabozzi et al (2007) has a good example, Ashcraft et al (2008) has a very detailed explanation of the whole process)

- The process starts with the borrower or most of the times through a mortgage broker, who gets paid for every mortgage arranged.

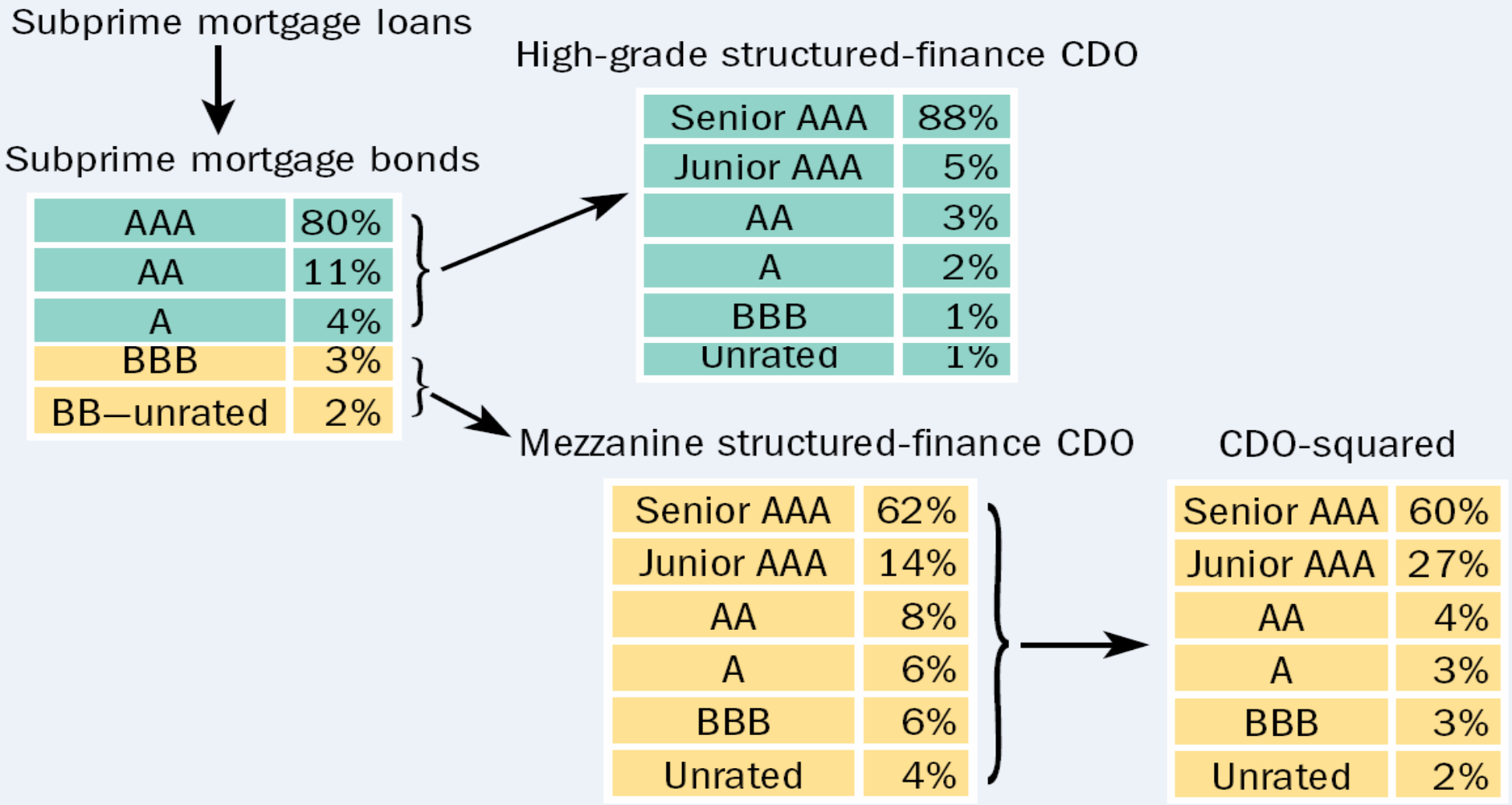
- The originator, (a bank or mortgage firm) lends the initial amount to the borrower.
- The pool of loans is then sold to an issuer (arranger). This might be at par value or higher than the initial principle, as the issuer expects to collect the interest payments on the loans. The originator already collects fees from the borrower for the contract.

- The issuer scrutinises the originator company, and then sets up a special-purpose vehicle (SPV) that legally purchases the loans. This SPV is a bankruptcy-remote trust, meaning that it is unaffected by the bankruptcy of the originator, or the arranger. However, it is still vulnerable to losses on the loans.

- For the purchase of loans, the issuer uses internal funds where available. In some cases, the issuers have to borrow the funds from a warehouse lender, using the loans as collateral. In this case, the warehouse lender may require the issuer to use some internal funds, meaning a 'haircut' to the collateral.
- The issuer pools the loans, and creates different tranches of securitized assets. (Mortgage-backed security) These in general involve three different classes: Senior, Mezzanine and Junior. Senior classes are protected by Mezzanine and Junior classes, as these bear the first losses if the loans default. For this reason, Junior class (toxic waste) offers the highest return and is the riskiest, while the senior class offers the lowest return and is the safest (AAA-rated securities).
- As a rule of thumb, securitization issues backed by mortgages are called MBS, and securitization issues backed by debt obligations are called CDO. Securitization issues backed by consumer-backed products — car loans, consumer loans and credit cards, among others — are called ABS

Highly complex

Structured credit products are thinly sliced and diced.



Source: IMF staff estimates.

Notes: CDO = collateralized debt obligation. Percentages represent share of bond in the rated tranche.

- Sometimes (not always) the issuers are asked to hold all or some of the junior tranche securities.

- The quality of the securities are rated by Credit Rating Agencies (S&P, Moody's) according to the loans in the tranches. The senior tranches receive AAA rating while junior tranches are not rated.

- The credit rating agencies receive regular payments from issuers for this service. The ratings help the investors to choose between various asset-based securities.
- This is the 'originate and distribute' model, as the risk is 'in theory' entirely removed from the banks' balance sheets.

- *Credit Default Swaps (CDS):* Another ingenious invention of the last decade.
- A CDS is an arrangement where the buyer makes periodic payments to the seller and receives a payoff in return, if the underlying debt instrument (loan, bond, MBS) defaults.

Table 1

Historical Default Experience of Bonds Rated by Fitch

	Investment-grade Bonds									
Rating at issuance	*AAA*	*AA+*	*AA*	*AA–*	*A+*	*A*	*A–*	*BBB+*	*BBB*	*BBB–*
10-year default probability	0.19%	0.57%	0.89%	1.15%	1.65%	1.85%	2.44%	3.13%	3.74%	7.26%
Default rate (annualized)	0.02%	0.06%	0.09%	0.12%	0.17%	0.19%	0.25%	0.32%	0.38%	0.75%

	Speculative-grade Bonds									
Rating at issuance	*BB+*	*BB*	*BB–*	*B+*	*B*	*B–*	*CCC+*	*CCC*	*CC*	*C*
10-year default probability	10.18%	13.53%	18.46%	22.84%	27.67%	34.98%	43.36%	48.52%	77.00%	95.00%
Default rate (annualized)	1.07%	1.45%	2.04%	2.59%	3.24%	4.30%	5.68%	6.64%	14.70%	29.96%

- At first glance, a CDS looks like insurance on debt. However, there are major differences between a CDS and an insurance contract.

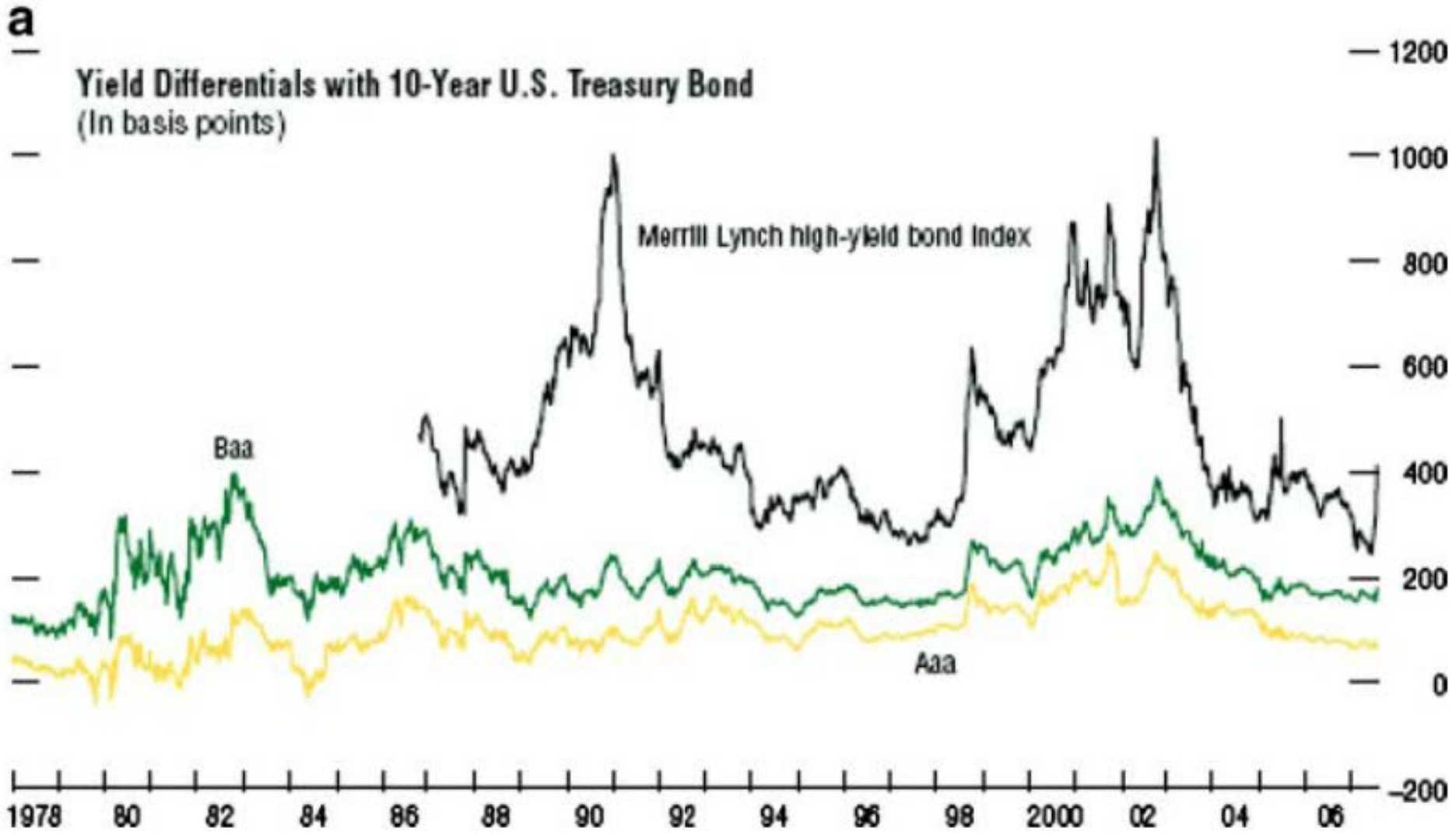
  - The seller of a CDS does not have to be a regulated entity.
  - The buyer of the CDS does not have to hold the underlying security or any other form of credit exposure. In other words, everybody can buy a CDS on any security or debt-related instrument. (on anybody's debt in plain English).
  - The seller of the CDS does not have any capital adequacy or reserve requirements. (Blind selling of CDS not backed up by any capital)
  - In U.S, the CDSs were subject to mark-to market accounting (just like MBS, or generally CDOs). Or in other words, the institutions holding these assets on their balance sheets would use market prices for these contracts as the underlying value. (Mark-to-market has been suspended in U.S and U.K and the applied in Europe with Basel II since 2007 . Now, mark-to model or mark-to-myth)

- Investors in securities engaged in extensive CDS purchasing. In this way, the default risk was removed(!), and the investors had little incentive to monitor or scrutinize the underlying loans in the securities.
- Very-short maturities of securities: The average maturity of asset-backed commercial paper was around 90 days. Reduces incentives for investors.

- In most cases, banks were either holders of securities by another issuer on their own mortgage loans, or were directly engaging in securitizing through special investment vehicles (SIV). Banks therefore bought CDS on this debt as well. This increased incentives for predatory lending.

- Total notional amount of CDS (on all debts) was between 45-62***trillion*** $ as of 2007 (larger than world GDP).

Yield differentials (premium) with 10yr U.S Treasury bond (Goodhart 2008)



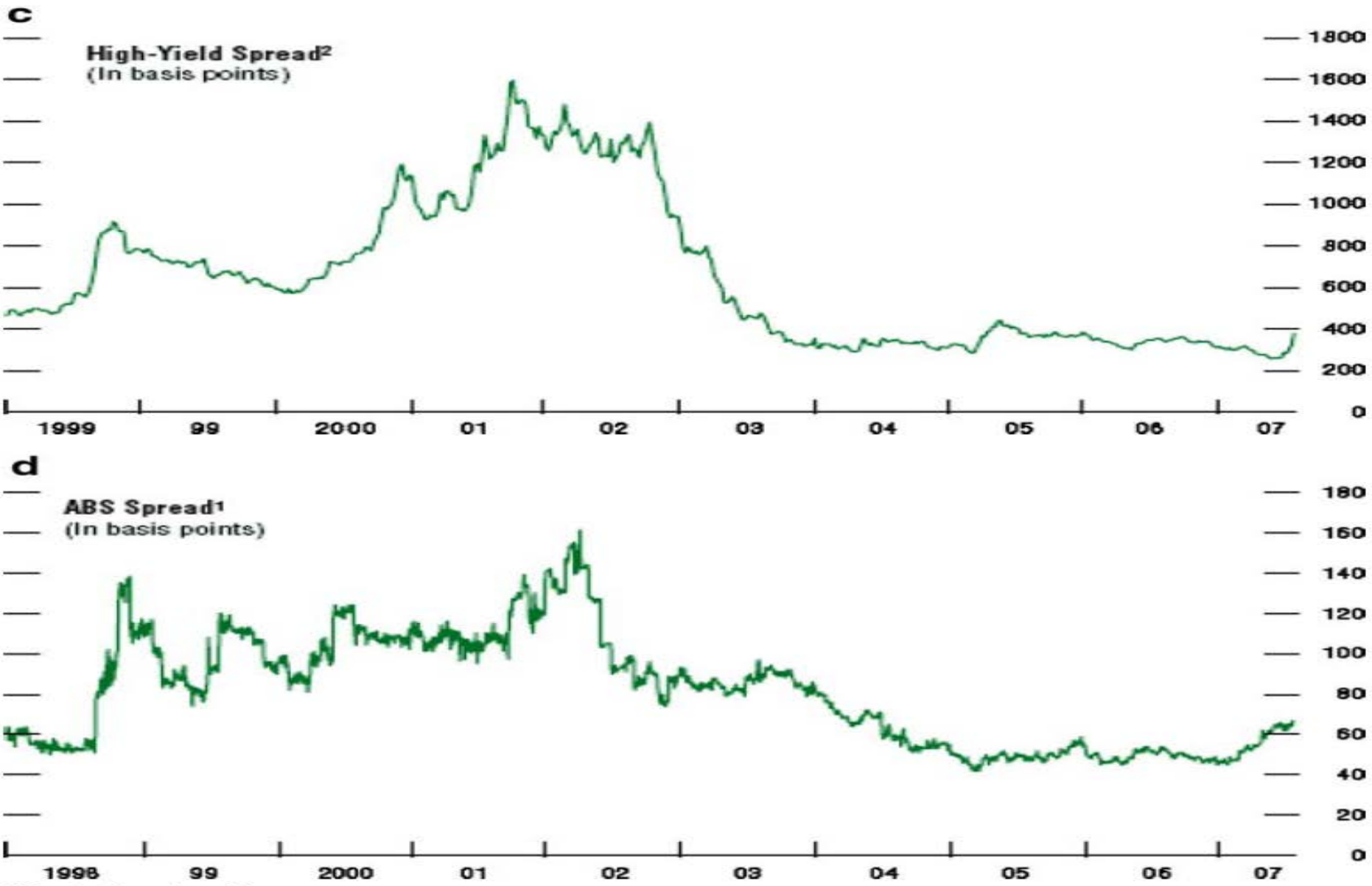


Fig. 3 (continued)

Fig. 3 **a** US yields on corporate and treasury bonds. **b** Stock market volatility (weekly data). **c** Europe corporate bond market (non-financial corporate bonds); spread between yields on a Merrill Lynch High-Yield European Issuers Index bond and a 10-year German government. **d** United States asset-backed securities: Merrill Lynch AAA Asset-Backed Master Index (fixed rate) option-adjusted spread

Securitization: A Simple Example

Borrower

↓(predatory lending)

Originator: Bank

↓(information advantage problem)

Issuer (Special Purpose Vehicle)

↙ ↑ ↘

Warehouse Lender ↑ Investors

↑ ↗ (conflict of interest)

Credit Rating Agency (paid by issuers)

Servicer

- All through the process, there are several incentive problems. (Detailed analysis in Ashcraft et al 2008)

- PROBLEMS
- 1- Mortgagor – Originator
- The most important problem is predatory lending: As the banks almost completely remove the risk from their balance sheets, there is incentive for making low-quality loans. This is documented in several empirical studies (Del'ariccia et al 2007, Keys et al 2008). Further, sub-prime borrowers do not understand the risks associated with the loans – Not financially sophisticated enough.

