University of Essex
Economics Department
Centre for Computational Finance and Economic Agents

Macerata Workshop: Can It Happen Again ? 1-2 October 2010:

Financial Contagion and Systemic Risk in Network Model of CDS and Other Credit Enhancement Obligations of US Banks

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Systemic Risk from Leverage and Derivatives

- This work identifies the Credit Default Swaps (CDS) within the context of the Basel 2 Synthetic Securitization framework as having a unique, pervasive and pernicious role to play in the recent 07-08 financial crisis
- First prepared for ECB *(Advances in Financial Network Modelling, Oct 09)*and for IMF Workshop *(Operationalizing Systemic Risk Monitoring 28 May 2010)*
- Relevance to India: RBI (Reported 6 Aug 2010 *Economic Times*) to allow single name CDS purchases exclusive to those with exposure to underlying (ie. No naked CDS buying); no multi-name CDS such as mortgage backed securities
- Concentration risk and perverse incentives must be monitored ; dominance of few big players in chains of insurance :idea of "too interconnected to fail" (Eg AIG) Tax payer bailout to maintain fiction of non-failure to avert credit event that can bring down the CDS pyramid and financial system.

Roadmap

- **Systemic Risk from Credit Expansion and asset price/real estate inflation: US/UK vs India**
  - **Financial Crisis 07-08 and Credit Derivatives**
  - **Financial Contagion and Systemic Risk**
  - **Synthetic Securitization and Basel II – Regulatory and Market Failure**
  - **Post Crisis Intercontinental Exchange (ICE) CDS Central Clearing : New Player in CDS Network (Taken approx. 30% of US CDS Market Share since March 2009)**
- **Model of Structural Contagion v Statistical Models of Contagion**
  - **Fine Grained Data-base driven Multi Agent Based Models of Financial Sector : Model Verite**
    New Office of Financial Research in the US Treasury to put an end to regulators flying blind
  - **Network Approach**
  - **Stress Test**
- **Conclusions**

Systemic Risk : Negative Externality arises from market failure and needs Macro-level Regulatory Control (known at least since Pigou, 1950)

- Overuse and degradation of resources as in environmental externalities (eg CO2 emissions and road congestion)arises from economic activities where the clean up costs are not fully priced at point of use by the individual ('Cap' aggregate quantity of the negative externality/economic bad and hence of the original economic activity; also how to price the negative externality ?)
- Likewise, financial activity such as demand for credit and of insurance against credit risk (ie. default by borrower) should be 'capped' and an appropriate model of 'price of clean up' instituted whereby tax payer bailout of failed financial intermediaries does not occur ; *chronic underpricing of credit and credit risk*
- Systemic risk from individual financial activity (should this be banks, consumer debt, non-bank financial intermediaries (FIs)) refers to threat to financial and economic stability

Webbased Digitally Mapped Monitoring (Mark Buchanan, Nature 2010)

A screen on the wall maps the world's largest financial players — banks, governments and hedge funds — as well as the web of loans, ownership stakes and other legal claims that link them. High-powered computers have been using these enormous volumes of data to run through scenarios that flush out unexpected risks. And this morning they have triggered an alarm.

Flashing orange alerts on the screen show that a cluster of US-based hedge funds has unknowingly taken large ownership positions in similar assets. If one of the funds should have to sell assets to raise cash, the computers warn, its action could drive down the assets' value and force others to start selling their own holdings in a self-amplifying downward spiral. Many of the funds could be bankrupt within 30 minutes, creating a threat to the entire financial system. Armed with this information, financial authorities step in to orchestrate a controlled elimination of the dangerous tangle.

Three major methodological issues:Why no dogs barked ? Catalogue of Errors

1. Why was the need for macroprudential framework eschewed? Mainstream Neoclassical 'Representative Agent' Models; high degree of aggregation *Unfortunate Irrelevance of Most State of the Art Monetary Economics (Buiter 09) Queen's visit to LSE ; DSGE Models; Reduced form vs Structural Models*

2.Why were there no system wide quantitative models developed for stress tests of how the financial network would function under these micro regulatory rules of individual bank behaviour?

Failure of macro-econometric models for policy analysis (Lucas Critique);we have yet to replace this with multi-agent fine grained data base driven financial network models

3. Urgent need for modelling tools to monitor liquidity gridlocks,direction of an ongoing financial contagion, systemic risk: Subject matter of my RBI talk and tutorial (and of a number of workshops eg ECB, IMF etc)

Answer: Lack of Complex Adaptive System framework- Red Queen type competitive co-evolution esp between regulator and regulatee requires constant vigilance and production of countervailing measures(Markose 2004, 2005)

Other Critiques of lack of Systemic Risk Perspective

- Brunnermeir et. al. (2009) on micro-prudential focus ignoring systemic risk implications : *fallacy of composition* Conflation of micro and macro

