

Supervisory Stress Test of Clearinghouses

An Analysis by CFTC Staff of Systemic Risk across Multiple Clearinghouses in all CFTC Asset Classes



DISCLAIMER

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Executive Summary

Purpose of Exercise – Test the resiliency of 5 major clearinghouses under a variety of stress scenarios

- Assess the impact of hypothetical stressed market conditions across multiple clearinghouses
 - Use actual positions and actual margin
- Analyze the overall risk that the largest clearing members pose across several asset classes
- Evaluate the sufficiency of the pre-funded resources of individual clearinghouses in the event of a clearing member default

BACKGROUND

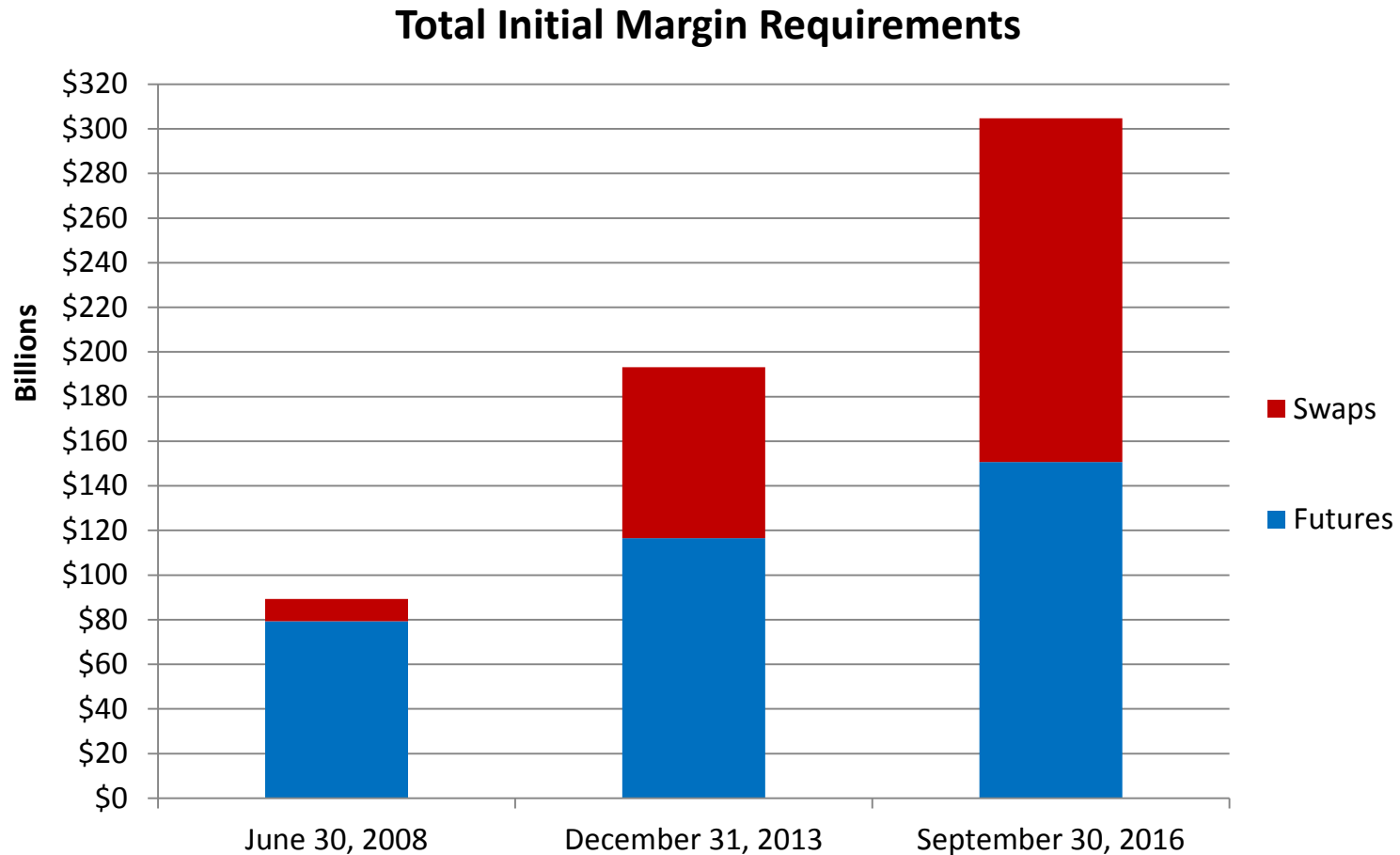


Central Clearing

- Used in futures market for over 100 years
- Expanded under Dodd-Frank Act
- Volume has increased significantly