- 2 – Originator – Arranger
- Once again, there's the problem of predatory lending and borrowing. The arranger needs to conduct due-diligence and the originator has information advantage over the arranger. This creates incentives for collaborative fraud (mortgagor and originator), if proper due-diligence is not carried out.
- 3-Arranger – Third Parties
- The arranger has information advantage over all other third parties concerned (CRAs, asset managers and warehouse lender) This creates the typical lemons problem. The warehouse lender may ask the arranger to fund part of the securities.

- 4- Servicer – Mortgagor
- Unobserved costly effort on the mortgagors side, which affects value of the collateral (e.g servicing the house, and paying property taxes)
- 5- Asset Manager – Investor
- Principal – Agent problem: Most investors invest in accordance with recommendations of asset managers. When asset managers do not conduct appropriate due-diligence on the issuer, the issuer has little incentive to conduct due-diligence on the originator or borrowers. In theory, this problem should be mitigated by the credit rating agencies.

- 6 – Investor – Credit Rating Agencies
- Credit Rating agencies are paid by issuers (Ironically!). They are paid higher fees to assess structured products. Creates a massive conflict of interest and may lead to over-pricing of securities.
- Investors lack the ability to evaluate the models of Credit Rating Agencies
- All the problems (except 4) have significantly contributed to the sub-prime crisis.

- Fabozzi and Kothari (2007) argue securitization

- Reduces funding costs through SIV's (as these are bankruptcy-remote entities), therefore cheaper than issuing corporate bonds
- Diversifies funding channels (bonds & securities)
- Reduces interest rate and credit risk
- Reduces on-balance sheet leverage
- Provides maturity intermediation, diversification and information processing regarding the loans
- converts otherwise illiquid assets such as mortgage loans into liquid securities, and therefore

- Further technical problems with securitization (see Coval et al 2009)
  - The overlap of geographical locations increases the probability of higher than expected default correlations
  - The probability of default has been higher than estimated due to declining credit quality of sub-prime borrowers
  - The existence of CDO-squared (and cubed) increases the errors in determining probablity of default

Classification of Mortgage Loans

- Prime Loans: High quality borrowers. The guidelines are set by Fannie Mae and Freddie Mac. The originators can sell the mortgages to GSEs. (See Mizen 2008)

- Jumbo Loans: Exceed the limits set by Fannie Mae and Freddie Mac (around $800.000) but the loan cannot exceed 125% of average county house value.

- Alt-A Loans: Do not conform to Fannie Mae and Freddie Mac definitions - has higher loan /income ratio, default probability than Jumbo and Prime Loans

- The 2001 '*Interagency Expanded Guidance for Subprime Lending Programs'* outlines the definition of a sub-prime borrower. (See Ashcraft et al 2008)
  - Bankruptcy in the last 5 years
  - Very high probability of defalut
  - Debt-Income Ratio of 50% , limited ability to cover living expenses after debt-service
- Sub-Prime Loans: Sometimes referred as NINJA(No Income No Job or Asset) loans. No upfront payment is provided by the borrower (The loan covers the full amount of the property)
- Sub-prime borrowers pay 2-3% premium compared to jumbo loans
- They are ineligible for securitization by GSEs, so were securitized by private Wall Street Banks

Table 2: Top Subprime Mortgage Originators

		2006		2005	
Rank	Lender	Volume ($b)	Share (%)	Volume ($b)	%Change
1	HSBC	$52.8	8.8%	$58.6	-9.9%
2	New Century Financial	$51.6	8.6%	$52.7	-2.1%
3	Countrywide	$40.6	6.8%	$44.6	-9.1%
4	CitiGroup	$38.0	6.3%	$20.5	85.5%
5	WMC Mortgage	$33.2	5.5%	$31.8	4.3%
6	Fremont	$32.3	5.4%	$36.2	-10.9%
7	Ameriquest Mortgage	$29.5	4.9%	$75.6	-61.0%
8	Option One	$28.8	4.8%	$40.3	-28.6%
9	Wells Fargo	$27.9	4.6%	$30.3	-8.1%
10	First Franklin	$27.7	4.6%	$29.3	-5.7%
	Top 25	$543.2	90.5%	$604.9	-10.2%
	Total	$600.0	100.0%	$664.0	-9.8%

Table 3: Top Subprime MBS Issuers

		2006		2005	
Rank	Lender	Volume ($b)	Share (%)	Volume ($b)	%Change
1	Countrywide	$38.5	8.6%	$38.1	1.1%
2	New Century	$33.9	7.6%	$32.4	4.8%
3	Option One	$31.3	7.0%	$27.2	15.1%
4	Fremont	$29.8	6.6%	$19.4	53.9%
5	Washington Mutual	$28.8	6.4%	$18.5	65.1%
6	First Franklin	$28.3	6.3%	$19.4	45.7%
7	Residential Funding Corp	$25.9	5.8%	$28.7	-9.5%
8	Lehman Brothers	$24.4	5.4%	$35.3	-30.7%
9	WMC Mortgage	$21.6	4.8%	$19.6	10.5%
10	Ameriquest	$21.4	4.8%	$54.2	-60.5%
	Top 25	$427.6	95.3%	$417.6	2.4%
	Total	$448.6	100.0%	$508.0	-11.7%

Source: Inside Mortgage Finance (2007)

- Further, a very large proportion of sub-prime loans consisted of hybrid loans defined as ARM, Option ARM etc..

- These loans had teaser (or no) interest rates at the initial stages but after some time (depending on the type of the loan) the payments increased dramatically.

- They also depended on the ongoing interest rate in the Interbank market (LIBOR), making payments further vulnerable to fluctuations in the economy and central bank policy.

Table 7: Monthly Payment Across Mortgage Loan Type

Monthly Payment Across Mortgage Loan Type							
Month	30-year fixed	30-year fixed	2/28 ARM	2/28 ARM	2/28 ARM IO	3/27 ARM	3/27 ARM
1	$ 1,633.87	$ 1,546.04	$ 1,701.37	$ 1,566.17	$ 1,404.01	$ 1,533.12	$ 1,437.35
24	1.00	1.00	1.00	1.00	1.00	1.00	1.00
25	1.00	1.00	1.14	1.18	1.19	1.00	1.00
30	1.00	1.00	1.14	1.18	1.19	1.00	1.00
31	1.00	1.00	1.26	1.32	1.45	1.00	1.00
36	1.00	1.00	1.26	1.32	1.45	1.00	1.00
37	1.00	1.00	1.26	1.32	1.45	1.13	1.18
42	1.00	1.00	1.26	1.32	1.45	1.13	1.18
43	1.00	1.00	1.26	1.32	1.45	1.27	1.34
48	1.00	1.00	1.26	1.32	1.45	1.27	1.34
49	1.00	1.00	1.26	1.32	1.45	1.27	1.43
60	1.00	1.00	1.26	1.32	1.45	1.27	1.43
61	1.00	1.00	1.26	1.32	1.56	1.27	1.43
359	1.00	1.00	1.26	1.32	1.56	1.27	1.43
360	1.00	83.81	1.26	100.72	1.56	1.27	105.60
Amortization	30 years	40 years	30 years	40 years	30 years	30 years	40 years

Note: The first line documents the average initial monthly payment for each loan type. The subsequent rows document the ratio of the future to the initial monthly payment under an assumption that LIBOR remains at 5.31% through the life of the loan.

Source: SEC filing, Author's Calculations

Table 8: Ratio of Debt to Income Across Mortgage Loan Type

Ratio of Debt to Income Across Mortgage Loan Type							
Month	30-year fixed	30-year fixed	2/28 ARM	2/28 ARM	2/28 ARM IO	3/27 ARM	3/27 ARM
1	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%
24	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%
25	40.00%	40.00%	45.46%	47.28%	47.44%	40.00%	40.00%
30	40.00%	40.00%	45.46%	47.28%	47.44%	40.00%	40.00%
31	40.00%	40.00%	50.35%	52.86%	58.14%	40.00%	40.00%
36	40.00%	40.00%	50.35%	52.86%	58.14%	40.00%	40.00%
37	40.00%	40.00%	50.45%	52.86%	58.14%	45.36%	47.04%
42	40.00%	40.00%	50.45%	52.86%	58.14%	45.36%	47.04%
43	40.00%	40.00%	50.45%	52.86%	58.14%	50.83%	53.53%
48	40.00%	40.00%	50.45%	52.86%	58.14%	50.83%	53.53%
49	40.00%	40.00%	50.45%	52.86%	58.14%	50.83%	57.08%
60	40.00%	40.00%	50.45%	52.86%	58.14%	50.83%	57.08%
61	40.00%	40.00%	50.45%	52.86%	62.29%	50.83%	57.08%
359	40.00%	40.00%	50.45%	52.86%	62.29%	50.83%	57.08%
360	40.00%	3352.60%	50.45%	4028.64%	62.29%	50.83%	4223.92%
Amortization	30 years	40 years	30 years	40 years	30 years	30 years	40 years

Note: The table documents the path of the debt-to-income ratio over the life of each loan type under an assumption that LIBOR remains at 5.31% through the life of the loan. The calculation assumes that all debt is mortgage debt.

Source: SEC filing, Author's Calculations

Table 9: Terms of Mortgage Loans in MBS Pools

Year	ARM	2/28 ARM	3/27 ARM	5/25 ARM	IO	Option ARM	40-year
A. Alt-A							
1999	6.3	2.6	0.9	1.9	0.8	0.0	0.0
2000	12.8	4.7	1.7	3.4	1.1	1.1	0.1
2001	20.0	4.9	2.3	8.8	3.9	0.0	0.0
2002	28.0	3.7	2.8	10.9	7.7	0.4	0.0
2003	34.0	4.8	5.3	16.7	19.6	1.7	0.1
2004	68.7	8.9	16.7	24.0	46.4	10.3	0.5
2005	69.7	4.0	6.3	15.6	38.6	34.2	2.7
2006	69.8	1.8	1.7	15.8	35.6	42.3	11.0
B. Subprime							
1999	51.0	31.0	16.2	0.6	0.1	0.0	0.0
2000	64.5	45.5	16.6	0.6	0.0	0.1	0.0
2001	66.0	52.1	12.4	0.8	0.0	0.0	0.0
2002	71.6	57.4	12.1	1.4	0.7	0.0	0.0
2003	67.2	54.5	10.6	1.5	3.6	0.0	0.0
2004	78.0	61.3	14.7	1.6	15.3	0.0	0.0
2005	83.5	66.7	13.3	1.5	27.7	0.0	5.0
2006	81.7	68.7	10.0	2.5	18.1	0.0	26.9

Source: LoanPerformance (2007)

- Total sub-prime mortgages reached 25% of all mortgages issued by 2007. Many sub-prime mortgage-backed bonds were further re-securitized to create CDO-squared! (See Coval et al (2009) for detailed analysis)
- Most borrowers have experienced an improvement in their equity position due to increases in house prices. (outstanding mortgage obligations less than the value of the property) Using this positive equity as collateral, mortgagors engaged in either re-financing their mortgages or borrowing personal loans, which were subsequently securitized themselves.

- This creates a vicious cycle that feeds itself. The securitized sub-prime mortgages reached incredible levels in 2007. As a result of all, the sub-prime market was like a bombshell waiting to explode.

- Remember that many countries outside U.S had similar experiences due to excessively cheap credit. (U.K, Baltic countries, Spain..)

Volume of Credit Instruments Wray (2008)

Table 2 U.S. Credit Instruments by Type, 2007 (in billions of dollars)

Securitized Products	Dollars (Billions)	Percent
Total	10,228	100
MBSs	7,750	76
Residential	7,100	69
Subprime	1,300	13
Prime	5,800	57
Commercial	650	6
ABSs	2,478	24
Home Equity	596	6
Credit Card	343	3
Student Loans	236	2
Auto-related	199	2
CDOs/CLOs	302	3
Other*	802	8
Memo: CDSs	45,000	
Memo: Nonfinancial Corporate Debt	9,000	
Memo: Commercial Paper	2,500	
Memo: Leveraged Buyouts	13,300	

Securities issued as % GDP (Landi et al 2008)

Table 3 – Securities issued as a percentage of GDP (%)

	Non-financial Business		MFIs		Other FI		GOVT	
	US	Euro area	US	Euro area	US	Euro area	US	Euro area
1995	20.5		9.2		53.7		63.2	
1996	21.0		9.4		56.6		61.4	
1997	22.0		10.2		58.9		58.7	
1998	23.7		11.1		65.5		55.9	
1999	25.1	5.9	12.2	25.9	71.7	7.3	52.4	57.7
2000	25.8	6.6	12.5	26.3	75.4	8.1	46.6	56.7
2001	27.3	7.9	12.1	27.0	82.6	8.9	46.1	56.4
2002	27.1	7.8	12.9	26.9	87.4	9.7	48.5	57.9
2003	26.9	8.3	13.3	26.9	91.7	10.5	51.0	58.7
2004	26.0	8.3	13.3	28.5	92.1	11.4	51.9	60.6
2005	24.8	8.3	13.9	31.1	94.9	13.1	52.6	61.4
2006	25.2	8.1	14.8	33.3	101.0	15.8	52.1	58.0
2007	26.4	8.2	15.6	35.6	105.2	19.2	52.8	55.5

Sources - For US: Flow of Funds Accounts of the United States, Board of Governors of the Federal Reserve System, Washington D.C. 20551. For Euro Area: Quarterly Euro Area Accounts