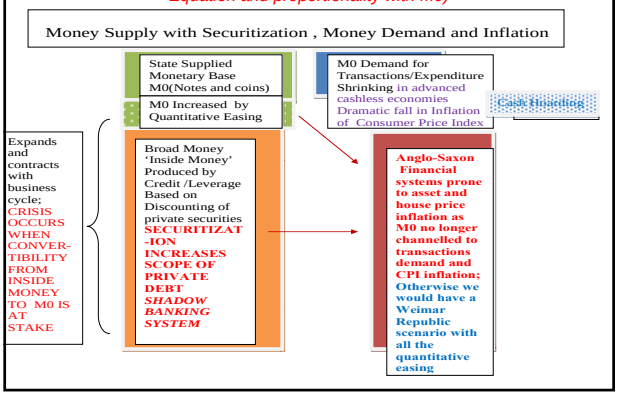
John Eatwell (Guardian, 19 Sept 2008)

Risks of system collapse are externalities; " their cost to the economy as a whole is greater than the cost to a firm whose actions are creating the risk. But if regulators focus on risks that are recognised by firms already, and neglect systemic risk" .. What does regulation achieve ?

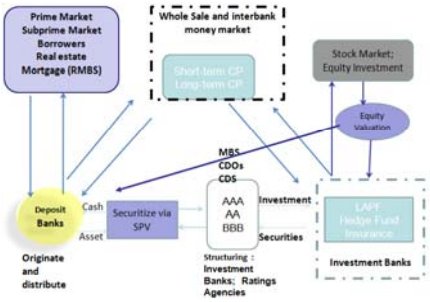
"Regulators must begin to base their approach on the system as a whole. .. while financial firms are encouraged by supervisors to conduct thousands of stress tests on their risk models, few are conducted by the regulator on a system-wide scale. If it is possible to have system-wide stress tests on the impact of Y2K, or of avian flu, why not on liquidity?"

- David Jones (2002)in a rare paper discusses regulatory arb and systemic implications from Basel suggests that lack of literature is due to lack of data for econometric analysis ; but are econometric models up to the task ?
- Recent UK Select Committee critique of Bank of England Dynamic General equilibrium models – no banks in it and no possibility for insolvency so no assessment of systemic risk possible from bank behaviour

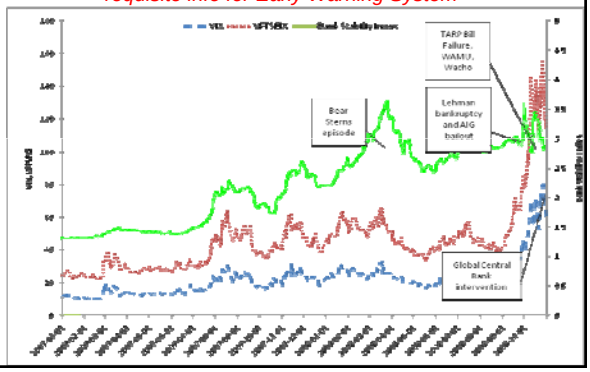
Understanding of Financial Innovations and Cashlessness leading to Low Inflation *Why ? (Markose and Loke (2003,2004) papers on cash card substitution) (Break Down of Transactions Demand for Money Equation and proportionality with M0)*



Financial Contagion and Systemic Risk: Multi Agent Model of US Financial Sector (For *TWO* decades regulators, central bankers and academics had no incentive to study and build large scale integrative financial sector models (Gary Gorton) Why ?)



Banking Stability Index (Segoviano, Goodhart 09/04) v Market VIX and V-FTSE Indexes : *Sadly market data based indices spike contemporaneously with crisis ; devoid of requisite info for Early Warning System*

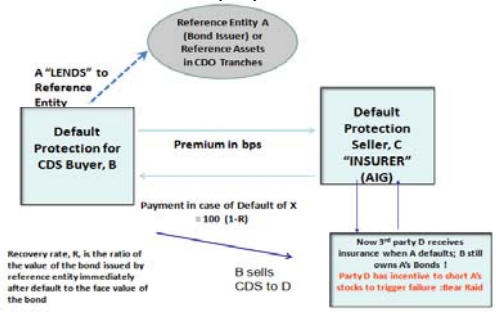


Remote Securitization of Bank Loans vs. Synthetic Securitization & CDS:A Case of Perverse Incentives