Growth in Clearinghouse Margin Requirements



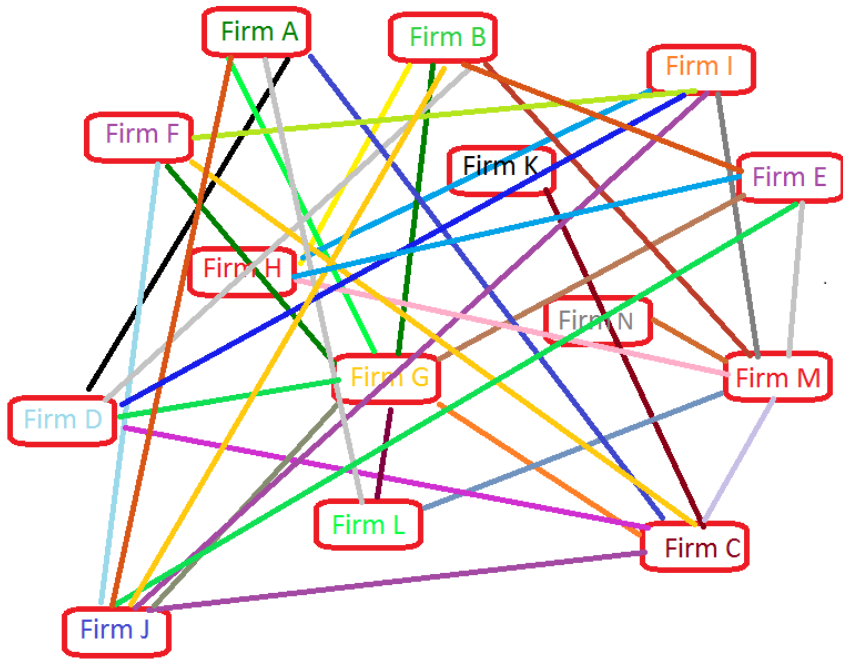


Why did we expand clearing?

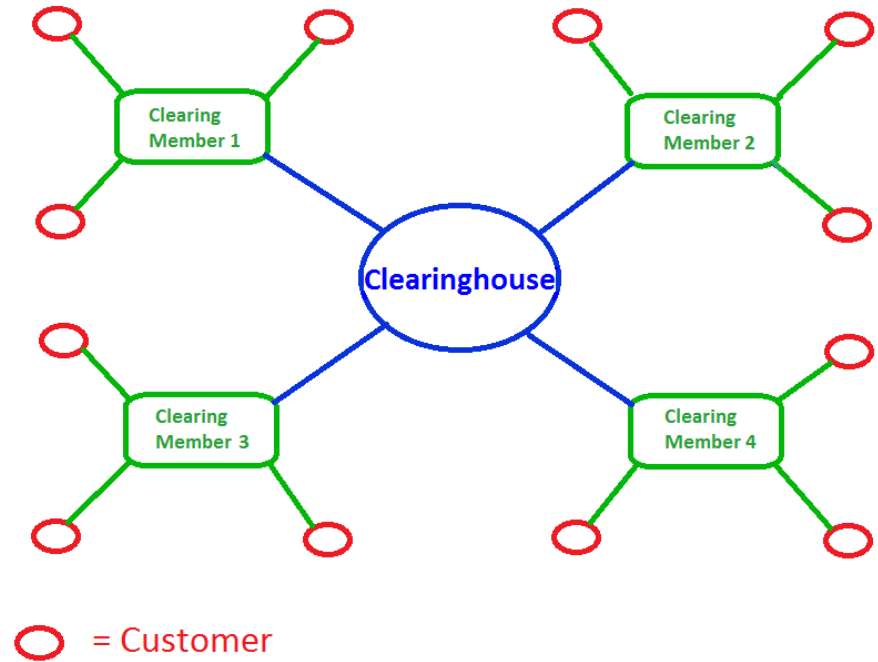
- Lessons of crisis: Problems in bilateral OTC swap market
- Clearinghouses functioned well during the crisis
- Goal of clearing: Improve risk mitigation and monitoring

Comparison of Uncleared and Cleared Markets

The Uncleared Marketplace



The Cleared Marketplace



Systemic Concerns

- Have we just moved the risk?
- Have we created new concentrations of systemic risk, new points of failure?