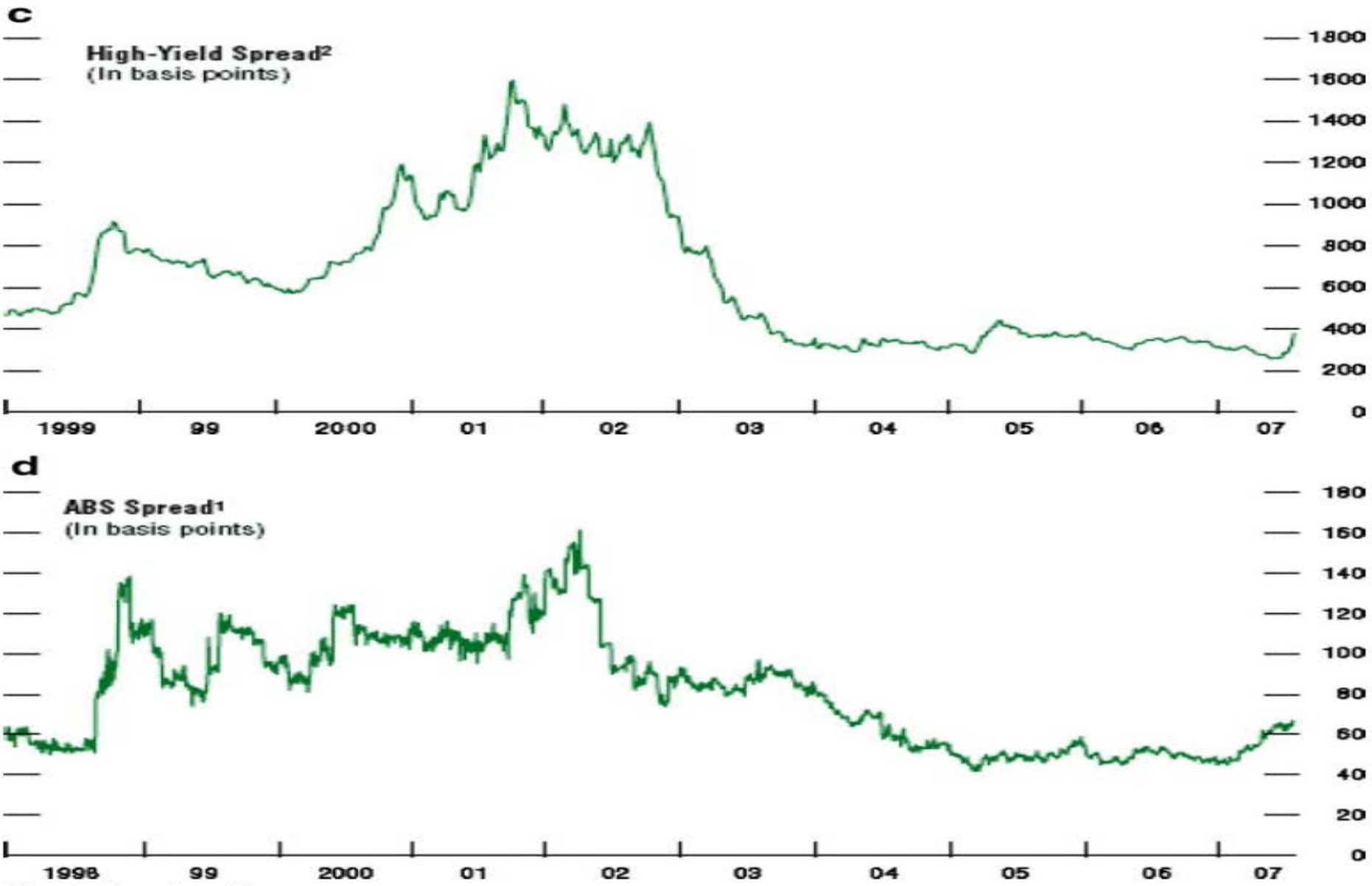


Fig. 3 (continued)

Fig. 3 **a** US yields on corporate and treasury bonds. **b** Stock market volatility (weekly data). **c** Europe corporate bond market (non-financial corporate bonds); spread between yields on a Merrill Lynch High-Yield European Issuers Index bond and a 10-year German government. **d** United States asset-backed securities: Merrill Lynch AAA Asset-Backed Master Index (fixed rate) option-adjusted spread

- Further risks associated with securitization (see Landi et al 2008)
- A very important development is the ability of the financial agents to bypass regulatory capital requirements
- This is achieved through off-balance-sheet vehicles, CDS covering and monoline insurers.
- Results in a systematic risk.
- Financial deepening has encouraged greater indebtedness of private sector
- Secondary securities markets (where securities are traded over the counter) creates a perception of higher liquidity.

- The problem of monoline insurers (AMBAC, MBIA)
- Monoline insurers insure municipal bonds (which are/were considered safe so they have AAA rating)
- Due to this perceived low-risk, they have excessively high leverage (150/1) Since monoliners have triple-A rating themselves, they don't have to post collateral.
- As of 2008, monoliners had insured around $2.5 trillion worth of asset backed bonds and CDOs.
- Downgrading of monoliners leads to lower ratings for municipal bonds and can increase funding costs

Table 1 – Total financial assets by financial sectors (%)

	Total financial assets financial sector/Total financial assets		Total financial assets MFIs/Total financial assets		Total financial assets Other FI/Total financial assets	
	US	Euro area	US	Euro area	US	Euro area
1995	42.2		11.7		9.6	
1996	42.2		11.1		9.7	
1997	42.4		10.6		9.7	
1998	42.8		10.2		10.2	
1999	42.4	46.9	9.4	26.7	10.5	12.0
2000	43.3	46.9	9.9	26.6	11.6	12.1
2001	44.9	48.0	10.4	27.8	13.0	12.1
2002	46.3	48.6	11.4	28.8	14.2	11.5
2003	46.5	48.7	10.9	28.2	13.9	12.0
2004	46.6	49.3	11.0	28.3	13.8	12.3
2005	46.9	50.6	11.0	28.6	14.0	13.2
2006	47.3	51.1	10.8	28.8	14.4	13.6
2007	48.0	52.3	10.9	30.1	14.8	13.8

- Financial institutions could acquire and dispose of these securities, and therefore manage their liquidity needs.
- On the other hand, financial deepening in the U.S was through the growth of non-bank financial institutions (investment banks, hedge funds, SIVs)
- The share of total financial assets of non-bank institutions display a large increase.
- This was accompanied with a large increase in the leverage of these institutions.

- Leverage: Total Assets / Equity
- Consider a household first
- Suppose the household has a mortgage worth $90, the value of the house is $100 and the household has an equity (net worth) of $10
- Then the leverage of this household would be 100/10 = 10. The balance sheet would look like

ASSETS	LIABILITIES
	MORTGAGE $90
HOUSE $100	EQUITY $10

- If we assume that the total market value of debt remains the same when there are small fluctuations in the value of the asset, then leverage would be
- $L = A / (A - 90)$
- Therefore, leverage and total assets are inversely related. In other words, if the value of the house goes up, equity (net worth) increases and leverage falls.
- This can be observed in the historical aggregate household data as well (showing passive behaviour to asset-price increases)

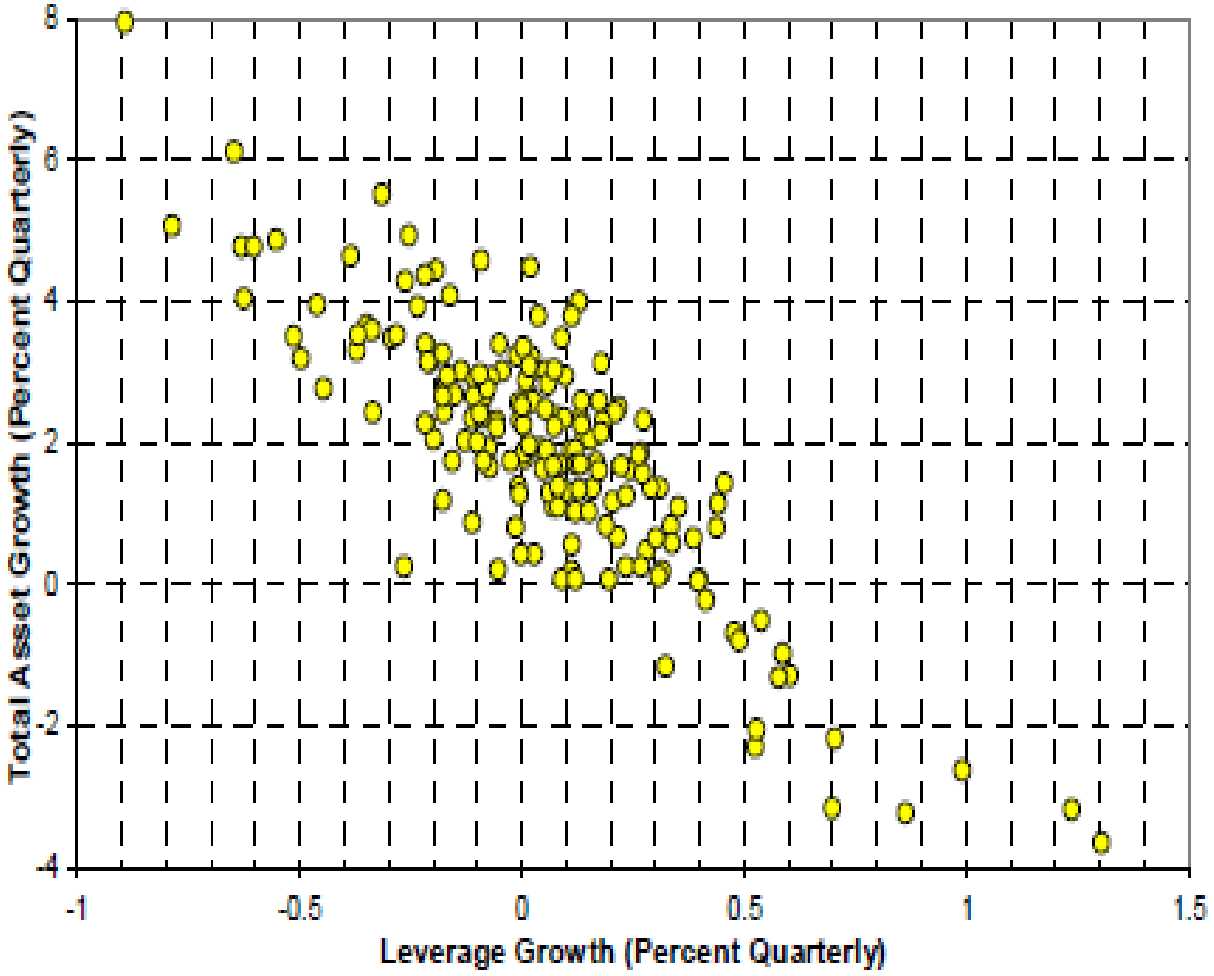


Figure 2.1: Total Assets and Leverage of Household

- How about the post-2000 period? What would you expect about the leverage of households?
- On the other hand, the historical data on commercial banks does not display the same characteristics
- The commercial banks seem to target a fixed leverage ratio, active management of leverage.
- The more striking observation is the **positive** relation between leverage and asset prices for security brokers and dealers (which include major Wall Street investment banks)
- Pro-cyclical leverage

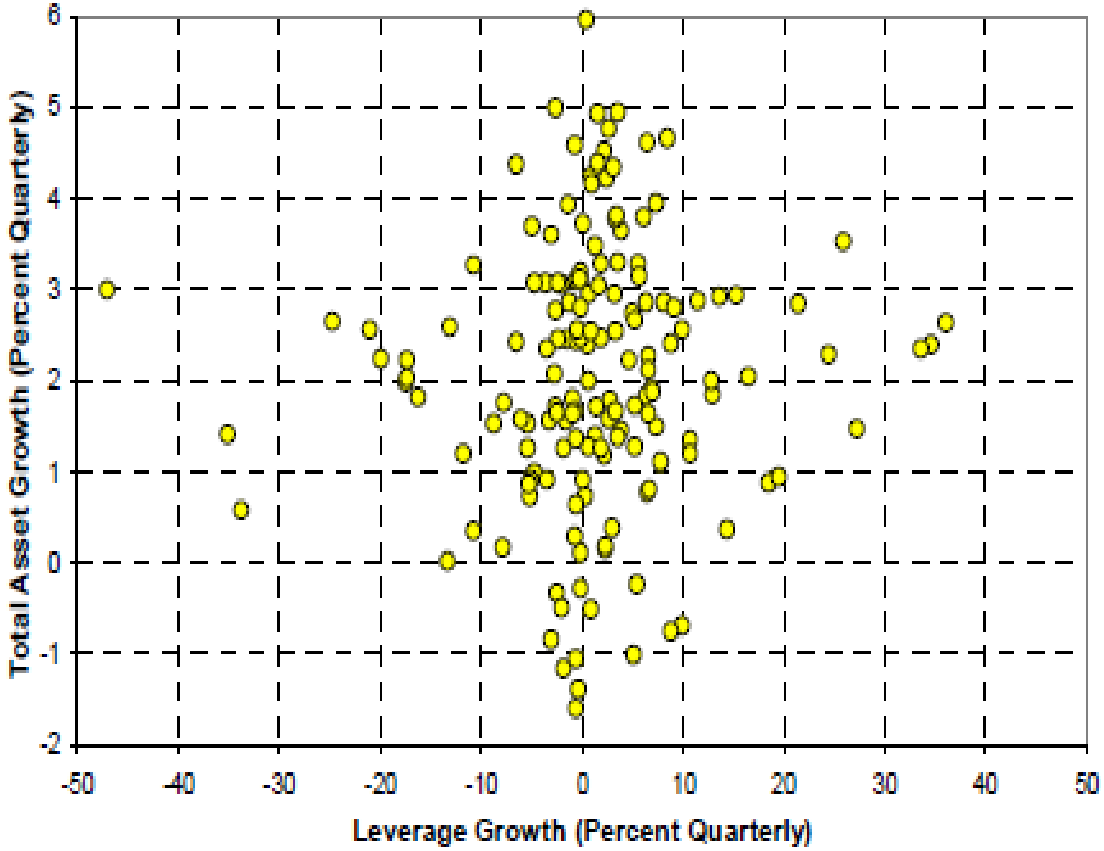


Figure 2.3: Total Assets and Leverage of Commercial Banks

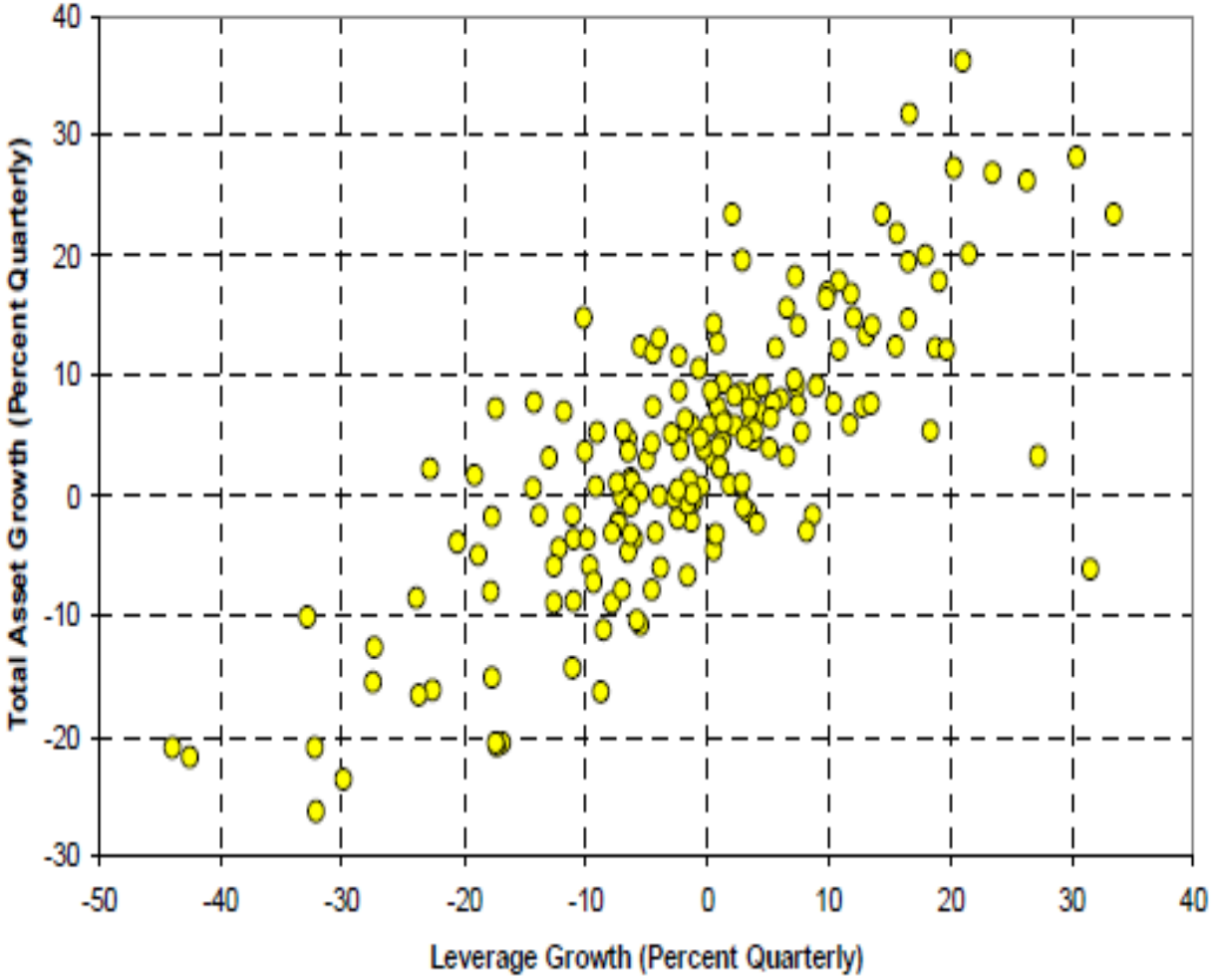


Figure 2.4: Total Assets and Leverage of Security Brokers and Dealers

Table 2 – Degree of financial leverage for the primary US banks (Ratio between total assets and equity capital)

