

L'instabilità nei mercati finanziari: il Flash Crash un anno dopo

Durante l'incontro verrà presentata una cronaca degli eventi accaduti durante il Flash Crash del 6 maggio 2010 sul mercato azionario americano ed una rassegna della letteratura scientifica apparsa nei mesi successivi

intervengono

STEFANO MARMI | Scuola Normale Superiore di Pisa

6 maggio 2010: l'effetto farfalla si abbatte sul ping pong del trading ad alta frequenza

FULVIO CORSI | Università della Svizzera Italiana Lugano

Ordini tossici e crisi di liquidità: un punto di vista accademico sul Flash Crash

FABRIZIO LILLO | Scuola Normale Superiore di Pisa

Trading ad alta frequenza ed instabilità sistemica: il punto di vista dei regolatori e dell'industria sul Flash Crash

GIACOMO BORMETTI | Scuola Normale Superiore di Pisa

Modelli quantitativi del panico di mercato

S. Marmi: 6 maggio 2010. L'effetto farfalla e
il ping pong del trading ad alta frequenza

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11 maggio 2011

6 maggio 2010: l'effetto farfalla si abbatte sul ping pong del trading ad alta frequenza

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<http://homepage.sns.it/marmi/>

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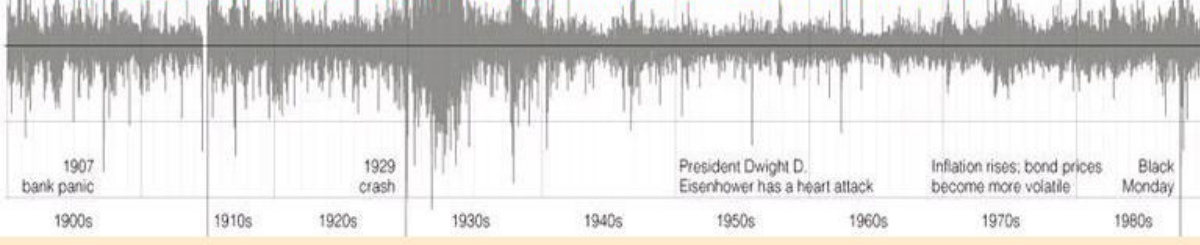
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La cronologia degli eventi del 6 maggio secondo il rapporto SEC/CTFC

- La crisi del debito greco: il DJIA apre in ribasso e prosegue la discesa fino alle 2:42pm (-300 punti)
- Tra le 2:42 e le 2:45 la discesa accelera arrivando a perdere oltre 950 punti. Il rapporto SEC/CTFC indica la causa in un cospicuo ordine di vendita sul mercato dei futures immesso alle 2:32
- Alle 2:45:28 il CME interrompe le contrattazioni per 5 secondi: *The CME has Stop Logic functionality which forces market participants to take a five second pause after a certain degree of price movement. **This pause provided ample time for market participants to consider their positions and return to the market or not depending on the conclusions they reached.** In this way, the limit down functionality imposed a moment of control and pause that stemmed the fall of the futures and allowed market participants to regain confidence. As we observed, liquidity quickly returned to the futures market as traders saw a buying opportunity and placed orders during the pause.* (Instinet Oct 18, 2010 newsletter)
- Il mercato si è poi ripreso recuperando 600 punti in 10 minuti e chiudendo la giornata con un ribasso del 3.2%
- Durante il crash le azioni di otto società appartenenti all'indice S&P500 sono state scambiate al prezzo di un centesimo (p.es ACN). Altre come AAPL e HPQ hanno visto il prezzo esplodere fino a 100000\$

ALFA O BETA?

Strategie quantitative di investimento alla portata di tutti



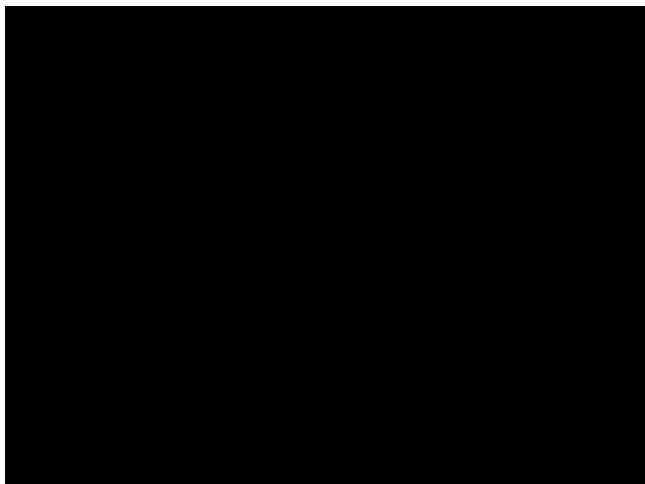
giovedì 6 maggio 2010

Se l'indice più importante del mondo perde l'1% al minuto...