Systemic Concerns

Have we just moved the risk?

Have we created new concentrations of systemic risk, new points of failure?

- Transaction risk still exists, it is easier to monitor and mitigate
- Less likely to lead to destructive chain of defaults
- Clearinghouses have tools and resources
 - To monitor and mitigate risk
 - To manage defaults
- Clearinghouses must meet CFTC & international safety and resilience standards
 - CFTC standards
 - PFMI
 - Coverage standards
- Vigilance and resilience are key



Clearinghouse Tools and Resources to Mitigate Risk

- Variation Margin (VM) and Initial Margin (IM)
- Clearing member requirements
 - Clearinghouse rules
 - CFTC rules
- Risk surveillance
 - By clearinghouse
 - By CFTC



CFTC Risk Surveillance Program

- Identify, quantify, and monitor risks posed by clearinghouses, clearing participants, and other market participants to the financial system
 - Identify positions in cleared products that pose significant financial risk
 - Confirm these risks are being appropriately managed
- Staff analyses risk in cleared futures and options, IRS and CDS markets
- Proactively identify customers and clearing members who pose significant risk based on various portfolio characteristics
- Actively communicates concerns directly with customers, clearing members, and clearinghouses
- Applies comprehensive stress testing program



Default Management Tools and Resources

Prefunded Resources

- Defaulting firm's initial margin
- Clearinghouse capital ("skin in the game")
- Prefunded guaranty fund – mutualized resource

Other ex ante Resources identified

- Assessments on Members
- Other tools
 - Gains based haircuts
 - "Tear ups"



Default Management Objectives

- Allocate losses
- Restore a matched book
- Maintain continuity of functions



Stress Testing

Clearinghouse stress testing

- Required by CFTC rules
- Run daily as part of routine risk management program
- Used to size guaranty fund (Cover 2 applied)
- Run using their own position data and clearing members to test margin adequacy
- Recent CPMI IOSCO guidance on clearinghouse stress testing

“Extreme but Plausible” scenarios used in stress testing

Supervisory stress testing

- Across multiple clearinghouses
- International standards being developed for supervisory stress tests for multiple clearinghouses

Objectives of Supervisory Stress Testing in this Exercise

- Assess the impact of hypothetical stressed market conditions across multiple clearinghouses
 - Use actual positions and actual financial resources
- Analyze the overall risk that the largest clearing members pose across all CFTC asset classes
- Evaluate the sufficiency of the prefunded resources of individual clearinghouses in the event of a clearing member default
- Tests do not address the following important clearinghouse risks
 - Liquidity Risk
 - Operational Risk
 - Cyber security Risk



Methodology

Clearinghouses

U.S.

CME Clearing (CME)

- Futures: equity, interest rates, energy, metals, currencies and agriculture
- Swaps: CDS and IRS

ICE Clear U.S. (ICUS)

- Futures: equity, softs, and currency

ICE Clear Credit (ICC)

- Swaps: index and single name CDS

Europe

ICE Clear Europe (ICEU)

- Futures: energy, equity, softs and currencies
- Swaps: index and single name CDS

LCH Clearnet Ltd (LCH)

- Swaps: IRS



Guaranty Funds

- Each clearinghouse may have more than one guaranty fund
- Tests covered a total of 8 guaranty funds for the 5 clearinghouses
- All clearinghouses in this exercise required to meet Cover-2 standard

Guaranty Funds by Clearinghouse

Asset Class	Clearinghouse				
	<u>CME</u>	<u>ICC</u>	<u>ICEU</u>	<u>ICUS</u>	<u>LCH</u>
Credit Default Swaps	√	√	√		
Interest Rate Swaps	√				√
Futures	√		√	√	



Guaranty Fund Amounts as of 3/31/16

Clearinghouse	Guaranty Fund
CME Futures	\$3.2 billion
CME Interest Rate Swaps (IRS)	\$2.8 billion
CME Credit Default Swaps (CDS)	\$650 million
LCH Interest Rate Swaps (IRS)	\$4.6 billion
ICEU Futures	\$1.9 billion*
ICEU Credit Default Swaps (CDS)	\$1.3 billion
ICC Credit Default Swaps (CDS)	\$1.9 billion
ICUS Futures	\$478 million

* ICEU GF adjusted to reflect pro rata energy futures component



Clearinghouses' Own Resources

Clearinghouses commit their own capital to be available in the event of a default