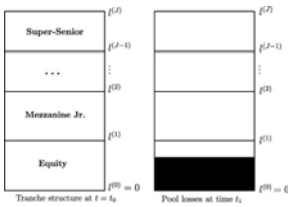
- **Basel I required 8% of equity capital against bank assets**
  - **Consider $1 bn Mortgage Loans**
  - **Equity Capital needed $80 million**
  - **If $.5 bn securitized and moved off balance sheet ie.50% of securitization Bank now needs only $40 million of Equity Capital**
  - **Further $40 million can be lent out ; securitize again and again …..First MONEY PUMP**
- **Synthetic securitization BASEL II and 2002 US Reg99.32 : an originating bank uses credit derivatives or guarantees to transfer the credit risk, in whole or in part**
- **CDS or insurance from AAA rated entities yield low risk weighting for ABS retained on balance sheet (from 8% - 1.6%) Huge bank behaviour changing incentive aggravated by negative CDS carry trade (triple whammy for banks : seemingly risk reduction, capital reduction plus huge leverage opportunities)**
- ***Second Money Pump: Peak of CDS Dec 07 $57 Tn ; Dec 08 $32 Tn of this $15.64 Tn involved top 5 US banks***
- ***Credit Risk transmuted to counterparty risk of bank and non-bank CDS protection sellers and now with tax payer bailout of these institutions post Lehman demise we have increased sovereign risk and the worst case of moral hazard***

Credit Default Swap (CDS)CHAINS and Bear Raids (John Paulsen and Paolo Pelligrini):

CDS had *a unique, endemic and pernicious role* in current crisis in context of Basel II and Fed Reserve Board Reg 99.32 Credit Risk Transfer (CRT) Scheme



Collateralized Debt Obligation,CDO
($155bn at peak 2007) Synthetic CDO combines CDO Tranches with CDS : Regulation by Ratings Agencies: Conflict of Interest

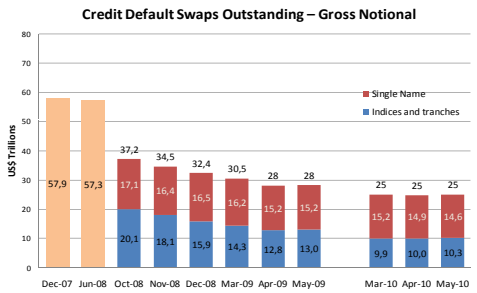


Tranche structure at time t_0; at time t_1, pool's losses (shaded in black) absorbed by Equity tranche; Mezzanine Jr., Mezzanine, Senior and Super-Senior tranches are not yet affected by pool losses.

Structural vs Statistical Contagion

- **DEFINITION: Economic and financial contagion refers to the *spreading of a negative shock* on the solvency conditions of an economic or financial entity in a physical supply chain or in terms of generic credit/debt and liquidity obligations governing interbank, payment and settlement systems and/or claims on other financial markets**
- **Structural model based on default causality of chain reactions governed by the network connections of the financial entities**
- **In contrast, models made popular by Kaminsky and Reinhart (2000) view financial contagion as the downward co-movement of asset prices across different markets and for different asset classes. This is based on statistical or econometric methods which measure (amongst other ways) the increased correlations of asset prices**
- **Above models complimentary to the causal default models that use financial network simulations, especially in the use of contagion models based on CDS price co-movements (*Jorge Chan-Lau et al., 2009)***

Drastic Compression post Lehman especially in tranche CDS

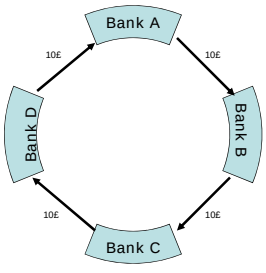


Source: BIS Dec 07, Jun 08 ; DTCC other dates

CDS Network Structures Private Incentives and Concentration Risk: Gross v Net

- ***Synthetic Securitization Regulation yields greatest capital relief with CDS cover from AAA rated entities like AIG and top banks- these are few in number***
- ***Offsetting by Broker dealers; bilateral offsets to minimize liquidity and rich club structures***
- **B buys a CDS from C with a certain annual "*premium*", say 3% (See Figure on CDS Chain)**
- **Condition of reference entity worsens, CDS premium rises, so B sells CDS to company D with a premium of say, 6%, and benefits from 3% difference. Note, in case of no insolvency of counterparty C, B has zero economic obligations due to offset. Otherwise, B has to settle gross.**
- **Closed /Circular CDS Chains are ex ante efficient in liquidity but with counterparty insolvency truncated chains require more than net notional to settle**
- **Closed CDS chains evolve which minimize settlement obligations through offset and maximize returns from CDS premia (lengthening chains) calling to question whether the CDS market can provide sufficient hedge for the reference assets**

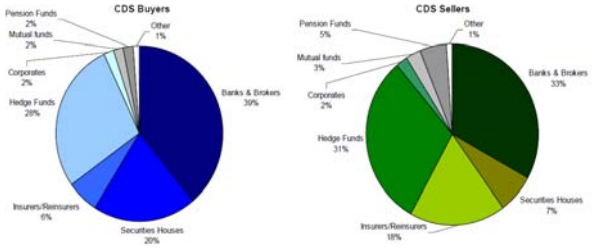
Multilateral Settlement (MS) and Circular Networks Ex Ante Efficient but Potentially Unstable vs. Fully Funded Gross Settlement Stable but Costly in terms of Liquidity
Private Sector Arrangements aim to minimize liquidity : ICE CDS Clearer could increase concentration risk