	Investment banks				Commercial banks			
	Goldman Sachs	Morgan Stanley	Merrill Lynch	Lehman Brothers	JP Morgan Chase	Citigroup	BOA	Wells Fargo
1999	24.7	21.6		30.6	19.0	13.7	14.2	9.9
2000	17.2	22.1	22.8	28.9	16.9	13.6	13.5	10.3
2001	17.1	23.3	21.0	29.3	16.9	12.9	12.8	11.3
2002	18.7	24.2	18.7	29.1	17.9	12.7	13.1	11.5
2003	18.7	24.2	16.6	23.7	16.7	12.9	15.3	11.3
2004	21.2	26.5	20.0	23.9	11.0	13.6	11.1	11.3
2005	25.2	30.8	19.1	24.4	11.2	13.3	12.7	11.8
2006	23.4	31.7	21.6	26.2	11.7	15.7	10.8	10.5
2007	26.2	28.9	31.9	30.7	12.7	19.3	11.7	12.1

Sources – Annual reports and SEC filings

- Let's see what happens when a financial intermediary targets a certain value for leverage

ASSETS	LIABILITIES
SECURITIES $100	EQUITY $10
	DEBT $90

- The initial leverage is 100/10 = 10. Assume the price of debt is constant for little changes in asset prices, and assume price of securities increases by $1 to $101

ASSETS	LIABILITIES
SECURITIES $101	EQUITY $11
	DEBT $90

- Leverage now falls to 101/11 = 9.18. If the intermediary wants to keep the leverage at the initial value of 10, then Assets/Liabilities = 10 must hold.
- (101+ D)/11 = 10 must hold, which gives D = 9
- Therefore, the intermediary takes an additional $9 of debt to purchase securities. The final balance sheet looks like

ASSETS	LIABILITIES
SECURITIES $110	EQUITY $11
	DEBT $99

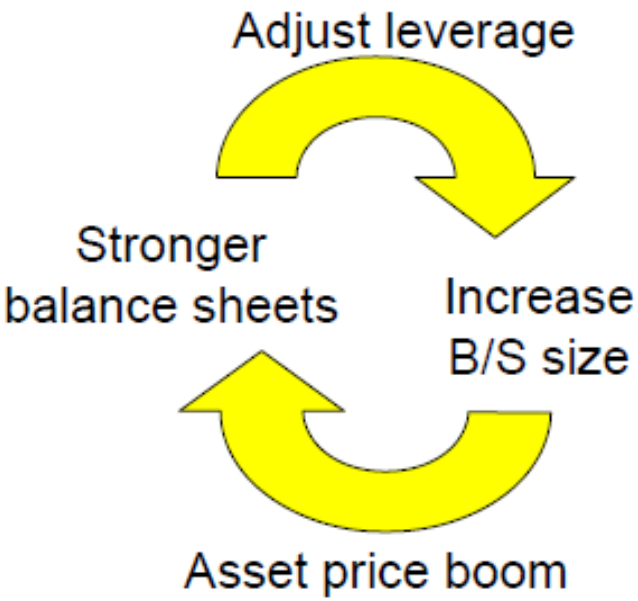
- The mechanism works exactly the same in the opposite way. Suppose the price of securities fall such that value of total securities fall to 109. Now, the balance sheet looks like

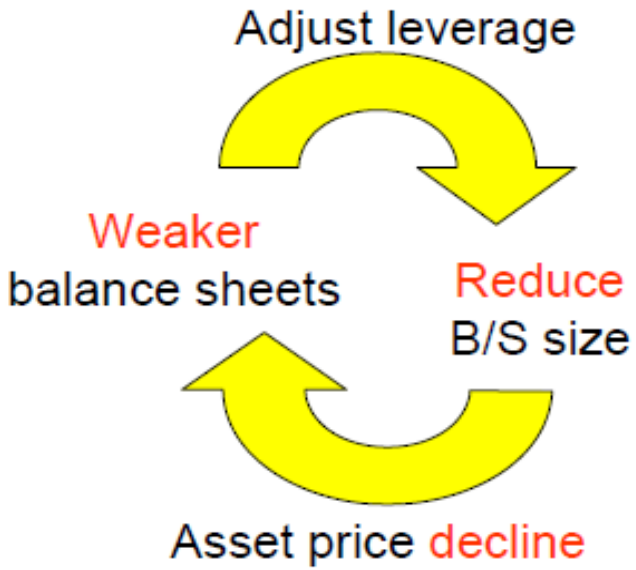
ASSETS	LIABILITIES
SECURITIES $109	EQUITY $10
	DEBT $99

- The leverage is too high now: 109/10 = 10.9. In order to keep the leverage at the same level, the firm sells securities worth $9 and pays back its debt. The final balance sheet is:

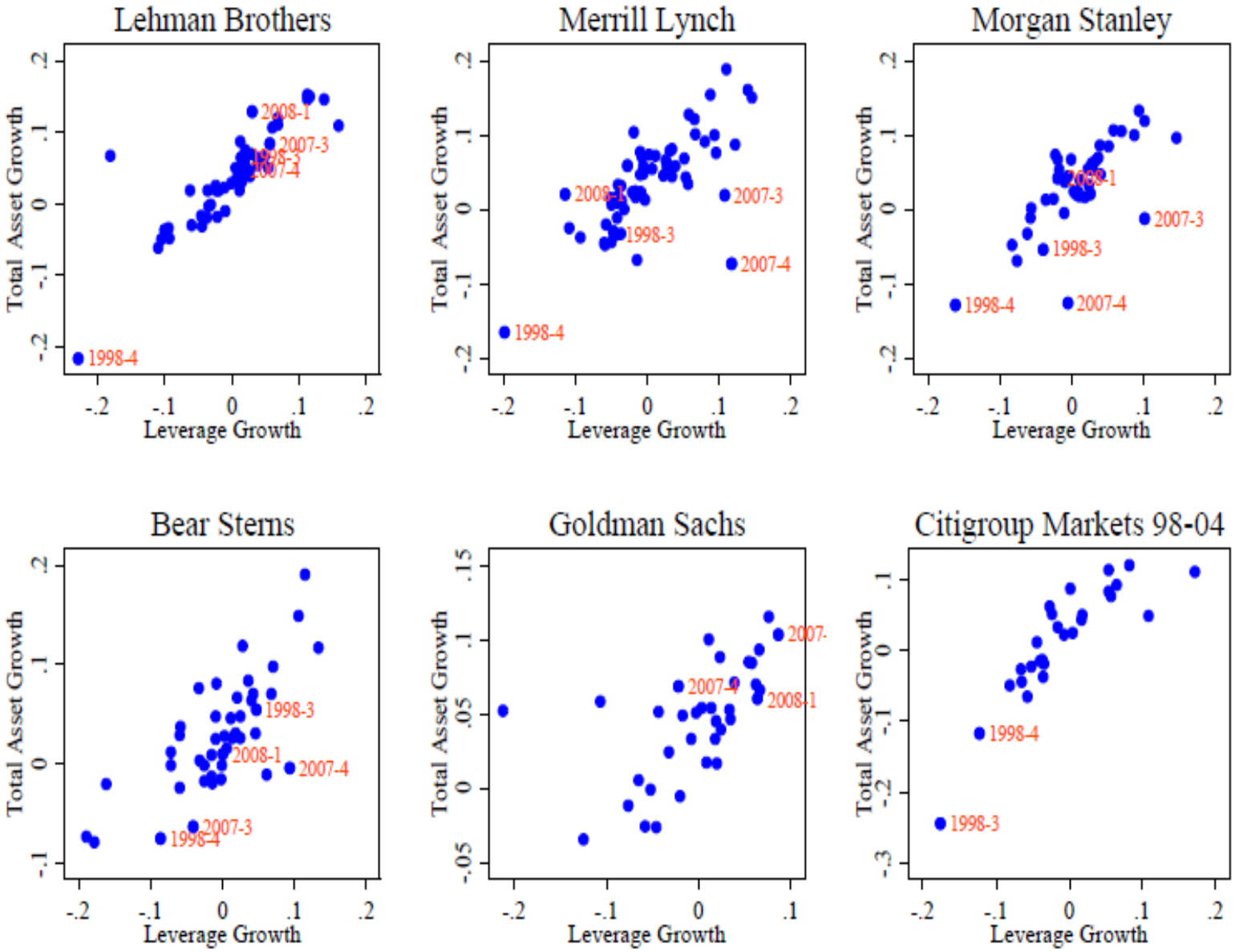
ASSETS	LIABILITIES
SECURITIES $100	EQUITY $10
	DEBT $90

- The magnitude of the reactions to price changes is amplified when leverage is pro-cyclical. When the price of the securities increase, the firm purchases even more securities *with debt* than constant leverage.
- Therefore, if higher demand for the securities puts upward pressure on the price, then stronger balance sheet (as implied by lower leverage) increases the demand for the securities, which puts further upward pressure on the price...
- This creates a vicious cycle in a boom, which is reversed in a downturn.


Adjust leverage
Stronger
balance sheets
Increase
B/S size
Asset price boom


Adjust leverage
Weaker
balance sheets
Reduce
B/S size
Asset price decline

Total Assets and Leverage



Securities issued as % GDP (Landi et al 2008)

Table 3 – Securities issued as a percentage of GDP (%)

	Non-financial Business		MFIs		Other FI		GOVT	
	US	Euro area	US	Euro area	US	Euro area	US	Euro area
1995	20.5		9.2		53.7		63.2	
1996	21.0		9.4		56.6		61.4	
1997	22.0		10.2		58.9		58.7	
1998	23.7		11.1		65.5		55.9	
1999	25.1	5.9	12.2	25.9	71.7	7.3	52.4	57.7
2000	25.8	6.6	12.5	26.3	75.4	8.1	46.6	56.7
2001	27.3	7.9	12.1	27.0	82.6	8.9	46.1	56.4
2002	27.1	7.8	12.9	26.9	87.4	9.7	48.5	57.9
2003	26.9	8.3	13.3	26.9	91.7	10.5	51.0	58.7
2004	26.0	8.3	13.3	28.5	92.1	11.4	51.9	60.6
2005	24.8	8.3	13.9	31.1	94.9	13.1	52.6	61.4
2006	25.2	8.1	14.8	33.3	101.0	15.8	52.1	58.0
2007	26.4	8.2	15.6	35.6	105.2	19.2	52.8	55.5

Sources - For US: Flow of Funds Accounts of the United States, Board of Governors of the Federal Reserve System, Washington D.C. 20551. For Euro Area: Quarterly Euro Area Accounts

- In the Euro area, banks became more active in the securities markets from 1999 to 2007. However, in the U.S, non-bank intermediaries involvement in the securitization process was much more significant. (from 71% to 105% from 1999 to 2007)
- A much closer relationship between traditional banks and non-bank intermediaries such as pension funds, investment banks, hedge funds in terms of balance sheet elements, business models and exposure to market, credit and liquidity risk.
- This creates homogeneity of financial portfolios and potential for strong *contagion affects* (deterioration in the balance sheet of one entity directly affecting others) and *systemic risk*.

- This was further accompanied by a decline in the relative weight of deposits in banks, which are the most stable and credible sources of credit and liquidity. (Note the huge difference between U.S and the Eurozone)
- As a result of all these, the originate and distribute model led to the standardization of balance sheets without adequate liquidity guarantees in secondary markets, thus creating a high systemic risk.
- In other words, the design of the system implicitly required that the central banks will provide the necessary liquidity in case of a downturn.

Table 4 – Deposits MFIs/Securities issued by financial sectors

	US	Euro area
1995	0.77	
1996	0.73	
1997	0.70	
1998	0.63	
1999	0.57	3.54
2000	0.55	3.47
2001	0.54	3.37
2002	0.52	3.26
2003	0.51	3.22
2004	0.52	3.12
2005	0.52	3.09
2006	0.49	2.92
2007	0.49	2.80

Sources - For US: Flow of Funds Accounts of the United States, Board of Governors of the Federal Reserve System, Washington D.C. 20551. For Euro Area: Quarterly Euro Area Accounts

Table | Comparison of European and US issuance volumes in 2007

(in EUR billions)

Financial instrument	Europe	United States	Difference
ABS	57.8	666.9	x11.5
RMBS and CMBS	307.3	1,485.5	x4.8
CDOs	88.7	252.5	x2.8
Total	453.7	2,404.9	x5.3

Source: European Securitisation Forum.

Notes: European ABS issuance includes auto, credit card, leases, loans, receivables and other; European CDO issuance numbers only include euro-denominated issuance regardless of the country of collateral. A substantial percentage of CDOs are backed by multi-jurisdictional collateral; US ABS issuance includes auto, credit card, home equity, student loan, equipment leases, non-jumbo mortgage, and other; US CDO issuance numbers only include US dollar-denominated issuance. US dollar transactions may include European transactions which are denominated in US dollars.

- When sub-prime loans (as well others) began to default at high rates in 2007, the investors withdrew from the securities markets, leading to increases in the spreads in secondary markets and massive fall in the prices of securities.
- Coupled with fire sales due to shortages of liquidity, the SIV's were unable to refinance the loans through the issuance of new bonds and securities.
- The central banks had to step forward to provide the liquidity needed for the functioning of the system. (Liquidity crisis). The large fall in the prices of financial instruments (due to massive de-leveraging) also created a solvency crisis for large financial institutions, as liabilities well exceeded their assets.

- Distorted Incentives of banksters and bonus schemes in financial institutions. (See Hoffmann (2008) for a very good discussion on this)

- Hoffman (2008) shows that as long as the banker/trader's discount rate for future income is below a certain threshold, he/she will choose to gamble for short-run profits.

- Further, the competitive pressures in the market will force the trader to gamble even if his/her discount rate is high. (the probability of losing his/her job will increase the minimum discount rate necessary for gambling)

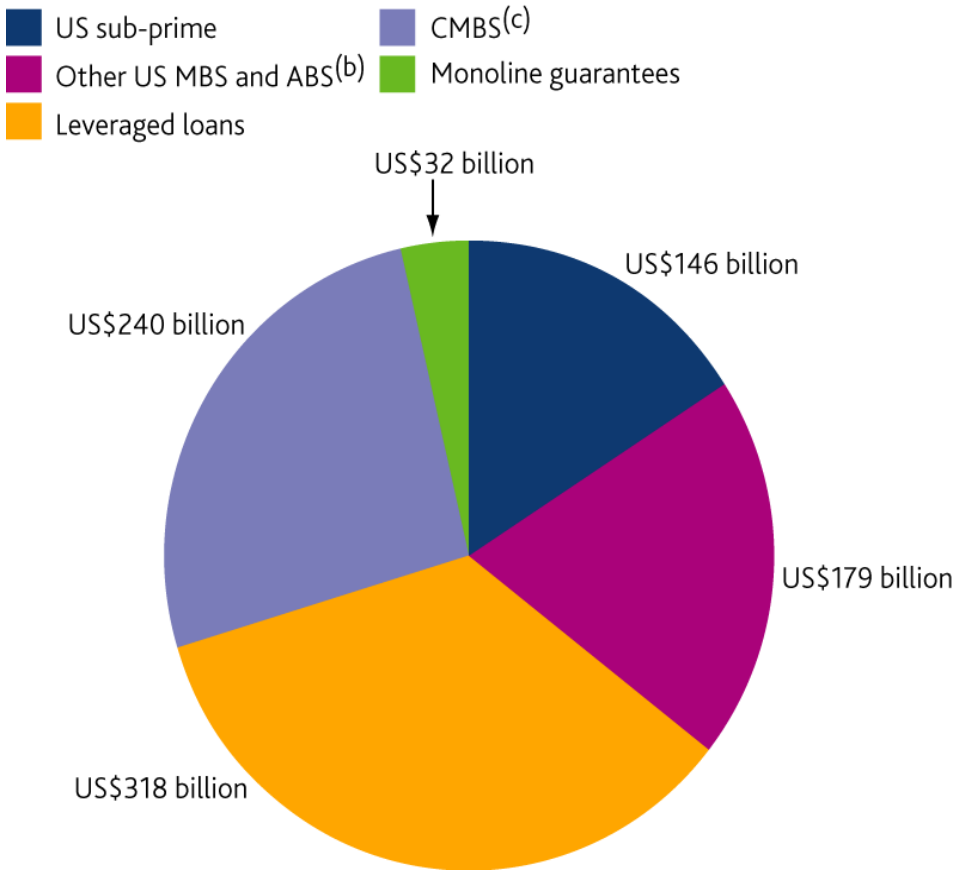
- Some numbers:
- On average, an employee in an investment bank earns $8367 per week ($435k annual) compared to 817$ per week ($40k annual) in private sector (Johnston 2007)
- The top 25 hedge fund managers earned an average income of $570 million in 2006, with the income of top 3 over $1billion
- Total earnings of 25 top hedge fund managers amount to $14 billion, and ranks 94th in World GDP statistics.