- Funds would be used after the initial margin and the guaranty fund contribution of the firm in default were exhausted subject to individual clearinghouse rules
- These are included in this default calculations in this exercise

Committed Amounts:

Clearinghouse	Amount
CME Futures	\$100 Million
CME Interest Rate Swaps (IRS)	\$150 Million
CME Credit Default Swaps (CDS)	\$50 Million
LCH Interest Rate Swaps (IRS)	\$63.4 Million
ICEU Futures	\$100 Million
ICEU Credit Default Swaps (CDS)	\$50 Million
ICC Credit Default Swaps (CDS)	\$50 Million
ICUS Futures	\$50 Million

Products Covered

- Most widely held contracts at all clearinghouses
- Futures and options on futures
 - Equity, Interest Rate, Energy, Metals, Agricultural, Softs, Currency
- Swaps:
 - Interest Rate Swaps (IRS)
 - Credit Default Swaps (CDS) – Single name and indices



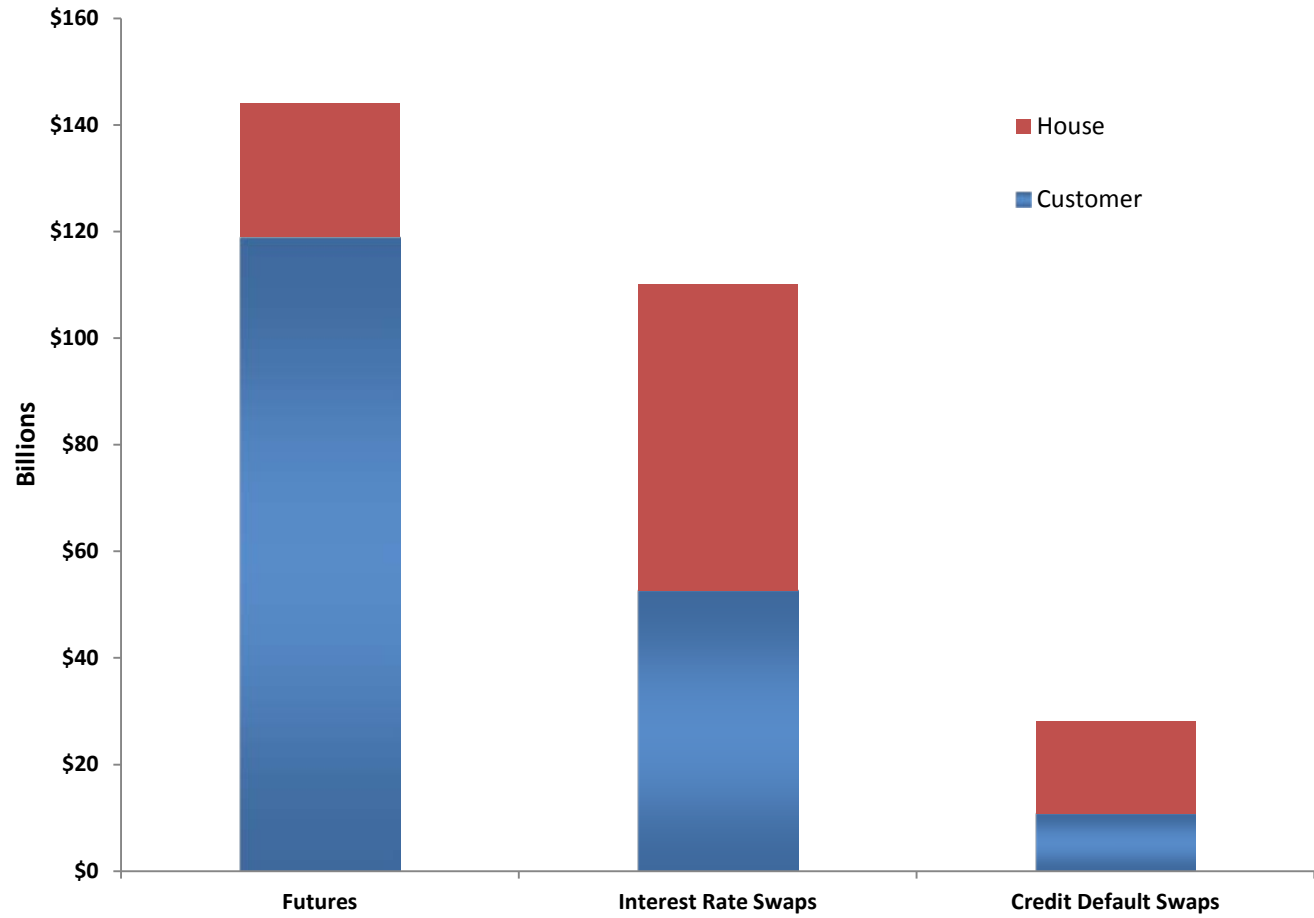
Clearing Members

- Included the 15 largest clearing members of each clearinghouse
- Results in 23 total corporate groups
- 23 groups account for approximately 88% of the total initial margin required by the five clearinghouses
- Affiliated clearing members are combined at the parent level
- These 23 groups comprised 23 house accounts and 20 customer accounts
 - Results in 43 clearing member accounts



Size of Cleared Markets

Total Initial Margin Requirements on April 29, 2016





Stress Test Scenarios

Staff constructed a series of hypothetical scenarios using multiple resources

Stress tests were applied as instantaneous shocks

- “Extreme but plausible” moves
- Calibrated using liquidation period in many instances of more than one day

Examples of CFTC Futures Stress Test Levels

Contract	Stress Up	Stress Down	Highest Actual Historical Return		Lowest Actual Historical Return	
Gold	10%	-10%	9/17/2008	9%	4/15/2013	-9.4%
Crude Oil (WTI)	20%	-20%	12/31/2008	14.3%	1/7/2009	-12.3%
S&P 500	15%	-20%	10/21/1987	19.4%	10/19/1987	-28.6%