	Liquidity
MS & Net Notional	0 £
Fully Funded Gross Settlement	40 £

Actual liquidity needed is between net notional and gross notional as counterparties default and concentration risk increases

Q4 2006 : Counterparties for CDS: Buying CDS Insurance from a passenger on Titanic The Role of the Monolines and Non-Regulated Bank Sector Credit Risk Converted to Counterparty Risk and now to Sovereign Risk



Source: British Bankers Association
NB: Threat to the system came from CDS Sellers 49% Hedge Funds and Monolines with inadequate capital base

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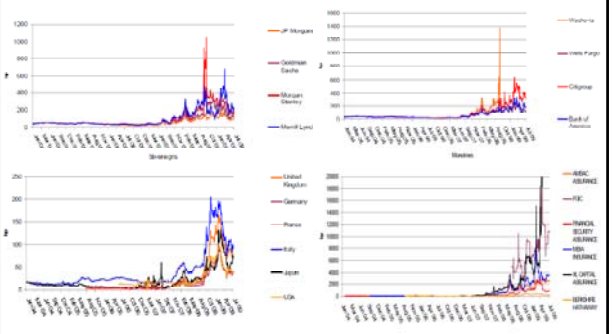
CDS Spreads: Default Risk Transmuted to Counterparty Risk and the Sovereign Risk (Source *Datastream)*



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Modelling Issues

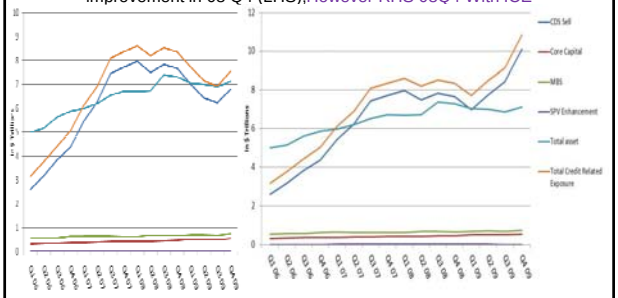
- **Empirical reconstruction of the US CDS network (FDIC 08 Q 4 data; also DTCC Data) for stress tests to investigate implications of fact that top 5 US banks account for 98% of $16 tn of the $37 tn gross notional value of CDS reported by the BIS and DTCC for the end of 2008**
- ***ARE WE OUT OF THE CDS WOODS ?* Empirically based CDS network for 26 US banks (2008 Q 4) data fundamentally unstable by May-Wigner criteria; does not have enough bank capital to prevent system collapse due to failure of a large CDS seller**
- **Above better than an equivalent random graph which leads to worse consequences**
- **Implications of ICE CDS Central Clearing : Network Stability updates after March 2009**
- **New concepts such as 'super-spreader' fund based on centrality in terms of connectivity of a financial entity in financial system**
- **Systemic Risk Ratio: measures the liquidity loss impact in terms of aggregate bank core capital loss due to failure of a major bank or non-bank player from its activities in CDS and credit enhancement**
- **Super-spreader funds: financial entities have to contribute proportional to their systemic risk impact. Over turns current practice where 'big' banks have lenient collateral requirements**
- **Eigenvalue Centrality statistics for superspreaders. Can this proxy for systemic risk losses of core capital for the CDS participants ?**

Inclusion of ICE CDS Clearer 09Q4 : US CDS Market Shares and Eigenvalue Centrality 08 Q4 v 09 Q4

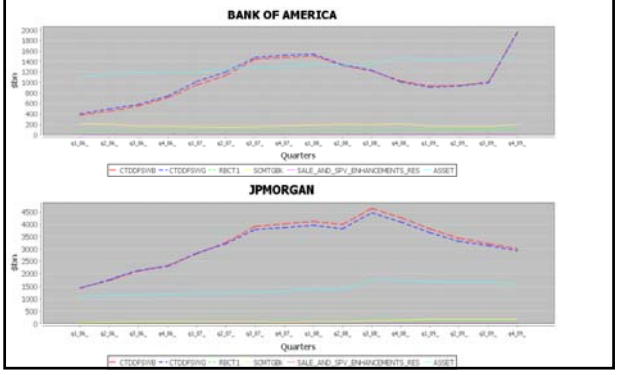
(Source FDIC ; B: CDS BUY. G: CDS Guarantees; RECT 1 Core capital NB ICE Capital only $45m, 0.0013% of Tot Exposure)