- Due to the global nature of financial markets, very high returns of ABS, and the possibility of CDS covering, securities ended up in the balance sheets of many financial institutions over the world.

- So the default risk of the borrower is actually replaced with the insolvency risk of the CDS seller (Remember AIG)

- The systemic risk was globalized, as financial markets became more and more linked.

Major UK banks' and LCFIs' outstanding exposures to selected structured credit markets and leveraged loans(a)



Sources: Bank of England, published accounts and Bank calculations.

(a) Exposures at end-2007, except for the US securities houses, US commercial banks and Credit Suisse, which are recorded at end-2008 Q1. Not all firms disclosed exposures to all categories.
(b) Mortgage-backed securities and asset-backed securities. Principally includes US prime and Alt-A residential mortgage-backed securities.
(c) Commercial mortgage-backed securities.

Credit Crunch: Quelle Surprise?

- *'That which can be securitized will be securitized'*

  —Hyman P.Minsky (1987)

- A good summary of key events:

- Brunnermeier(2009), Hoffman (2008), a whole index of events regarding Northern Rock and others until end 2008 in Hall (2009).

- The interest rates in U.S start to rise from the very low levels in 2005, leading to a decline in housing demand and prices.

- As early as end of 2006, the increase in house prices almost come to an end, signalling first signs of distress

The logbook of events (Hall 2009, summarised for key points)

August 2007

The European Central Bank injects €94.8 billion into the money markets, in a 'front-loading' operation, to shore up confidence in the financial system. 49 banks availed themselves of the funding.

US Fed announces a new emergency credit facility providing term loans for up to 30 days. Citigroup, JP Morgan Chase, Bank of America and Wachovia each borrow $500 million, funds which will be passed on to clients, in a largely symbolic gesture as each claims to have ample liquidity and access to funds elsewhere in the system on better terms.

September 2007

US Fed cuts the Federal funds rate by 50 basis points, to 4.75 per cent, as well as the discount rate by 50 basis points. Moves designed to 'help forestall some of the adverse effects on the broader economy that might otherwise arise from the disruptions in financial markets'.

Following assurances from the FSA that the bank is solvent, Bank of England provides emergency funding to Northern Rock, the UK's fifth largest mortgage lender and eighth largest bank. It also announces that, contrary to its stated position of 12.9.07, it will now, after all, lend to banks for periods of up to three months against a wider range of collateral, including mortgages.

October 2007

US Fed cuts the Federal funds rate by 25 basis points to 4.5 per cent.

November 2007

ECB announces it will inject an unspecified amount of extra liquidity into the money market next week and will continue to do so at least until the end of 2007 in order to deal with "re-emerging tensions".

December 2007

US President unveils a voluntary plan to freeze interest rates on some subprime loans for up to five years to limit foreclosures (some 300,000 borrowers are expected to benefit).

US Fed cuts the Federal Funds rate by 25 basis points to 4.25 per cent and also the discount rate by 25 basis points to 4.75 per cent.

ECB pumps a record €348.6 billion of two-week money into the markets. Some 390 Eurozone banks request funds, which are provided at 4.21 per cent.

January 2008

The monoline, Ambac, suffers a ratings downgrade, triggering downgrades for the bonds it guarantees, thereby threatening huge losses for the companies holding the bonds. The downgrading follows the downgrading of the smaller monoline, ACA Financial Guaranty, in December 2007.

US Fed cuts the Federal funds rate by an unprecedented 75 basis points to 3.5 per cent at an unscheduled meeting in a bid to ward off recession in the US.

Ambac Financial, the World's second largest bond insurer, reports a $3.26 billion loss after writing down the value of its guarantees on sub-prime mortgage-related bonds by $5.21 billion.

US Fed announces a further 50 basis points cut in the Federal funds rate, taking it to 3 per cent, in a further attempt to ward off recession in the US. The discount rate is also cut by 50 basis points.

February 2008

AIG, the US insurance company, raises its estimate of 2007 losses incurred on insuring mortgage-related instruments (e.g. CDOs) from $1 billion to $5 billion.

US President enacts a $170 billion fiscal stimulus package in an attempt to reinvigorate the US economy.

U.K government nationalises Northern Rock

March 2008

A second round of co-ordinated central bank intervention is announced. US Fed is to lend, *via* an auction, primary bond dealers up to $200 billion in Treasury securities for a month at a time in exchange for triple-A rated mortgage-backed securities as collateral. The Fed, the ECB and the Swiss National Bank (SNB) also announced an increase in the size of currency swaps (extended until September 2008) put in place in December 2007 by 50 per cent.

US Fed provides $30 billion of emergency liquidity support, in the form of collateralised discount window lending, *via* JP Morgan Chase, to Bear Stearns, the fifth largest investment bank in the US. This is the first time cash has been disbursed to a US financial institution other than a regulated commercial bank since the 1930s, and reflected the Fed's concerns with the systemic risks associated with allowing the bank to fail given its interconnectedness with the wider US financial system *via* its operations in mortgage-backed securities and the credit default swaps and other derivatives markets, and its role as prime broker to hedge funds.

US Fed cuts the Federal funds rate by a further 75 basis points, to 2.25 per cent, as well as the discount rate (by 75 basis points, taking it to 2.5 per cent).

The US Office of Federal Housing Enterprise Oversight announces a reduction in surplus regulatory capital requirements (from 30 per cent to 20) for the government-chartered mortgage providers Fannie Mae and Freddie Mac to allow them to pump up to $200 billion of additional liquidity into the beleaguered US mortgage market.

In a further bid to support the US housing market, the US Government, through the Federal Housing Finance Board, gives the Federal Home Loan Banks permission to increase (by over $100 billion) for two years their purchases of mortgage-backed securities guaranteed by Fannie Mae and Freddie Mac, the Government-chartered mortgage financiers.

Federal Reserve Bank of New York activates its 'Term Securities Lending Facility' (TSLF) auctioning $75 billion of US Treasury securities in exchange for other securities held by primary dealers. The loan lasts for 28 days.

April 2008

UBS announces a further $19 billion of sub-prime-related writedowns amid plans to park troubled sub-prime mortgage assets in a separate subsidiary.

Citigroup announces a first quarter loss of $5.1 billion caused, in part, by nearly $16 billion of writedowns, including $6 billion on sub-prime mortgages, $3.1 billion on leveraged loans, $1.5 billion on exposure to monoline bond insurers and $1.5 billion on auction rate securities.

US Fed cuts the Federal funds rate by 25 basis points to 2 per cent, taking the cumulative cut since mid-September 2007 to 325 basis points.

Bank of England reveals a new Special Liquidity Scheme under which it will swap Treasury bills for securities backed by mortgages made before 1 January 2008 or credit card debts for a period of up to 364 days

May 2008

Lehman Brothers, the US investment bank, announces a second-quarter loss of $2.8 billion, largely due to losses on fixed income business. Plans to raise $6 billion through common and preferred stock issues were also announced simultaneously.

According to the Nationwide's house price index, UK house prices suffered their biggest annual fall in May 2008, of 4.4 per cent, since December 1992, when the market was last in a downturn

June 2008

According to Standard & Poor's Case-Shiller Index, house prices in large US cities declined by a record 15.3 per cent in April 2008

July 2008

The ECB **raises its policy rate by 25 basis points** to 4.25 per cent in the face

of eurozone inflation of over 4 per cent, more than double its target of 2 per cent.

IndyMac Bancorp, a large Californian-based US regional bank, collapses and is subjected to a 'bridge bank' scheme by the FDIC. With assets of around $32 billion, this represents the US's second-biggest bank failure.

Merrill Lynch announces sales of $30 billion of CDOs for $6.7 billion, **raising just 22 cents on the dollar**, intensifying pressure on other banks to make further writedowns on mortgage-related securities.

US Fed announces that it will offer three-month (84-day) cash loans (under its TAF) to banks and create a new $50 billion options auction facility giving bidders the right to swap illiquid securities for Treasuries over periods of likely funding stress (e.g. year-end). Investment banks and other primary dealers will also be given extended access to emergency cash and loans of Treasury securities until 30 January 2009.

August 2008

Fannie Mae and Freddie Mac post total losses of $3 billion in the second quarter

FDIC reveals that its 'problem list' of banks grew from 90 institutions at the end of March 2008 to 117 by the end of June, the highest figure since 2003. Meanwhile, the agency's insurance fund fell to 1.01 per cent of insured deposits, the lowest level since the 1990s and below the target level of 1.25 per cent.

FSA figures reveal that repossessions of UK houses have risen by more than 40 per cent – from 6,471 to 9,152 – during the first quarter of 2008 compared with the same period one year earlier

September 2008

ECB announces that, from 1 February 2009, it will change its procedures to reduce the abuse of its special liquidity operations. Accordingly, haircuts applied to ABS used as collateral will be increased; and some bonds not backed by mortgages or other loans denominated in euros will be excluded.

US Government takes control of the troubled GSEs Fannie Mae and Freddie Mac and pledges to inject up to $100 billion in each of them if necessary to prevent their failure. It will also buy and hold mortgage bonds issued by the two entities and extend an unlimited liquidity facility to them until end-2009. The decision to formally assume control was taken in order to bolster the US housing market – the two bodies combined
own or guarantee more than $5 trillion of mortgage-backed securities – and prevent turmoil in the US and global financial markets

Lehman Brothers announces a third-quarter loss of $3.9 billion after making credit-related writedowns of $7.8 billion. Only 5 days later, Lehman Brothers, the fourth-largest investment bank in the US, files for bankruptcy

In the wake of the turmoil, the Fed dramatically eased the terms on which it lends to investment banks. Under the primary dealer credit facility it will now accept equities and sub-investment grade debt as eligible collateral; whilst, under its Treasury securities lending facility – now expanded to $200 billion – it will now accept all investment-grade debt against loans of government bonds. In addition, it supplied an extra $70 billion of overnight liquidity into the money markets to try to keep the effective Federal funds rate close to the policy rate of 2 per cent.

The rating agencies Standard & Poor's and Moody's both downgrade Washington Mutual bank to junk status, raising fears that this bank would become the next US bank to fail.

Reluctantly, and following a failed attempt to find a private sector solution, the US Fed extends an $85 billion, two-year bridging loan to the insurance giant AIG to fend off imminent bankruptcy. In exchange for the loan, the US Government takes an 80 per cent equity interest in the firm. Existing management are to be replaced; and the loan is made at a punitive rate of interest of LIBOR plus 8.5 per cent.

Shares in the two remaining US investment banks, Morgan Stanley and Goldman Sachs, crash – by 37 per cent and 23 per cent respectively

Figures released by the US Fed reveal a $61 billion decline in outstanding volume in the US commercial paper market following a $52.1 billion decline the week earlier, making it increasingly difficult for corporates to raise working capital. The fall in market liquidity reflects the dramatic withdrawal of funds from the market by money market funds as the latter flee to safer investments (i.e. government securities).

Washington Mutual collapses to become the biggest bank failure in US history and the fourteenth casualty of the credit crunch this year. JP Morgan swoops to acquire the bank's assets and branches for $1.9 billion, in the process becoming the largest US bank.

Following the House of Representatives' rejection of the US Government's $700 billion bailout plan ('TARP'),* US markets go into freefall, with the Dow Jones falling by just under 780 points on the day.

On the same day that the US Government's bail-out plan was voted down, another major (the sixth largest) US bank – Wachovia – had to be rescued in a government-brokered takeover by Citigroup.

UK Government's nationalisation of Bradford and Bingley, the Icelandic Government were forced to take control of Glitnir, the country's third largest bank, to prevent a systemic crisis (€600 million of equity had to be injected into the bank by the Government, which assumed a 75 per cent stake). The German Government, too, were in bailout mode, joining together with the banks to provide a €85 billion liquidity lifeline to Hypo Bank Estate, one of the country's biggest lenders in the commercial property market and to local authorities. The Governments of Belgium, Holland and Luxembourg

also joined forces to inject €11.2 billion into Fortis's national banking subsidiaries to help shore up confidence in the banking and insurance group.

U.K Prime Minister unveils a £1.6 billion package of measures to support the UK housing market. The package embraces a one-year increase in the zero-rate stamp duty threshold from £125,000 to £175,000, measures designed to help first-time buyers get on to the housing ladder

FSA places a temporary ban (until 18 January 2009) on the short-selling of financial stocks to support financial markets. This follows its earlier ban on the short-selling of the stock during the period of firms' rights issues

UK Government announces the nationalisation of Bradford and Bingley following the FSA's decision

October 2008

US Senate passes the revised (it now includes a $150 billion range of tax breaks for firms and individuals as well as a temporary increase in the level of FDIC-insured deposits from $100,000 per person per institution to $250,000) 'TARP' bill and it now passes back to the House of Representatives for reconsideration. Its potential cost now exceeds $850 billion.

In the wake of the continuing uncertainty over the fate of Hypo Real Estate, the German Government announced that it would offer a 100 per cent guarantee to all private bank depositors, following the lead taken by Ireland and Greece.

Iceland, Portugal, Denmark and Sweden all extended the size of their explicit guarantees for depositors.

The Fed announces that, for the first time in its history, it will purchase commercial paper from US corporations directly.

FDIC announces that it is to double deposit insurance contributions to cover further expected losses arising from future bank failures of about $40 billion. $45 billion of losses had already been racked up by the end of the second quarter 2008.

In a co-ordinated action by central banks around the world (including the Bank of England, the Peoples Bank of China, the ECB, the SNB and Sweden's Riksbank), the US Fed cuts its policy rate by 50 basis points to 1.5 per cent, the ECB's policy rate falling to 3.75 per cent.

ECB switches to offering banks unlimited euro-denominated liquidity at fixed interest rates and emergency lending at a lower penalty rate. Collateral requirements are also to be relaxed, contrary to earlier announcements.

The US Fed announces that it is making unlimited amounts of dollar funds available to be distributed by the ECB, the SNB and the Bank of England.

Following the lead taken by European governments, the US Government announces that $250 billion of the previously-agreed $700 billion bailout funds will now be used to recapitalise US banks. Half ($125 billion) is to be injected into just nine banks: Bank of America (including Merrill Lynch, which it is acquiring), JP Morgan Chase, Citigroup and Wells Fargo will each receive $25 billion; Goldman Sachs and Morgan Stanley will each receive $10 billion each; and the Bank of New York Mellon and State Street will receive $2 billion and $3 billion respectively. In return, the US Government will take non-voting preference shares paying 5 per cent annual interest, rising to 9 per cent after five years, as well as warrants for common stock equal to 15 per cent of its preference share investment until 2018. Unlike the UK, recipient banks will be able to carry on paying dividends but cannot increase them (nor buy back shares) without the permission of the Treasury.

ECB confirms that it is to relax collateral requirements, other than for ABS, by reducing the acceptable ratings threshold from "A-" to "BBB-". Eurozone assets denominated in dollars, pounds and yen will now also be accepted as collateral alongside euro-denominated assets; and dollar liquidity will also be provided in exchange for euros, under swap arrangements which will not require banks to put up collateral.