Giovedì 6 maggio 2010, ore 20.45 (ora legale italiana): da 1116,71 a 1065,79 in meno di 5 minuti, cioè **una variazione di oltre -1% al minuto**. Ecco le emozioni che l'indice S&P500 sta regalandoci in questo istante. Eppure **oggi non è il lunedì nero....** comunque vada a finire di questo giovedì sentiremo parlare a lungo.

Pubblicato da Stefano Marmi a 20:55

Etichette: **crash**



Il crash del 19 ottobre 1987 fu un evento oltre 20-25 deviazioni standard

La volatilità tipica sulla scala del minuto è dello 0.05%: il flash crash del 6 maggio 2010 corrisponde a 3 barre consecutive corrispondenti a 20-25 deviazioni standard

PG sample of Trades on May 6th

Time & Sales Ticker: PG Date: May 6, 2010

Time	Bid	Size	Ask	Size	Last	Size	
14:43:00	61.23	7	61.24	3	61.23	2	
14:44:00	60.86	7	60.87	3	60.86	4	
14:45:00	59.60	1	59.73	1	59.61	15	
14:45:18	59.37	1	59.41	144	59.39	1	
14:46:00	57.26	15	57.36	2	57.26	7	
14:46:30	54.62	1	55.51	12	55.00	3	
14:46:35	52.80	2	53.99	3	53.00	10	
14:46:40	50.94	1	52.93	6	51.00	1	
14:46:55	50.00	4	51.00	1	50.00	1	
14:47:00	47.63	3	48.96	2	47.63	3	
14:47:04	46.01	119	49.01	2	46.01	7	
14:47:07	43.51	1	48.71	2	43.90	1	
14:47:10	41.58	1	48.99	7	41.89	1	
14:47:17	39.37	9	49.06	2	39.37	1	Low Print
14:47:21	46.20	6	48.65	6	48.65	2	Bids coming in
14:47:42	52.89	22	52.84	14	56.27	1084	
14:48:08	57.95	7	60.00	2	59.04	1	
14:50:59	62.00	3	62.19	2	62.09	1	Starting to trade normal again

ACN sample of Trades on May 6th

Time & Sales Ticker: ACN Date: May 6, 2010

Time	Bid	Size	Ask	Size	Last	Size
14:45:01	40.19	4	40.21	1	40.31	4
14:46:02	39.89	2	39.90	6	39.73	2
14:46:31	39.66	2	39.40	1	39.68	2
14:47:41	38.00	99	39.04	2	38.00	4
14:47:46	32.62	39	36.59	3	34.61	1
14:47:49	27.70	1	33.24	3	32.12	1
14:47:50	24.02	1	33.24	4	24.09	1
14:47:51	1.88	1	33.24	4	17.74	1
14:47:55	0.01	4	33.23	3	27.00	1
14:48:00	28.34	3	33.24	2	33.24	2
14:48:00	0.01	4	33.49	1	28.34	3
14:48:02	38.88	22	36.69	1	39.00	54
14:48:03	39.01	3	39.02	10	39.01	4

stock starts to trade normally

IWF sample of Trades on May 6th

Ticker: IWF (Russell 1000 Growth Index fund) Date: May 6, 2010

Time & Sales

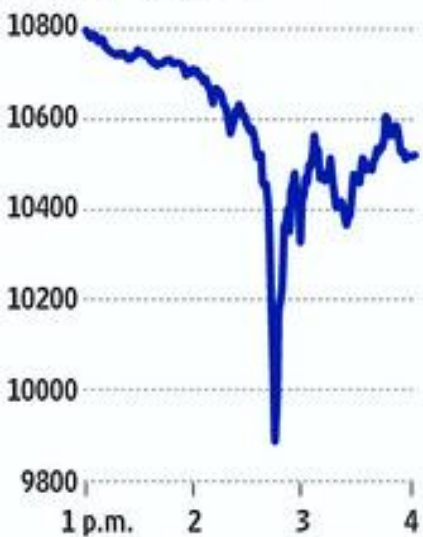
Time	Bid	Size	Ask	Size	Last	Size
14:45:00	48.26	14	48.32	1	48.28	1
14:45:30	47.25	20	47.43	20	47.50	10
14:46:00	41.48	3	44.28	3	42.14	1
14:46:08	35.28	2	42.64	4	36.58	1
14:46:15	27.56	1	34.98	2	27.56	1
14:46:17	18.58	1	32.53	4	21.58	1
14:46:19	0.58	1	20.89	8	3.58	1
14:46:35	0.10	984	18.24	11	0.10	23
14:46:38	19.96	40	18.16	2	19.97	16
14:46:39	0.10	906	19.87	1	14.65	1
14:47:27	0.01	22	0.03	97	0.10	2
14:47:28	0.0001	10	19.97	4	0.0001	1
14:49:57	11.20	12	18.24	19	17.28	1
14:54:44	38.00	2	38.39	5	38.19	5

I flash crash delle materie prime

Flashes of the Past

In the year since the May 6 'flash crash' in stocks, the currency and commodities markets have endured similar events.