BANK	CTDDFSWB				CTDDFSWG				RBCT1				Eigen Value Centrality	
	q4 08		q4 09		q4 08		q4 09		q4 08		q4 09			
	$1,000		$1,000	%	$1,000	%	$1,000	%	$1,000	%	$1,000	%	q4 08	q4 09
CETRUST		0.000%	3301673718	32.039%		0.000%	3301673718	32.702%		0.000%	45624	0.088%	0	0.5308
JPMORGAN CHASE	4262320000	32.910%	3007303000	29.183%	4103539000	53.564%	2939911000	29.118%	1005970000	20.798%	96372000	17.650%	0.6605	0.4874
CITIBANK	1397546000	17.348%	1160557000	11.262%	1290310000	16.843%	1089611000	10.792%	709770000	14.674%	96833000	17.734%	0.2474	0.2072
BANK OF AMERICA	1028649827	12.769%	1972633888	19.142%	1004736144	13.115%	1964463832	19.457%	889790017	18.396%	111915735	20.496%	0.1929	0.3472
GOLDMAN SACHS USA	718013000	8.913%	374417000	3.633%	640462000	8.360%	339144000	3.359%	132120000	2.731%	17152000	3.141%	0.1274	0.0724
HSBC USA	457088944	5.674%	366613338	3.558%	473629328	6.182%	372604526	3.690%	108219319	2.237%	13353708	2.446%	0.1027	0.0795
WACHOVIA	150748000	1.871%	90859000	0.882%	141959000	1.853%	85699000	0.849%	32772000	6.775%	39786000	7.286%	0.0337	0.0188
MORGAN STANLEY	22058000	0.274%	24606000	0.239%	0	0.000%	0	0.000%	5776000	1.194%	7360000	1.348%	0	0
MERRILL LYNCH USA	8897420	0.110%		0.000%	0	0.000%		0.000%	4321213	0.893%		0.000%	0	0
KEYBANK	3876800	0.048%	2496491	0.024%	3309302	0.043%	1916952	0.019%	8012102	1.656%	8089597	1.482%	0.0009	0.0006
PNC BANK	2000500	0.025%	1046000	0.010%	1054500	0.014%	542000	0.005%	8337592	1.724%	24490673	4.485%	0.0003	0.0008
NATIONAL CITY	1285226	0.016%		0.000%	945218	0.012%		0.000%	12757364	2.637%		0.000%	0.0002	
NEW YORK MELLON	1175000	0.015%	804000	0.008%	2000	0.000%	2000	0.000%	1148000	2.305%	10149000	1.859%	0	0
WELLS FARGO	1036000	0.013%	865000	0.008%	488000	0.006%	340000	0.003%	33129000	6.849%	43765000	8.015%	0.0001	0.0000
SUNTRUST	585219	0.007%	525226	0.005%	195819	0.003%	144476	0.001%	12564741	2.598%	11973003	2.193%	0.0001	0
NORTHERN	235500	0.003%	127000	0.001%	0	0.000%	0	0.000%	4385245	0.907%	4755543	0.871%	0	0
STATE STREET	145000	0.002%	170000	0.002%	0	0.000%	0	0.000%	13422034	2.775%	11378194	2.084%	0	0
DEUTSCHE BANK	100000	0.001%	68000	0.001%	0	0.000%	68000	0.001%	7872000	1.627%	8289000	1.518%	0	0
U.S. BANK	63500	0.001%	116000	0.001%	0	0.000%	0	0.000%	14558168	3.010%	16249713	2.976%	0	0
COMMERCE	17385	0.000%		0.000%	30365	0.000%		0.000%	1368254	0.283%		0.000%	0	0
MERCANTIL	10500	0.000%		0.000%	0	0.000%		0.000%	538101	0.111%		0.000%	0	0
ASSOCIATED BANK	7500	0.000%	7500	0.000%	120645	0.002%	109781	0.001%	1576864	0.326%	1779593	0.326%	0	0
COMERICA	5273	0.000%	3698	0.000%	45558	0.001%	26560	0.000%	5706736	1.180%	5763297	1.055%	0	0
SIGNATURE	3000	0.000%	8000	0.000%	0	0.000%	0	0.000%	760308	0.157%	840057	0.154%	0	0
BANK OF PENNSYLVANIA	0	0.000%		0.000%	9299	0.000%		0.000%	2479166	0.513%		0.000%	0	0
FIFTH THIRD	0	0.000%	0	0.000%	10000	0.000%	5000	0.000%	441536	0.091%	445902	0.082%	0	0
PNC	0	0.000%	114733	0.001%	52273	0.001%	93998	0.001%	6152532	1.273%	9271982	1.698%	0	0
HORICON	0	0.000%	0	0.000%	6000	0.000%	5600	0.000%	42265	0.009%	49437	0.009%	0	0
AMBSY	0	0.000%	0	0.000%	170	0.000%	301	0.000%	939442	0.194%	1271949	0.233%	0	0
CALIFORNIA	0	0.000%		0.000%	371	0.000%		0.000%	872714	0.180%		0.000%	0	0
MITSUBISHI UFJ	0	0.000%		0.000%	50000	0.001%		0.000%	695894	0.144%		0.000%	0	0
RBS CITIZENS	0	0.000%		0.000%	55477	0.001%		0.000%	8471557	1.751%		0.000%	0	0
AMERICAN CHARTERED		0.000%	0	0.000%		0.000%	4100	0.000%		0.000%	194418	0.036%	0	0
SOUTHWEST		0.000%	954	0.000%		0.000%	625	0.000%		0.000%	477944	0.088%	0	0
M&I MARSHALL & ILSLEY		0.000%	3423	0.000%		0.000%	9274	0.000%		0.000%	3949430	0.723%	0	0
STATE BANK FINANCIAL		0.000%	0	0.000%		0.000%	16059	0.000%		0.000%	27713	0.005%	0	0
TOTAL	8055868498		7003344661		7661008470		6794718082		4836927764		5459838911			