EU regulators agree to relax accounting rules relating to the "fair" valuation of bank assets. EU banks now have the discretion to "reclassify" certain financial instruments and shift them from their trading books,

US Fed agrees to finance up to $540 billion of purchases of short-term debt (e.g. CDs, bank notes and commercial paper of up to three months maturity) from money market mutual funds, to help them finance redemptions and continue their normal investment patterns.

US Fed reduces the federal funds rate by 50 basis points to 1 per cent; the lowest level since June 2004,

November 2008

ECB cuts its policy rate by 50 basis points to 3.25 per cent.

US Government announces a new $150 billion bailout of AIG after the insurer posts a third-quarter loss of $24.5 billion. This follows the $85 billion loan provided earlier to the firm to prevent its collapse.

US Government announces a bailout of Citigroup, the ultimate "too-big-toofail" bank with assets in excess of $2 trillion and operations in over 100 countries. Under the deal, the US Treasury will inject another $20 billion under TARP ($25 billion had already been injected) via purchases of preference shares paying an annual return of 8 per cent. The US Government is also capping Citigroup's losses on $306 billion of potentially toxic assets, by shouldering 90 per cent of the residual pre-tax losses once the bank has taken the first $29 billion hit (the Treasury will absorb the first $5 billion of

losses, the FDIC the next $10 billion, with the Federal Reserve standing by to provide a loan covering the remaining $227 billion of losses)

US Fed pledges up to $800 billion to help homebuyers, small businesses and students facing difficulty in raising credit at reasonable rates. Under one scheme, it will buy up to $100 billion of debt from Fannie Mae, Freddie Mac and Federal Home Loan Banks, starting next week, with a further $500 billion to be used to buy mortgage-backed securities from these GSEs before the end of the year. Separately, a $200 billion lending facility – the "term asset-backed securities loan facility", or TALF – for holders of asset-backed securities supported by car, credit cards, student loans or business loans is to be launched to encourage lending at lower rates.

The Monetary Policy Committee of the Bank of England slashes its policy rate by 150 basis points, from 4.5 per cent to 3 per cent, the lowest rate seen for 54 years.

December 2008

ECB cuts its main policy rate by 75 basis points – its largest reduction ever – to 2.5 per cent in the face of evidence of a further weakening in the real economy in euroland.

US Fed cuts its policy rate to between zero and 0.25 per cent, a record low, in order to guard against deflation – prices fell by 1.7 per cent in November – and limit the severity of the downturn.

Bank of Japan cuts its policy rate from 0.3 per cent to 0.1 per cent whilst announcing that it would buy commercial paper directly from issuers and increase its outright purchases of Japanese government bonds to ¥1,400 billion a month from ¥1,200 billion a month.

U.K Government announces a £1 billion scheme to underwrite deferred mortgage interest payments for up to two years. Under the scheme, those with mortgages of up to £400,000 and with less than £16,000 savings would enjoy deferred mortgage payments if their mortgage payments were not covered through the benefits system following a "sudden and temporary loss of income".

January 2009

Figures reveal that more than one million jobs were lost in the US in December 2008 for the second successive month taking the unemployment rate to 7.2 per cent, its highest level in 16 years

ECB cuts its policy rate by 50 basis points to reach a record low of 2 per cent in the face of a deepening recession in the euro area.

S&P downgrades Portugal and Spain government bonds

Latest GDP figures reveal that the US economy contracted by 3.8 per cent at an annualised rate in the final quarter of 2008, the worst performance since 1987.

Table 2

Attributes for Mortgages in Subprime and Alt-A Pools

Panel A: Market Share of Loans by Year and Loan Type

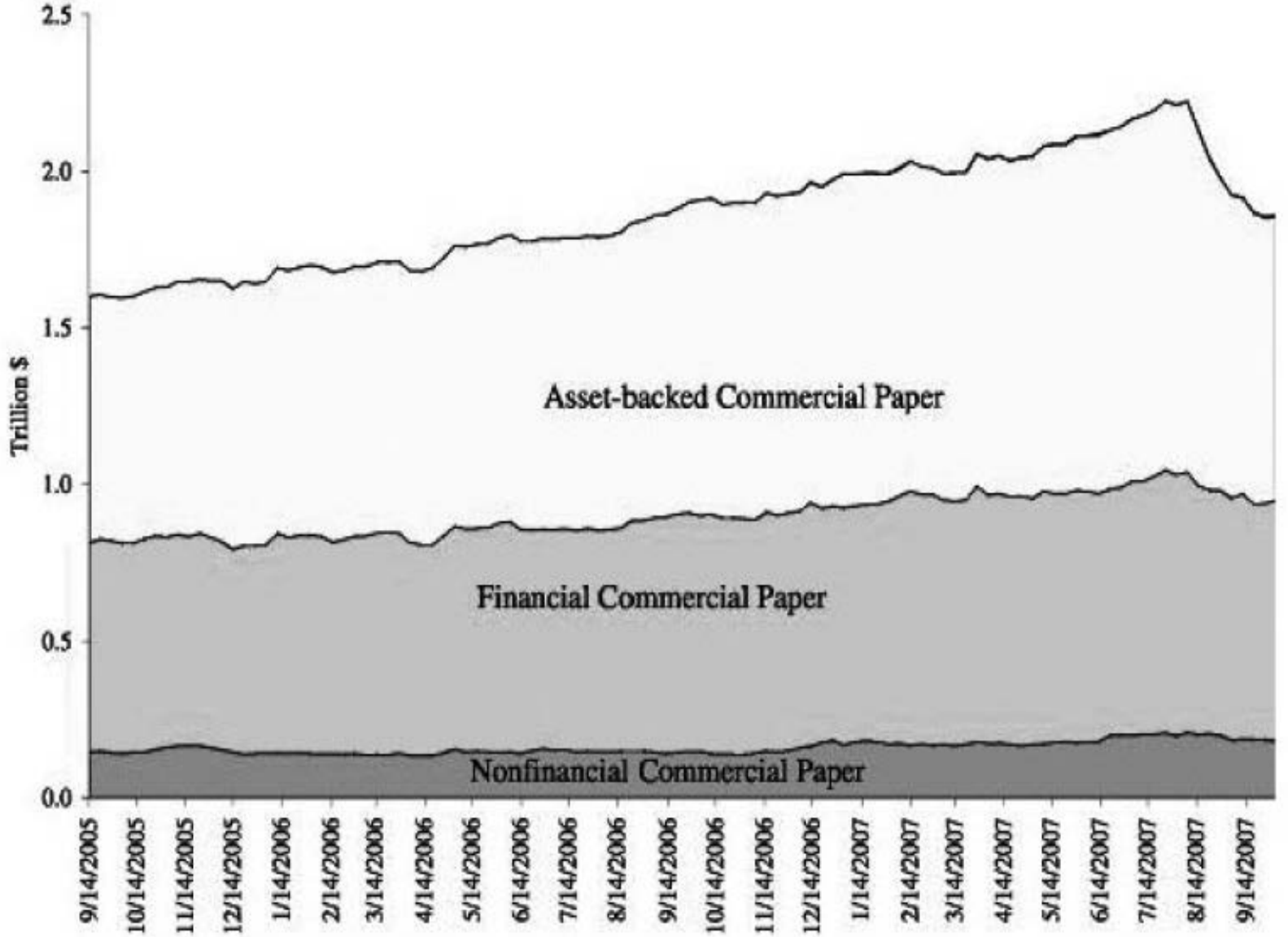
Collateral type	*Loan type*	*2003*	*2004*	*2005*	*2006*	*2007 (Jan–June)*	*All*
Subprime							
	Fixed rate	30%	21%	17%	20%	27%	21%
	Floating rate	0%	0%	0%	0%	0%	0%
	Short-term hybrid	68%	77%	81%	77%	68%	76%
	Long-term hybrid	1%	1%	2%	3%	4%	2%
Alt-A							
	Fixed rate	69%	36%	39%	39%	42%	41%
	Floating rate	5%	20%	26%	23%	12%	21%
	Short-term hybrid	11%	23%	12%	6%	1%	12%
	Long-term hybrid	16%	21%	23%	32%	45%	26%

Panel B: Median Combined Loan-to-Values for Mortgages in Subprime and Alt-A Pools

Collateral type	*Loan purpose*	*2003*	*2004*	*2005*	*2006*	*2007 (Jan–June)*	*All*
Subprime							
	Purchase	90	95	100	100	100	95
	Refinance	80	80	80	80	80	80
Alt-A							
	Purchase	90	90	90	95	95	90
	Refinance	74	75	75	79	79	76

(continued on next page)

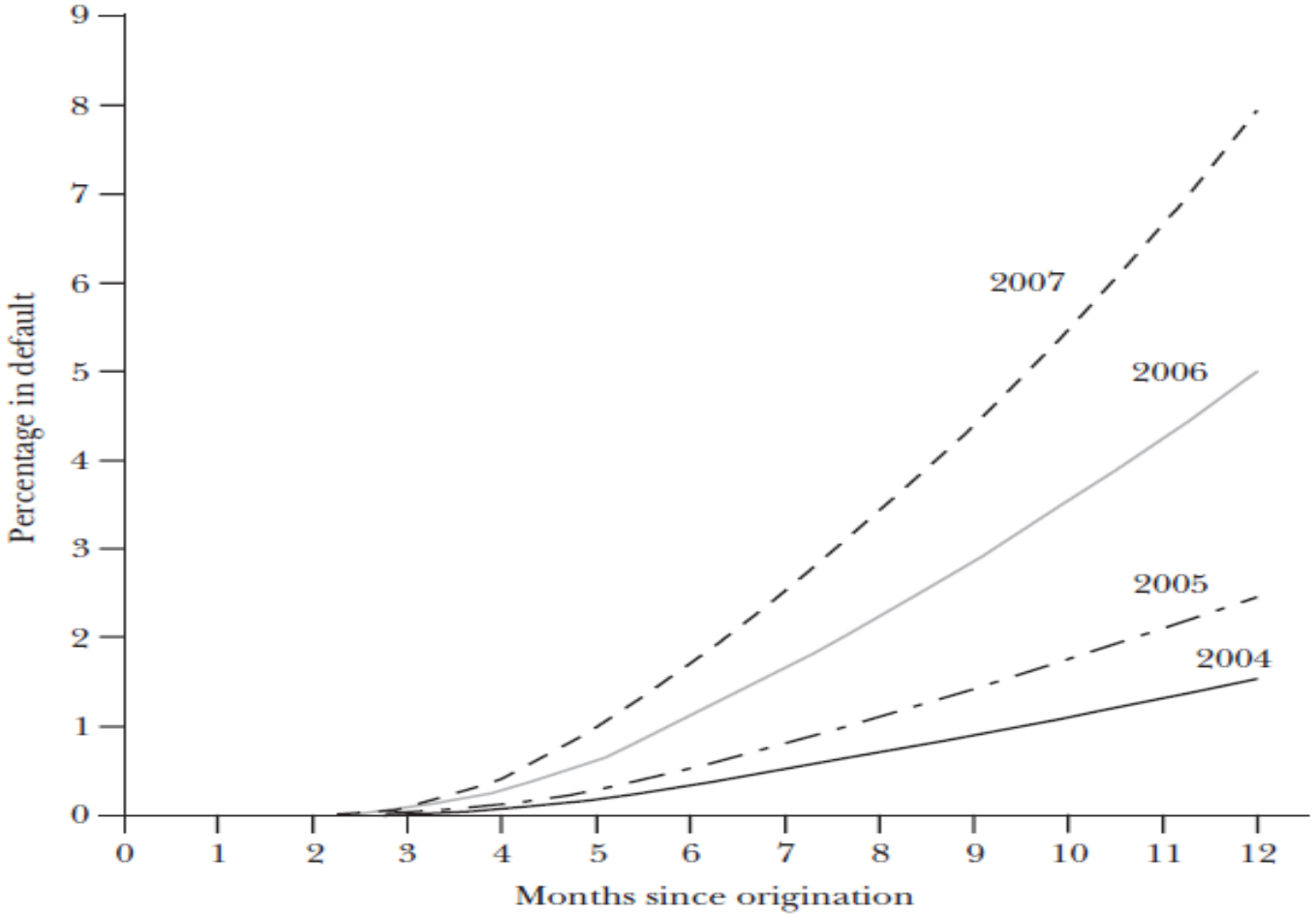
Figure 3 Commercial paper outstanding (weekly, seasonally adjusted)



Mayer et al (2009)

Figure 2

Early Payment Defaults on Subprime Loans

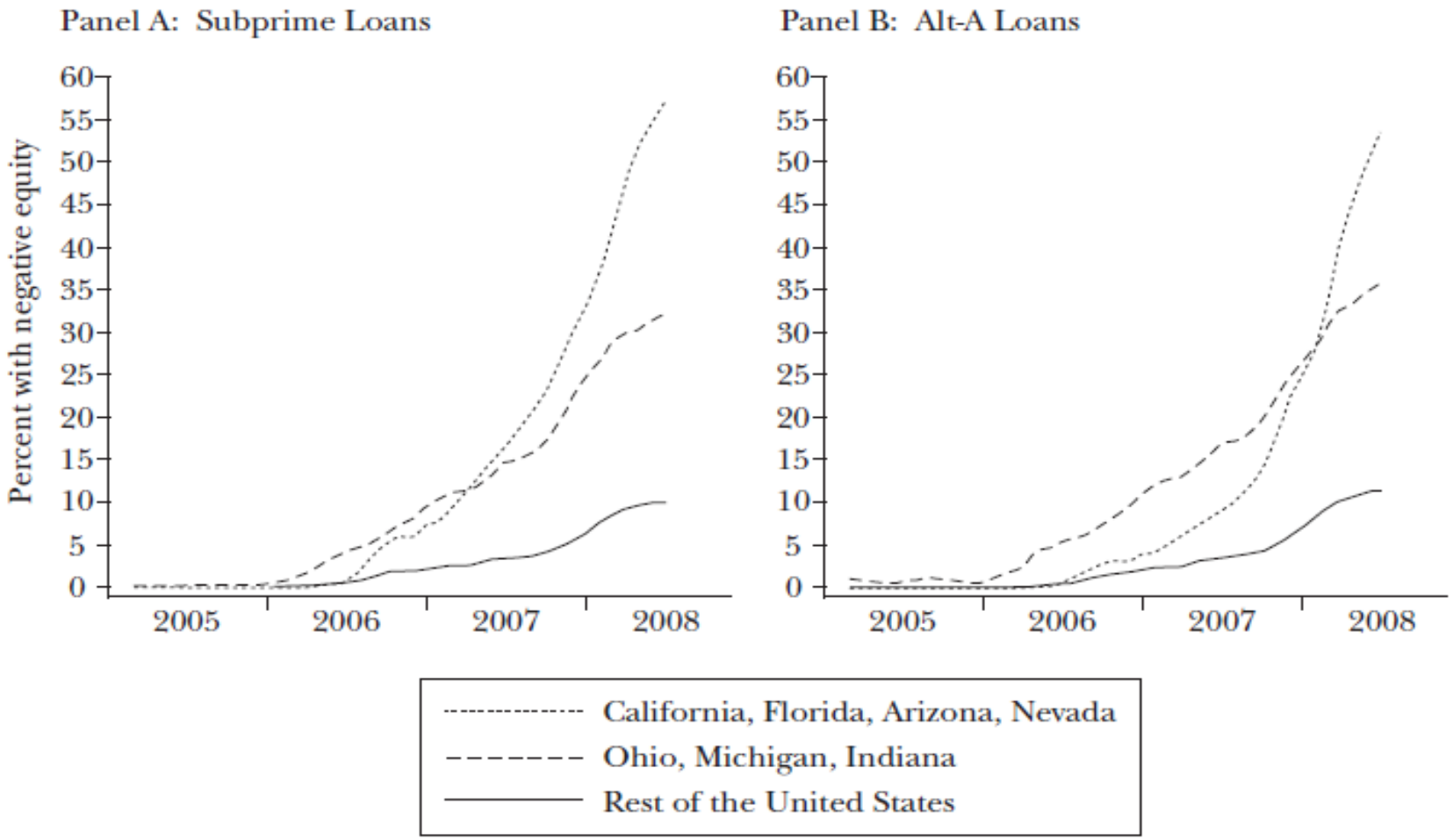


Source: Calculations from First American LoanPerformance data.