Examples of Price Changes on Dates of Extreme Volatility

	Lehman Collapse	Worldwide Action to Address Crisis	Post Crisis Recession Fears	BREXIT	CFTC Stress Tests	
	9/15/2008	10/13/2008	10/21/2008	6/24/2016	UP	DOWN
Gold Futures	3.00%	-1.90%	-2.70%	4.70%	10%	-10%
S&P 500 Futures	-4.95%	14.10%	-3.10%	-4.10%	15%	-20%
WTI Crude Oil Futures	-5.40%	4.50%	-4.50%	-4.90%	20%	-20%



Sector Directional Stress for Test Scenario 4

Sector	Scenario 4
Equity Futures	DOWN
Rates Futures	UP
IRS	DOWN
CDS	UP
Energy	DOWN
Metals	UP
Ags	DOWN
Softs	DOWN
Currency	UP

Sector Directional Stress by Scenario

Sector	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Scenario 8	Scenario 9	Scenario 10	Scenario 11
Equity Futures	UP	DOWN	DOWN	DOWN	UP	UP	DOWN	DOWN	DOWN	DOWN	UP
Rates Futures	DOWN	UP	DOWN	UP	DOWN	DOWN	DOWN	UP	DOWN	UP	DOWN
IRS	UP	DOWN	UP	DOWN	UP	UP	UP	DOWN	UP	DOWN	UP
CDS	DOWN	UP	UP	UP	DOWN	DOWN	UP	UP	UP	UP	DOWN
Energy	UP	DOWN	UP	DOWN	DOWN	DOWN	UP	DOWN	UP	DOWN	UP
Metals	UP	DOWN	UP	UP	DOWN	DOWN	UP	UP	UP	FLAT	UP
Ags	UP	DOWN	FLAT	DOWN	FLAT	DOWN	DOWN	DOWN	UP	DOWN	DOWN
Softs	UP	DOWN	FLAT	DOWN	FLAT	DOWN	DOWN	DOWN	UP	DOWN	DOWN
Currency	UP	DOWN	UP	UP	DOWN	DOWN	DOWN	DOWN	UP	UP	UP



Application of Methodology

- Stress Tests calculated and aggregated independently by CFTC staff
- Reviewed our stresses and test results & draft report with the clearinghouses
- Shared draft of report with certain other authorities
- Staff used position and margin data routinely filed under CFTC rules as of COB 4/29/16
- Clearinghouse guaranty fund amounts as of 3/31/16 (reported at quarter end)
- Verified dates were representative
- Applied as instantaneous shocks but in many instances were calibrated using a liquidation period of more than one day
- **Tests assume all firms with losses that exceed margin do not make additional payments to the clearinghouse**



Did Clearinghouses Meet Required Resilience?