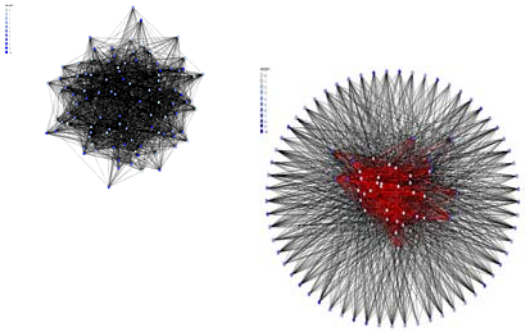
US FDIC Banks in CDS Market Tier 1 Capital and Credit Exposure (LHS): 2006 marks technical insolvency of US Banks as CDS (Sell) plus SPV Enhancement obligations of US banks in CDS exceeds assets; Marked improvement in 08 Q4 (LHS);However RHS 08Q4 With ICE



Trends in CDS Market for Some US Banks (Source FDIC) NB Bank of America has increased market share while others like JP Morgan have reduced drastically by Q409



Some Network Concepts:A graphical representation of random graph (left) and small world graph with hubs, Markose et. al. 2004



Financial Networks for the US CDS Obligations: High Clustering from broker dealer behaviour and Barabasi et. al. Preferential attachment model

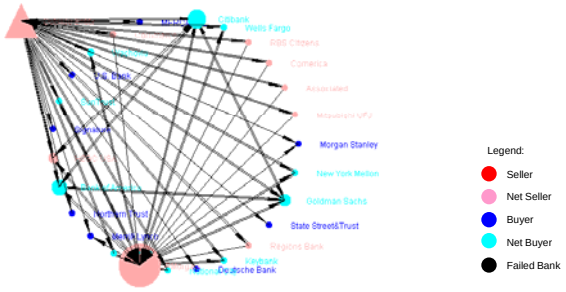
- Our algorithm assigns in and out degrees for a bank in terms of its respective market shares ($s_i^{B/G}$) for CDS purchases(B) and sales (G), resp.

$$X = \begin{bmatrix} 0 & x_{12} & x_{13} & \cdots & x_{1N+1} \\ x_{21} & 0 & x_{23} & \cdots & x_{2N+1} \\ \cdot & \cdot & 0 & \cdots & \cdot \\ x_{i1} & \cdot & \cdot & 0 & x_{iN+1} \\ \cdot & \cdot & \cdot & \cdot & 0 \\ x_{N+11} & \cdot & x_{N+1j} & \cdots & 0 \end{bmatrix} \quad \begin{matrix} \Gamma = \sum_i G_i \\ G_1 \\ G_2 \\ \cdot \\ G_i \\ \cdot \\ G_{N+1} \end{matrix}$$

$$\Theta = \sum_j B_j \quad B_1 \quad \cdots \quad B_j \quad \cdots \quad B_{N+1}$$

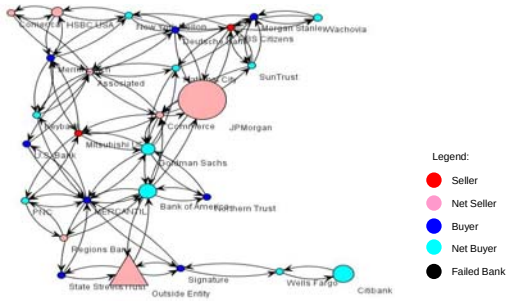
$$x_{ij} = \begin{cases} G^i s_j^B & \text{for the largest } (1+Ns_i^G)\text{'s counterparties} \\ 0 & otherwise \end{cases}$$

Initial CDS Financial Network for 26 US Banks (2008 Q4): Note Majority of Interconnections are among top 4 banks and Monolines & Hedge Funds(30%Triangle)



Source: ACE Stress Testing

Random Graph with Same Connectivity and Gross CDS Buy/Sell



May-Wigner Stability Criteria for Networks

$$\sqrt{NC}\ \sigma < 1 .$$

- Sinha (2005) and Sinha and Sinha (2006) found that the transition point between stability and instability with respect to the given parameters (N:No. of Nodes, C:Connectivity and sigma) does not differ between random and small world networks.
- However, they found that the speed and manner in which these different network systems transited into instability differed.
- An unstable clustered network system will disintegrate in a less pervasive way than an unstable random network system.