Note: Figure 2 shows the percentage of borrowers with subprime mortgages in the 2004, 2005, 2006, and 2007 vintages whose mortgage balances in a given number of months were in default. The sample is restricted to thirty-year, first-lien mortgages originated on one- to four-family properties in the contiguous United States. Adjustments have been made for calendar effects.

Figure 3

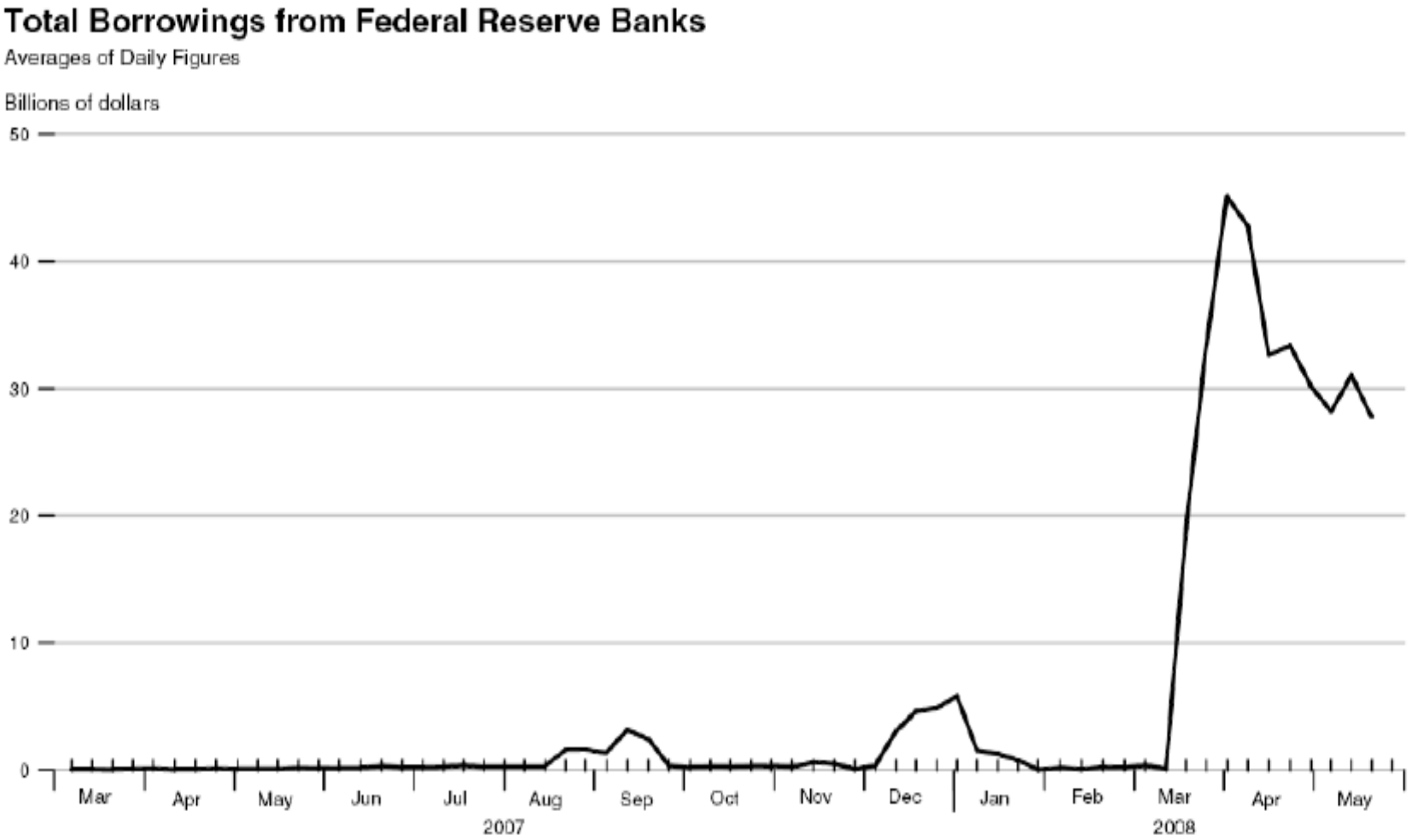
Percent of Nonprime Loans with Negative Equity



Source: Calculations from S&P/Case-Shiller, Office of Federal Housing Enterprise Oversight, and First American LoanPerformance data.

Note: The sample is restricted to thirty-year, first-lien mortgages originated on one- to four-family properties in the contiguous United States.

Tatom (2009)

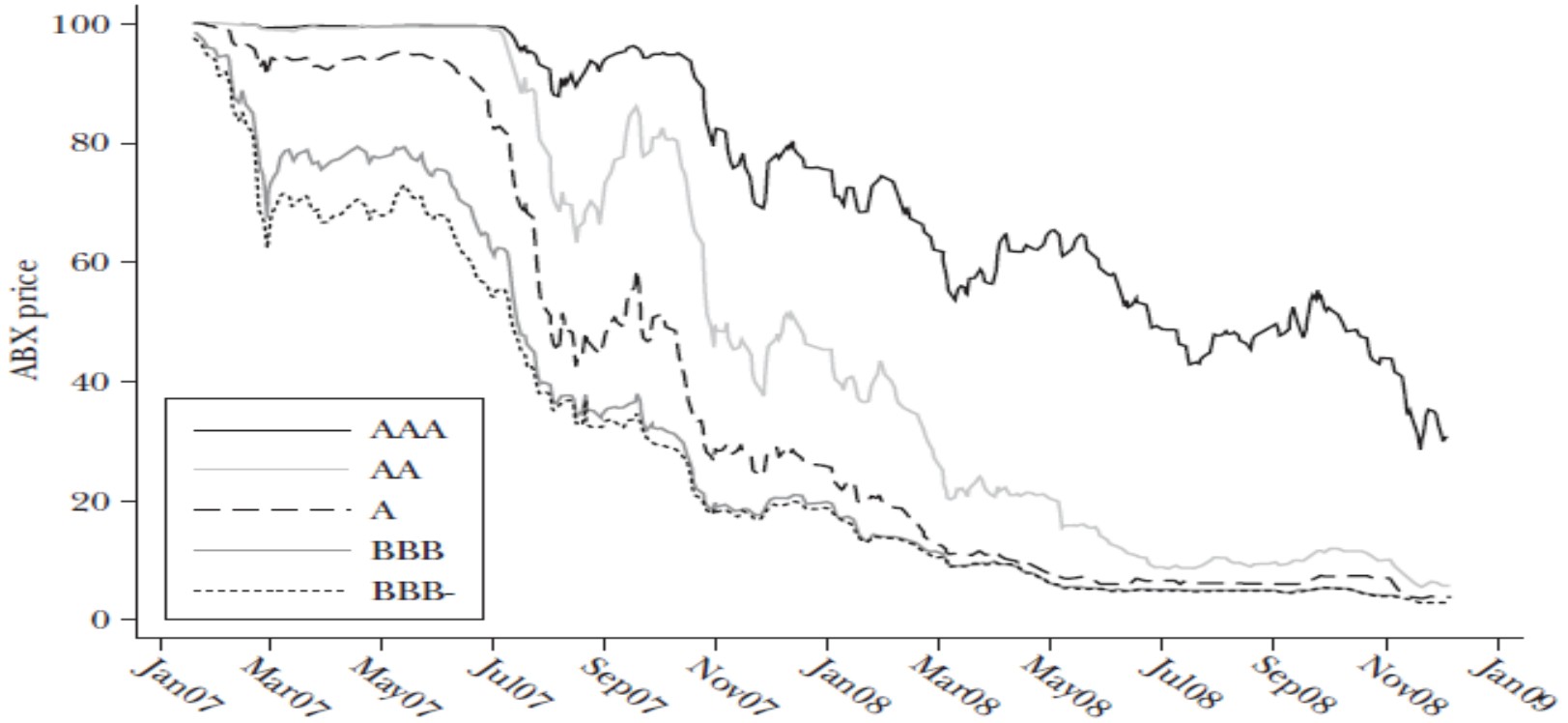


Note: Total borrowings include loans to depository institutions for primary, secondary, and seasonal credit, primary dealer credit facility, and other credit extensions, but exclude term auction credit.

Source: Federal Reserve Bank of St. Louis, *U.S. Financial Data*, May 23, 2008.

Brunnermeier (2008)

Figure 1
Decline in Mortgage Credit Default Swap ABX Indices
(the ABX 7-1 series initiated in January 1, 2007)



Source: LehmanLive.
Note: Each ABX index is based on a basket of 20 credit default swaps referencing asset-backed securities containing subprime mortgages of different ratings. An investor seeking to insure against the default of the underlying securities pays a periodic fee (spread) which—at initiation of the series—is set to guarantee an index price of 100. This is the reason why the ABX 7-1 series, initiated in January 2007, starts at a price of 100. In addition, when purchasing the default insurance after initiation, the protection buyer has to pay an upfront fee of (100 – ABX price). As the price of the ABX drops, the upfront fee rises and previous sellers of credit default swaps suffer losses.

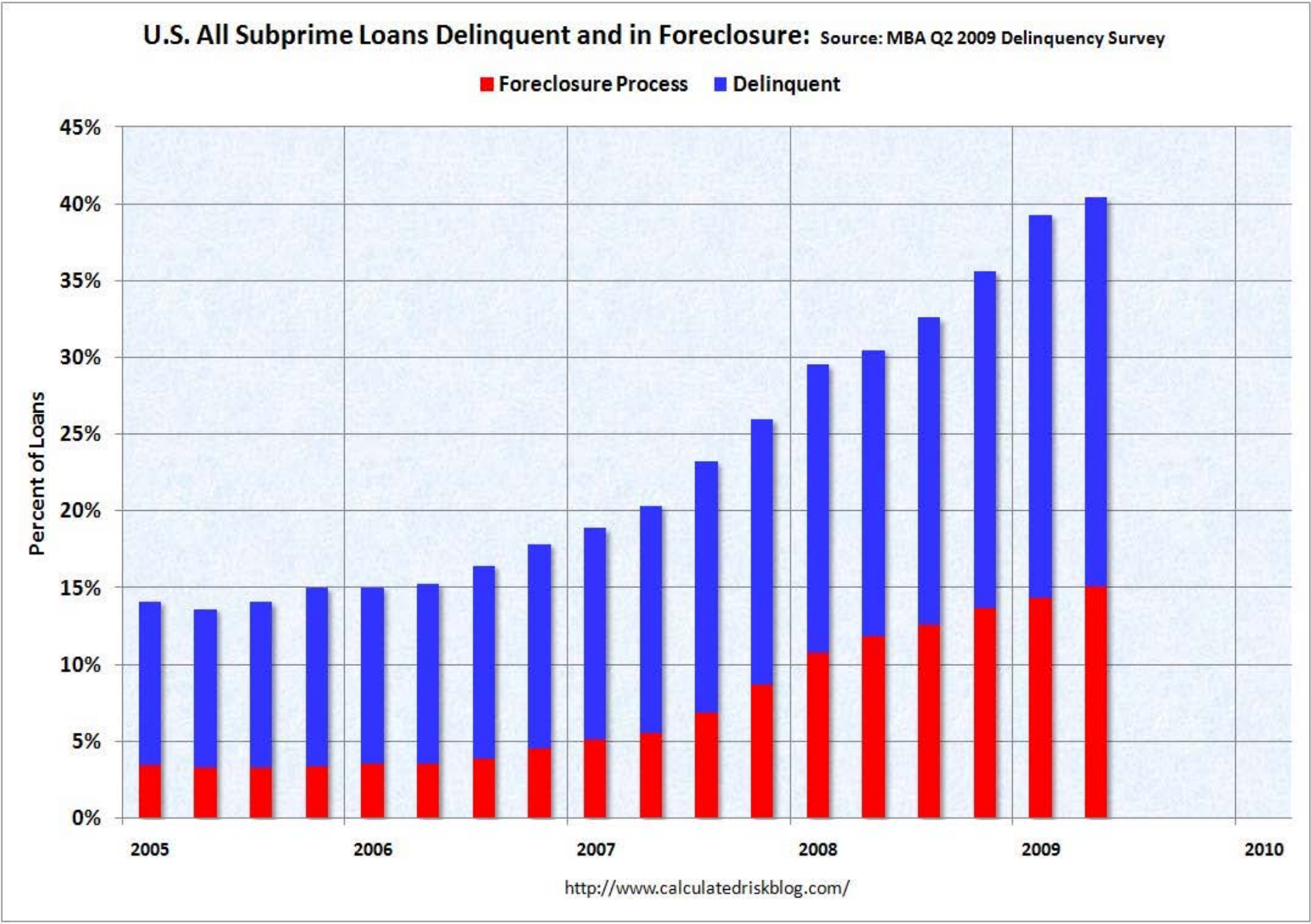
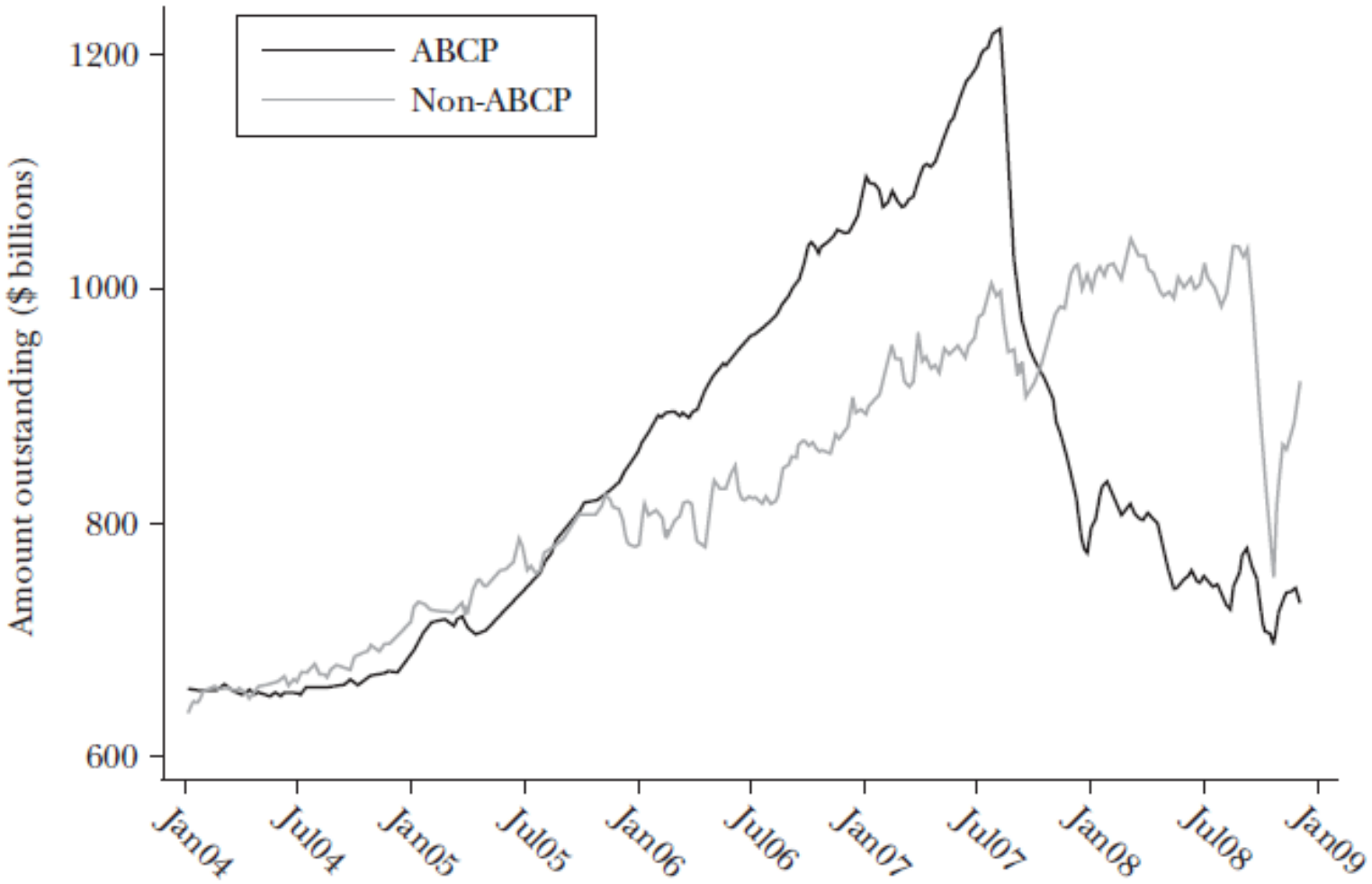