Level of Coverage at Clearinghouses

- 11 scenarios ran across the five clearinghouses and eight guaranty funds
- Some scenarios produced identical effects on a guaranty fund, creating a total of 36 non-duplicative tests
- Clearinghouses achieved at least cover-two in all tests
- Full coverage of defaults achieved in 23 of the 36 tests

Summary of Default Coverage

Cover Ratio	No. of Tests	% of All Tests
At Least Cover 2	36	100%
At Least Cover 3	30	83%
At Least Cover 4	25	69%
Cover All	23	64%
Total	36	100%



Do Clearing Members have Similar Risk Profiles?

Did the same scenarios cause shortfalls at multiple clearing members?

- Clearing Member risk was generally diversified among scenarios

Out of 43 total clearing members accounts (23 house, 20 customer):

- No single scenario accounted for more than 19% of the worst outcomes (8 of 43)
- 10 of the 11 scenarios generated the worst outcome for at least one account

Number of Worst Outcomes for 43 Clearing Member Accounts by Stress Test Scenario

Scenario	No. of Accounts
Scenario A	8
Scenario B	7
Scenario C	7
Scenario D	6
Scenario E	5
Scenario F	3
Scenario G	3
Scenario H	2
Scenario I	1
Scenario J	1
Scenario K	0



Degree of diversification of Clearing Member Risk

- No single clearing member had the largest loss in more than 6 of the 36 tests
- No two firms generated the largest losses at more than one guaranty fund in any scenario



If a Clearing Member incurs a big shortfall at one clearinghouse, did it incur large shortfalls at all the clearinghouses?

Worst Net Shortfall Across All Clearinghouses (shows position for each guaranty fund)
(See Appendix 3 for full account list)

Clearing Member Account	Worst Net Shortfall Across all Clearinghouses	Remainder or Shortfall at Each Individual Guaranty Fund							
		1	2	3	4	5	6	7	8
1	-\$1,724,399,671	(-)		(-)	(+)	(+)			(-)
2	-\$1,296,896,175	(-)	(-)	(-)	(+)	(+)	(+)	(-)	(+)
15	-\$56,350					(-)			
16	\$42,502,136	(-)				(+)		(-)	
25	\$1,664,597,019	(+)	(+)		(+)	(-)	(+)	(-)	
26	\$1,725,577,649	(-)	(+)	(+)	(+)	(+)	(+)	(+)	(+)
41	\$6,402,580,285	(+)		(-)	(+)	(+)		(+)	(-)
42	\$7,627,877,534	(+)			(+)	(+)		(+)	

Conclusions

- Clearinghouses had the financial resources to withstand extreme market price changes across a wide range of products
 - Cover two requirement was met in every test
 - 64% of the tests there was sufficient coverage for a default by every clearing member
- A Clearing Member with the worst loss in a particular scenario at one clearinghouse did not have losses everywhere and in many cases had a net surplus remaining or even a net gain across all clearinghouses
- Clearing member positions were highly diversified across clearinghouses
 - 65% of the accounts did not have a margin shortfall under any scenario
 - No single scenario produced the worst result for more than 8 of the 43 clearing member accounts
 - Identity of the two firms generating the largest losses was diversified across scenarios
 - No two firms generated the largest losses at more than one guaranty fund in any scenario

Limitations

- Only as of one date (April 29, 2016)
- Limited number of scenarios
- Time period – calibrated single day shock
- Not a test of liquidity, investment losses, operational risk etc.

Next Steps

Supervisory Stress Tests will be conducted on a regular basis at the CFTC and the program will be continually enhanced

Potential Enhancements include:

- Extreme market conditions projected over an expanded timeframe
- Test positions and margins from multiple days
- Include yield curve reshaping and futures forward curve shifts
- Incorporate other clearinghouse risks such as liquidity, operational and cybersecurity
- Reverse stress testing
- Expand to include more clearinghouses and clearing members
- Broaden product scope
- Joint supervisory stress test efforts with other domestic and international regulators
- Incorporate recommendations of CPMI-IOSCO working group

Project Team

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QUESTIONS?