Network Statistics for Degree Distribution for CDS Network: Small World Network Properties Compared with Random Graph with Same Connectivity

Q409 Network Statistics with ICE CDS Clearing House (NB less clustered , but remains May-Wigner Unstable)

Initial Network Statistics (In Degrees) CDS Buyers	Mean	Standard Deviation σ	Skewness	Kurtosis	Connectivity	Clustering Coefficient	May-Wigner Stability
In Degrees CDS Buyers	3.04	4.44	3.13	9.12	0.12	0.92	7.814
Out Degrees CDS Sellers	3.04	5.34	3.60	14.12	0.12	0.92	9.432
Random Graph	3.48	1.50	0.70	0.04	0.12	0.09	2.64

MARKET SHARE NETWORK - Q4 2009						
	mean	std	skewness	kurtosis	connectivity	cluster coeff
in degrees	3.366667	5.880906	3.135305	9.562411	0.116091954	0.911334428
out degrees		4.671877	3.383789	13.35499	0.116091954	

Too Interconnected To Fail : Stress Test

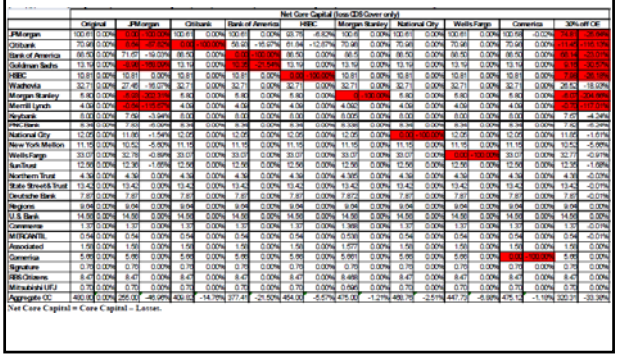
- Objective: Build CDS Network and Conduct Stress Tests
  There is very high correlation between the dominance of market share in CDS and CDS network connectivity
- Stress Tests: Follow Furfine (2003) Algorithm
- We use 20% reduction of core capital to signal bank failure
- Experiment 1: (A) The loss of CDS cover due to the failed bank as counterparty suspending its guarantees will have a contagion like first and multiple order effects. Full bilateral tear up assumed; No possibility for Novation

NET EXPOSURE > 20% Core Capital

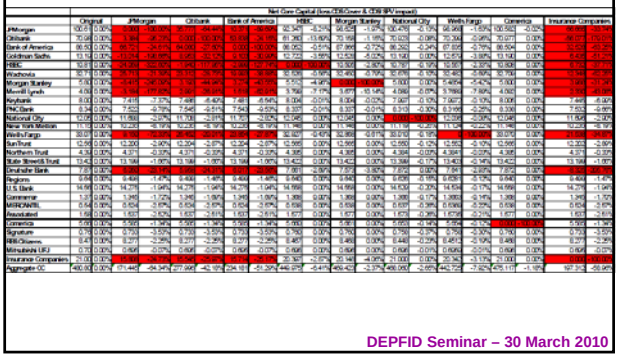
- Experiment 2: Armageddon Scenario
- Experiment 1 + (B) Concentration Risk ($Div_j^=$ (Gross notional – Net Notional)x failed counterparties) and Liquidity Risk (DTCC Data based relative CDS activity on i as reference entity) and Loss from SPV Credit Enhancements

$$[s^j{}_G + \%Gross_j\,][Net_i^R + Div_i^R\,(\sum_{i\in D^i} s^i{}_G\,)] + \beta MBS_j\ (SPV^i / \sum_n SPV^n).$$

Contagion table – exp 1

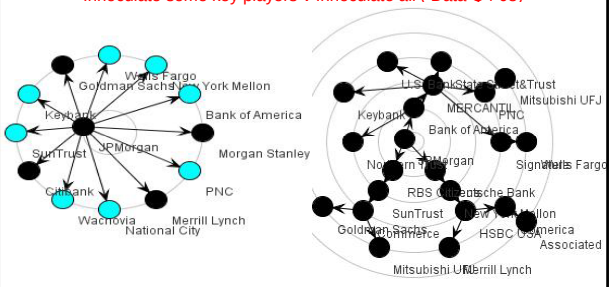


Contagion table – exp 2



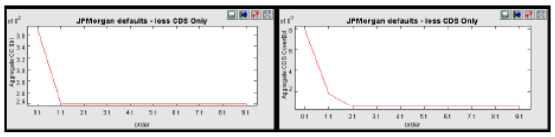
DEPFID Seminar – 30 March 2010

Contagion when JP Morgan Demises in Clustered CDS Network (Left 4 banks fail in first step and crisis contained) v In Random Graph (Right 22 banks fail !! Over many steps)
Innoculate some key players v Innoculate all (Data Q4 08)