U.S. All Subprime Loans Delinquent and in Foreclosure: Source: MBA Q2 2009 Delinquency Survey
Foreclosure Process
Delinquent
Percent of Loans
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
2005
2006
2007
2008
2009
2010
http://www.calculatedriskblog.com/

Figure 2

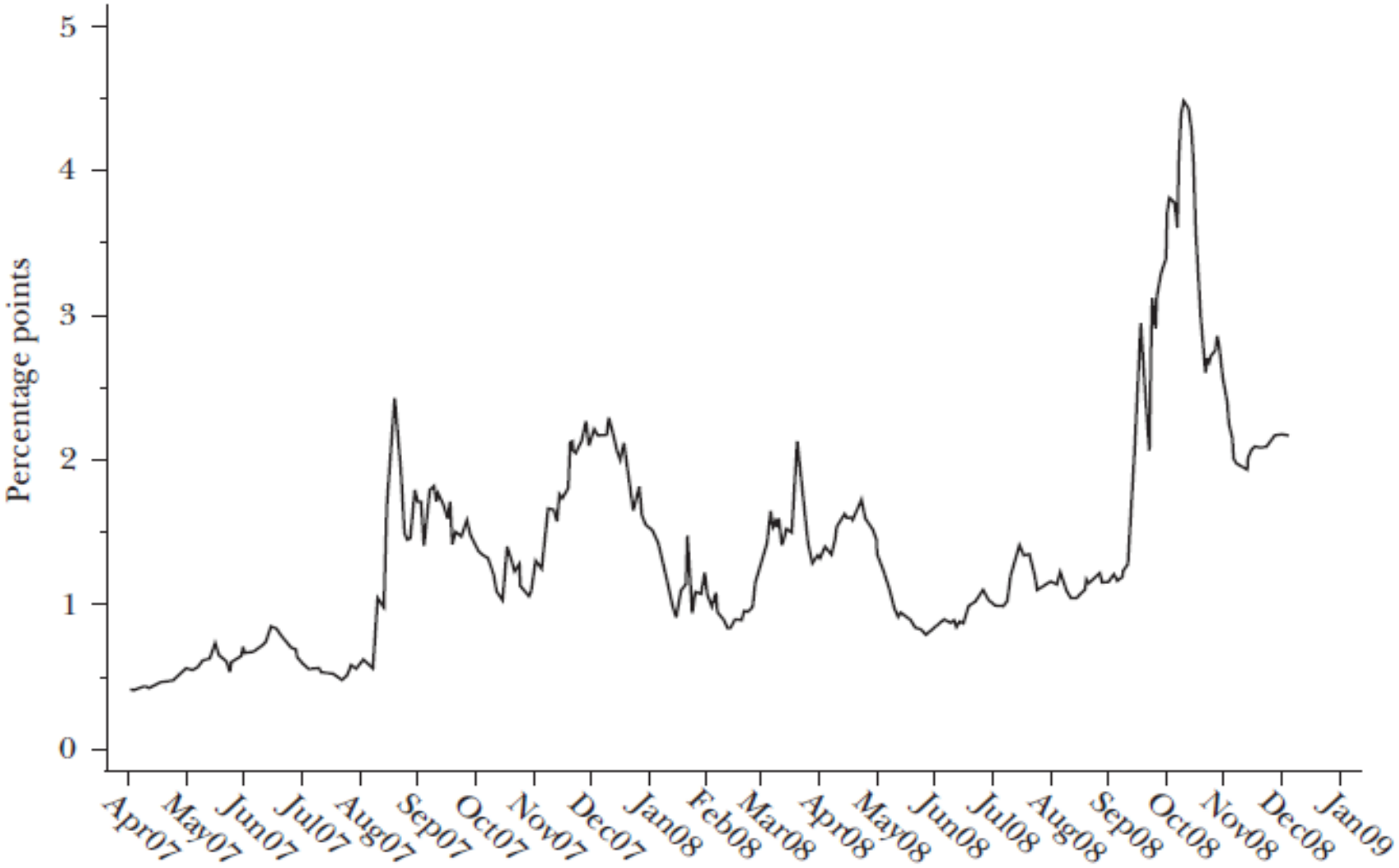
Outstanding Asset-Backed Commercial Paper (ABCP) and Unsecured Commercial Paper



Source: Federal Reserve Board.

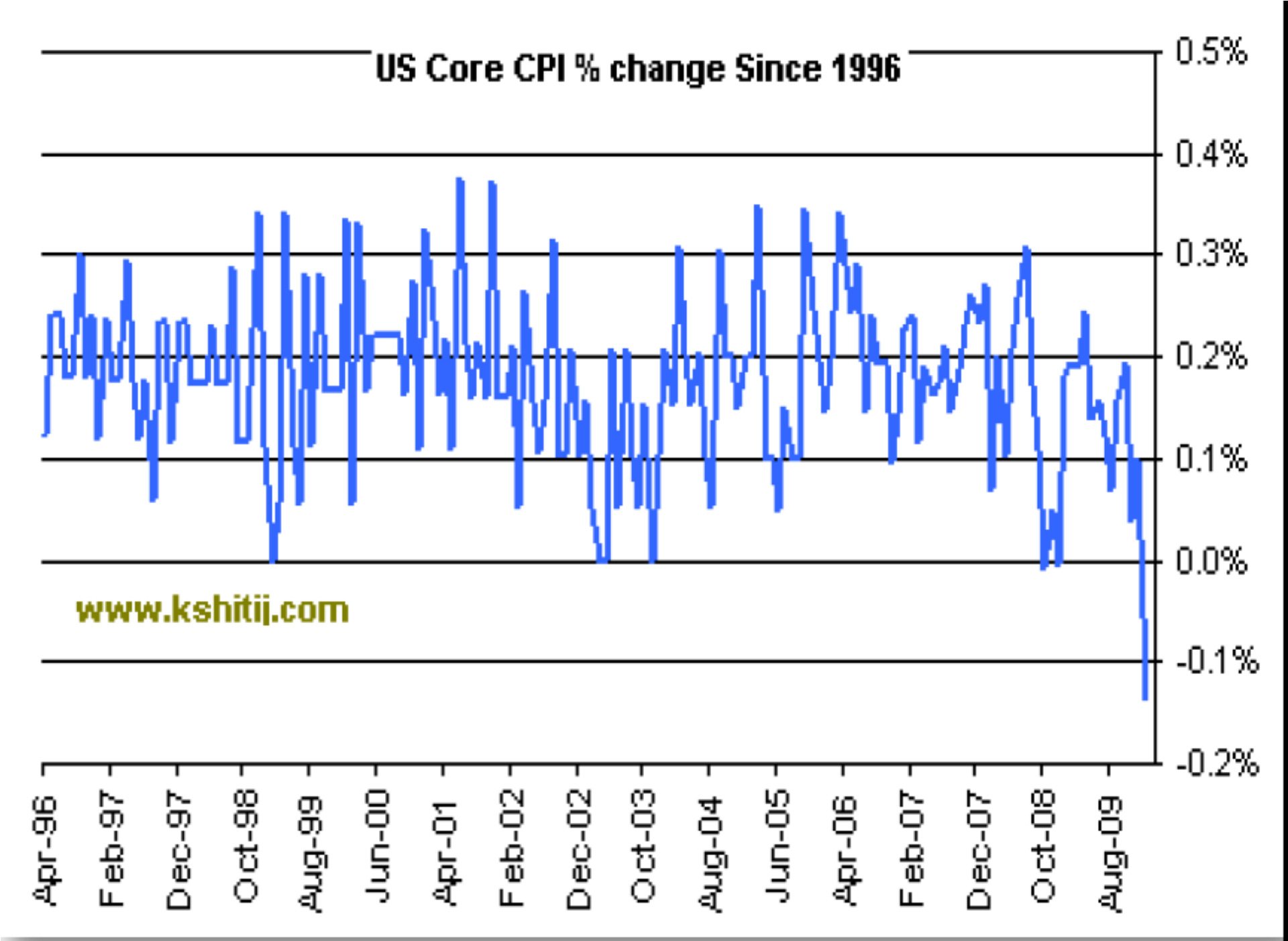
Figure 3

The TED Spread



Source: Bloomberg.

Note: The line reflects the TED spread, the interest rate difference between the LIBOR and the Treasury bill rate.


US Core CPI % change Since 1996
0.5%
0.4%
0.3%
0.2%
0.1%
0.0%
-0.1%
-0.2%
www.kshitij.com
Apr-96
Feb-97
Dec-97
Oct-98
Aug-99
Jun-00
Apr-01
Feb-02
Dec-02
Oct-03
Aug-04
Jun-05
Apr-06
Feb-07
Dec-07
Oct-08
Aug-09

Iceland: The First Country to Fail

- Explicit Inflation targeting in practice
- Very high interest rates, triggering incentives for carry trade (from 5.3 % in 2003 to 15.25% in 2007)
- Oversized banking sector (around 10 times Iceland's GDP)
- Bank assets and liabilities denominated in FX with a maturity mismatch (no lender of last resort unless CB has FX reserves or swap lines)
- Increase in the interest rates cannot stop the asset price boom and expansion of credit
- Currency appreciation

- Very high trade & current account deficits
- High inflation – high interest rates – restart the cycle
- Typical sudden stop experience
- Stop in capital flows – Currency Depreciation – Increase in the value of credit liabilities for the household – Increasing defaults – Banking Crisis
- The CB tries to defend the currency but cannot due to lack of FX reserves
- Due to oversized banking sector, the government is not able to provide guarantees.
- GDP falls 30% in Euro terms in 2009

The problem of Icesave

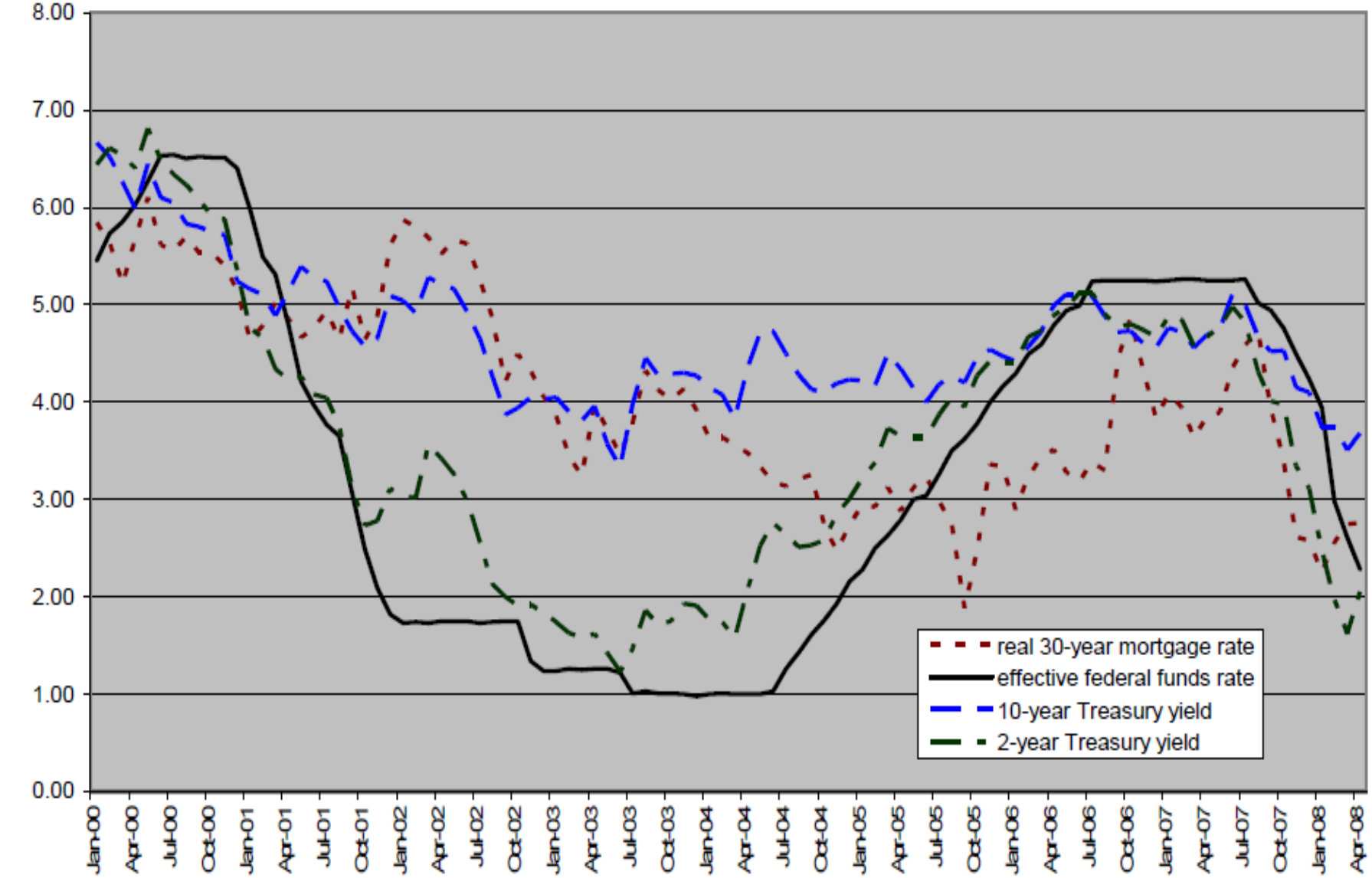
- Offered high-interest savings accounts in U.K and Netherlands with local branches (Landsbanki)
- Regulated and insured in Iceland
- The bank went into administration in Iceland due to massive losses
- The deposits of U.K and Dutch investors are only fractionally covered by the deposit insurance fund in Iceland. (Some City Councils in U.K had invested in Landsbanki)
- U.K froze accounts of all Icelandic banks and placed Iceland on the list of terrorist countries

- The cost of foreign deposits in Landsbanki only to the Icelandic government is around 150% of GDP.
- The referendum about whether to pay back this amount or not was refused with 93% in March 2010.

- One important observation in the case of Iceland is the ineffectiveness of monetary policy to prevent the boom
- Major reason: Carry trade opportunities and lack of regulatory supervision

- The unexpected response of interest rates to CB policy can be observed in the U.S as well, particularly during 2004 and 2005.
- Although the federal funds rate was going up, mortgage rates fell and housing boom speeded up at this period
- On the other hand, exactly the opposite can be seen after 2007, as mortgage rates climbed up as the federal funds rate fell
- The pass-through effect of CB interest rates have weakened, reducing (if not completely abolishing in some cases) the effectiveness of monetary policy

The federal funds rate has had little effect on long-term interest rates



Source: Federal Reserve Bank of St. Louis and U.S. Bureau of Economic Analysis

- A further problem of dollar appreciation appeared through the initial phases of the crisis.
- From 2004 to 2007, the dollar either did not move or depreciated despite the increases in the federal funds rate.
- On the other hand, although the FED reduced the interest rates at record speed (and faster than all other Central Banks) after 2007, the dollar appreciated against most currencies. (Apart from Japanese Yen).
- Nominal Exchange rate behaves in exactly the opposite way : The power of carry trade. Very high demand for Japanese Yen and U.S Dollar as the carry trade reverses.

EUR-USD


1.60
1.40
1.20
1.00
EUR=X
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
0.8
0.3

GBP-USD


2.20
2.00
1.80
1.60
1.40
GBP=X
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
0.8
0.3

USD-JPY


130.00
120.00
110.00
100.00
90.00
JPY=X
Oct
Jan
Apr
Jul
Oct
Jan
Apr
Jul
Oct
Jan
Apr
Jul
Oct
Jan
Apr
Jul
Oct
Jan
Apr
2005
2006
2007
2008
2009
2010
0.8
0.3