Appendix 1: Futures Stress Test Levels

Contract	Stress Up %	Stress Down %	Highest % Return		Lowest % Return	
S&P 500	15	-20	10/21/1987	19.4	10/19/1987	-28.6
Russell 2000	15	-15	10/28/2008	10	12/1/2008	-11.9
S&P 400 Midcap	15	-20	10/13/2008	10.5	12/1/2008	-10.9
MSCI EAFE	10	-10	10/29/2008	8.6	10/10/2008	-8.4
MSCI Emerging Mkts	11	-11	10/30/2008	10.6	10/6/2008	-9.5
MSCI Europe	10	-10	10/13/2008	10.1	10/6/2008	-7.6
Nasdaq 100	20	-20	1/3/2001	18.8	9/29/2008	-10.5
10 YR	2.5	-2.5	3/18/2009	3.6	9/19/2008	-2.4
5 YR	2	-2	3/18/2009	2	9/19/2008	-1.9
Eurodollar	0.4 (price)	-0.4 (price)	10/20/1987	1.16 (price)	3/17/1989	-0.40 (price)
30 year	3	-3	3/18/2009	4.1	9/19/2008	-3
2-year	1.15	-1.15	9/15/2008	0.9	3/1/2002	-1
30-day fed funds	.22 (price)	-.22 (price)	1/22/2008	0.52 (price)	9/19/2008	-0.22 (price)
Natural Gas	25	-25	7/31/2006	14.3	2/5/2001	-15.4
Crude Oil	20	-20	12/31/2008	14.3	1/7/2009	-12.3
Heating Oil	20	-20	9/19/2005	11	11/15/2001	-9
Gasoline	20	-20	7/8/2008	13.9	3/9/2015	-14.9
Brent Oil	15	-15	12/11/2008	11.8	9/24/2001	-13.4
GasOil	15	-15	1/5/2009	11.9	9/24/2001	-13.2
Gold	10	-10	9/17/2008	9	4/15/2013	-9.4
Copper	13	-13	10/29/2008	12.4	10/13/2004	-11.1
Silver	18	-18	3/19/2009	13	9/23/2011	-17.8
Corn	15	-15	9/15/2009	9	4/1/2013	-7.6
Wheat	17	-17	10/29/2008	9.2	1/12/2009	-9.5
Live Cattle	10	-10	6/15/2006	3.8	12/30/2003	-6.2
Soybean	15	-15	10/8/2010	6.6	6/30/2014	-5.8
Soybean Meal	15	-15	10/27/2014	7.6	7/16/2007	-7.5
Soybean Oil	10	-10	2/22/2005	8.4	10/22/2008	-7
Sugar	15	-15	2/23/2016	11	7/26/1988	-16.7
Coffee	20	-20	10/13/1999	23.6	7/20/2000	-12.1
Cotton	12	-12	6/25/2001	12	11/23/2010	-7.2
Cocoa	10	-10	10/5/2009	8	10/18/2002	-9.5
Hogs	10	-10	12/14/1998	7.1	12/15/1998	-6.7
Euro	6	-6	12/3/2015	3.4	12/19/2008	-3
GBP	6	-6	10/29/2008	3.4	1/20/2009	-5
U.S. Dollar	3	-3	12/19/2008	2.3	3/18/2009	-2.7
Yen	6	-6	5/6/2010	5.3	10/28/2008	-3.9
Mexican Peso	10	-10	10/9/2008	7.3	10/13/2008	-6.4
Aussie Dollar	10	-10	10/13/2008	8.6	10/24/2008	-7

Appendix 2: IRS and CDS Stress Test Levels

CDS

Sectors	Widening (%)	Tightening (%)
Asia Pacific Sovereigns	75	-30
Basic Materials	75	-40
CDX	45	-20
CDXEM Sovereigns	60	-45
CDXNAHY	45	-20
CDXNAIG	45	-20
CDXNAIGHVOL	45	-20
Consumer Goods	50	-25
Consumer Services	70	-40
Corporate	65	-40
Emerging Market Sovereigns	100	-40
Energy	70	-30
Financials	120	-60
Healthcare	65	-30
Industrials	75	-40
iTraxx	50	-25
iTraxx Asia IG	50	-25
iTraxx Australia	50	-25
iTraxx Eur	50	-25
iTraxx Eur HiVol	40	-20
iTraxx Eur Xover	30	-15
ITRAXX FINSEN	60	-30
Technology	65	-30
Telecommunications	65	-30
Utilities	75	-50
Western European Sovereigns	75	-30

IRS

Currency	Jurisdiction	Interest Rates (bps)	FX (%)
AUD	Australia	60	10
BRL	Brazil	60	10
CAD	Canada	60	1.5
CHF	Switzerland	30	0
CZK	Czech Republic	30	0
DKK	Denmark	30	0
EUR	Europe	30	6
GBP	Great Britain	30	6
HKD	Hong Kong	60	2.4
HUF	Hungary	30	0
JPY	Japan	15	6
MXN	Mexico	90	10
NOK	Norway	30	0
NZK	New Zealand	60	2.9
PLN	Poland	30	0
SEK	Sweden	30	0
SGD	Singapore	60	2.4
USD	United States	60	0
ZAR	South Africa	60	2.6