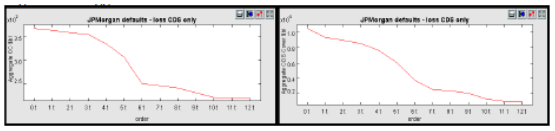


Contagion Rounds

JPMORGAN DEFAULTS: Non calibrated Small World Empirical CDS Network



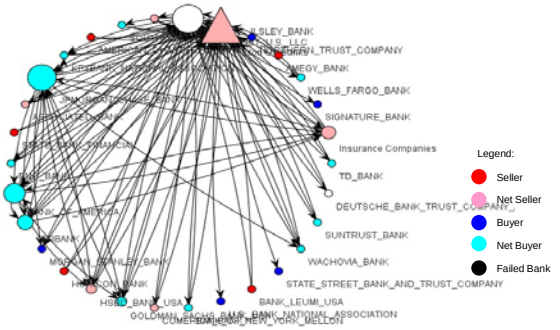
JPMORGAN DEFAULTS: Random Network



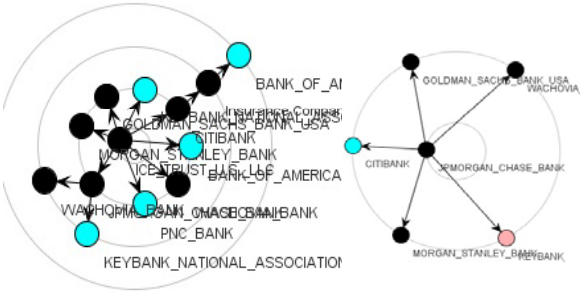
CDS Network with ICE 09Q4

ICE Trust clearing members are Bank of America, Barclays Capital, Citi, Credit Suisse, Deutsche Bank, Goldman Sachs, HSBC, JP MorganChase, Merrill Lynch,

Morgan Stanley, BNP Paribas, RBS and UBS (white circle ICE G=B)



09 Q4 Contagion from ICE as Trigger (LHS) and JP Morgan (RHS) (Note JP Morgan now a much less potent super-spreader)



Systemic Risk Ratio (SRR) : Non Correlation Calibrated Case

- JP Morgan has a SRR of 46.96% implying that in aggregate the 25 US banks will lose this percentage of core capital with Citibank, Goldman Sachs, Morgan Stanley and Merrill Lynch being brought down.
- The highly likely scenario of the demise of 30% of a non-bank CDS protection seller (such as a Monoline) has a SRR of 33.38% with up to 7 banks being brought down.
- Bank of America has an SSR of 21.5%, followed by Citibank at 14.76% and then Wells Fargo at 6.88%. The least connected banks in terms of the CDS network, National City and Comerica have SSRs of 2.51% and 1.18%.
- The premise behind too interconnected to fail can be addressed only if the systemic risk consequences of the activities of individual banks can be rectified with a price or tax reflecting the negative externalities of their systemic risk impact to mitigate the over supply of a given financial activity.

Ongoing tests and Concluding Remarks

- Behavioural change – test *carry trade* strategies and *capital structure* arbitrage
- *What if* questions in 2006 : if Basel II capital relief incentives were disallowed
- Worst case of regulatory failure : concerted effort via VaR and copius micro bank level stress testing led to undercapitalization of banks
- Basel II use of AAA CDS sellers increased leverage by a factor of 65
- Our work finds no evidence that CDS market can deliver AAA cover for bank assets; immediate repeal of Basel II re unfunded CDS cover leading to capital relief
- Super spreader tax and fund recommended over ad hoc breakup of banks
- Further stress tests for robustness of ICE to see if .0013% capital is sufficient
- Can eigenvalue centrality be a good systemic risk proxy for % loss of core capital for the CDS participants from trigger bank?

Systemic Risk Monitoring Issues for India: Leap Frog in terms of Modelling Technology – Move to ICT Platforms wiht Multi-Agent Based Models

- FDIC type full data sets to be collected for *all* Financial Intermediaries; Electronically accessible data with automated visualization facilities at an integrated level
- On and off balance sheet financial obligations data to be submitted
- Bilateral obligations of FIs above a certain threshold to be collected
- Large scale data base driven financial linkages based on above data to be digitally mapped and used as basis of multi-agent models for stress tests
- Special attention to design of CCPs and Capital Needed
- Any sudden growth of activity in unregulated sectors (eg how Monolines in US started supplying CDS cover) to be monitored

Avoid Regulations that may give perverse incentives :capital reduction from CDS cover is one such regulation to be avoided

- Eg. If capital reduction on balance sheet items for AAA rated CDS cover then suddenly there will be an inflation in AAA rated assets ;
- If incentives are given for CDS for hedging then suddenly every CDS activity will be portrayed as a hedge
- Quantitative and integrative model of globalization consequences: activities of Indian banks with branches abroad and foreign banks in India
- Empirical Research on the role of EFTPOS (Electronic Fund Transfer at Point of Sale) Debit Card Use in India, M0 growth and Inflation

Some References 1

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- Amadeo Alentorn and Serafin Martinez have a Phd from the Centre for Computational Finance and Economic Agents (CCFEA), University of Essex.