Appendix 3: Worst Net Shortfall across All Clearinghouses

Clearing Member Account	Worst Shortfall Across all DCOs (Net)	Remainder or Shortfall at Each Individual Guaranty Fund								
		1	2	3	4	5	6	7	8	
1	-1,724,399,671	(-)		(-)	(+)	(+)			(-)	
2	-1,296,896,175	(-)	(-)	(-)	(+)	(+)	(+)	(-)		(+)
3	-1,195,029,470	(-)	(+)	(-)	(+)	(-)	(+)	(-)		(-)
4	-1,050,726,441	(-)		(-)		(-)		(-)		(+)
5	-805,606,822	(-)		(+)		(-)				(+)
6	-502,241,996	(-)				(+)			(+)	
7	-365,240,667	(+)				(-)			(-)	
8	-341,904,566	(-)							(-)	
9	-322,644,015	(-)	(+)	(-)	(+)	(-)	(+)	(-)		(+)
10	-310,484,500	(-)				(+)		(-)		
11	-292,259,072	(-)		(-)		(-)				
12	-144,683,197	(-)				(-)		(-)		
13	-126,596,254	(-)							(+)	
14	-881,905	(+)				(-)		(-)		
15	-56,350					(-)				
16	42,502,136	(-)				(+)		(-)		
17	86,513,679	(+)								
18	190,393,693	(+)						(-)		
19	319,496,066	(-)		(-)	(+)		(+)			(+)
20	567,079,071									(+)
21	858,779,737									(+)
22	1,378,255,178	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)
23	1,404,095,021	(+)	(-)		(+)			(+)		
24	1,610,515,750	(+)	(+)	(+)	(+)	(-)	(+)	(+)	(+)	(+)
25	1,664,597,019	(+)	(+)		(+)	(-)	(+)	(-)		
26	1,725,577,649	(-)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)
27	1,750,123,798	(-)		(+)		(-)				(+)
28	1,771,180,814	(+)				(+)		(+)		
29	1,810,410,790	(+)		(-)	(+)	(+)		(+)		(-)
30	1,943,276,443	(-)	(+)		(+)	(+)	(+)	(-)		(+)
31	2,517,914,443	(+)			(+)	(+)		(+)		-
32	2,657,061,905	(+)	(+)	(-)	(+)	(-)	(+)	(-)		(+)
33	2,751,769,880	(-)	(+)	(+)	(+)	(+)	(+)	(-)		(+)
34	3,071,510,201	(+)			(+)	(+)		(+)		
35	3,110,156,991	(-)		(+)	(+)		(+)	(-)		(+)
36	3,191,208,097	(+)		(-)	(+)	(+)		(+)		
37	3,522,120,318	(+)		(-)	(+)	(+)				
38	3,632,373,279	(+)		(-)	(+)	(+)		(+)		
39	3,911,904,461	(-)	(+)	(+)	(+)	(-)	(+)	(-)		(+)
40	4,919,045,537	(+)		(-)	(+)	(+)		(+)		
41	6,402,580,285	(+)		(-)	(+)	(+)		(+)		(-)
42	7,627,877,534	(+)			(+)	(+)		(+)		
43	12,245,020,985	(+)			(+)	(+)		(+)		

Appendix 4: Herfindahl-Hirschman Index

The Herfindahl-Hirschman Index (“HHI”) was used to measure the concentration of risk among clearing members using Initial Margin at each clearinghouse

- HHI is calculated by squaring the market share of each firm competing in the market and then summing the resulting numbers
- The initial margin required at the clearinghouse was combined for all futures and swaps products across both customer and house accounts for all clearing members to calculate each RISK HHI
- The DOJ and the Federal Trade Commission a HHI between 1,500 and 2,500 points to be moderately concentrated and HHI is in excess of 2,500 points to be highly concentrated
- The index levels across clearinghouses ranged from 437 – 1033 indicating a low level of concentration

Concentration of Clearing Members under Clearinghouse Risk HHI

Clearinghouse	Herfindahl-Hirschman Index (HHI)
CME	707
LCH	437
ICC	1033
ICUS	930
ICEU	808
Combined	591

Appendix 5: Increase in Futures and Swaps Margin