DJIA May 6, 2010



Cocoa futures March 1, 2011



Japanese yen March 16, 2011

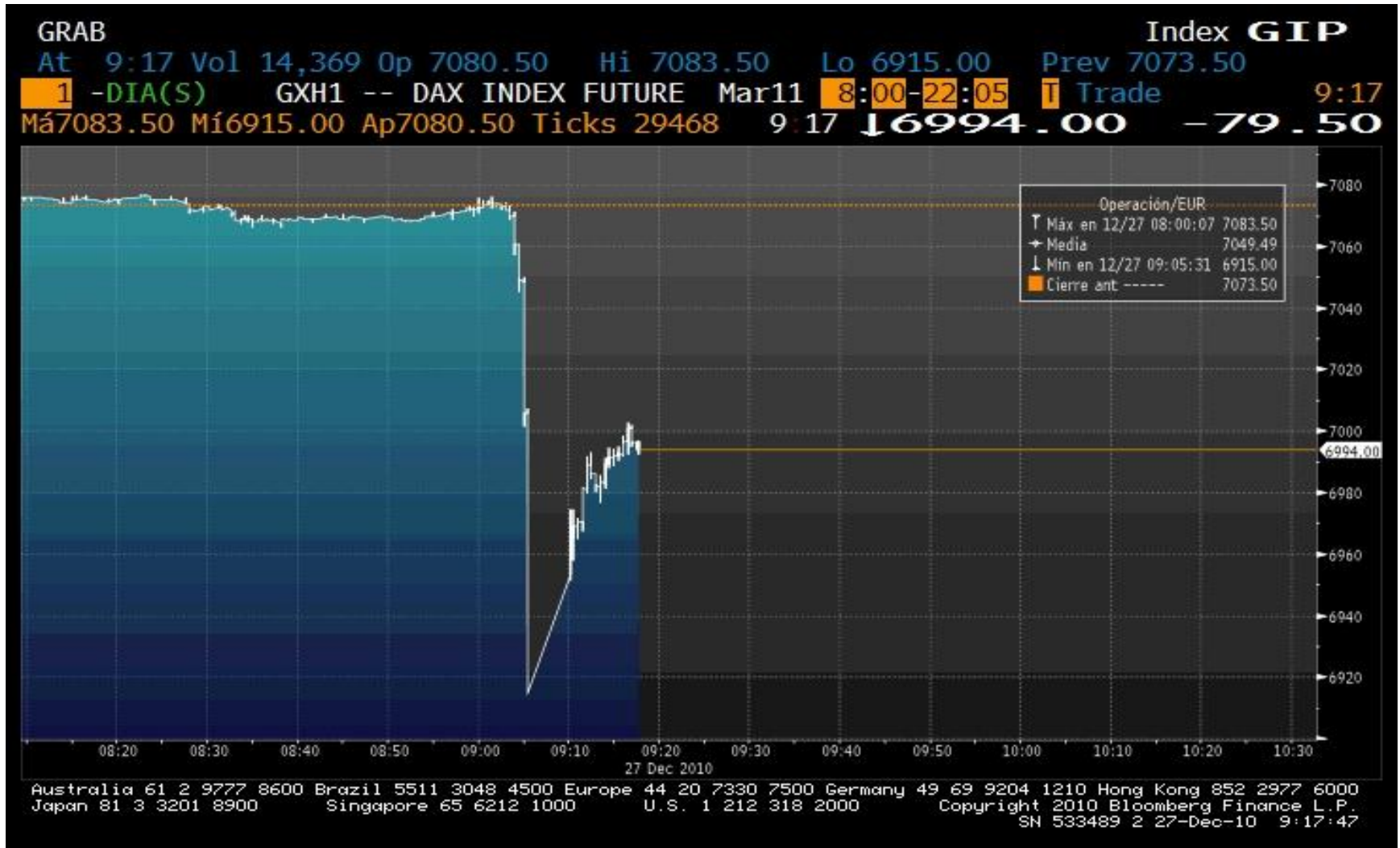


High-frequency trading



Sources: WSJ Market Data Group; Thomson Reuters; Aite Group

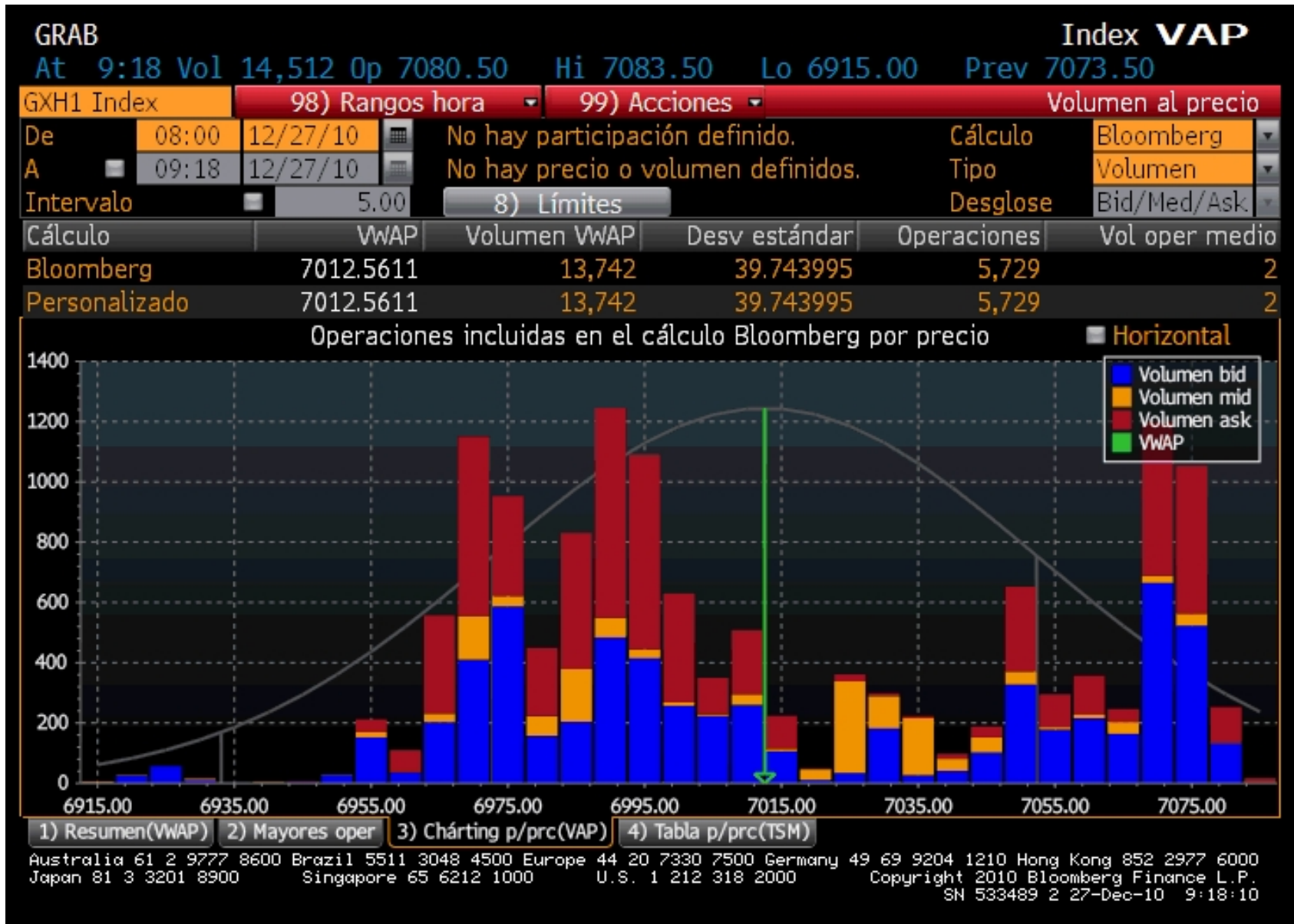
E in Europa? Ecco un mini flash-crash il 27 gennaio 2010 per il DAX future



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Volumi tuttavia pressochè inesistenti



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Un evento isolato?

All listed equities for 2006-2011 searching for potential "mini crashes" in individual stocks.

- **To qualify as a down(up)-draft candidate, the stock had to tick down (up) at least 10 times before ticking up (down)-- all within 1.5 seconds and the price change had to exceed 0.8%.**

(www.nanex.com)

		Down Drafts		Up Drafts		
Year	Count	Download All	Examples	Count	Download All	Examples
2011	69+	Download		70+	Download	
2010	1041	Download	View	777	Download	View
2009	1,462	Download	View	1,253	Download	View
2008	4,065	Download	View	4,354	Download	View
2007	2,576	Download	View	2,456	Download	View
2006	254	Download	View	208	Download	View

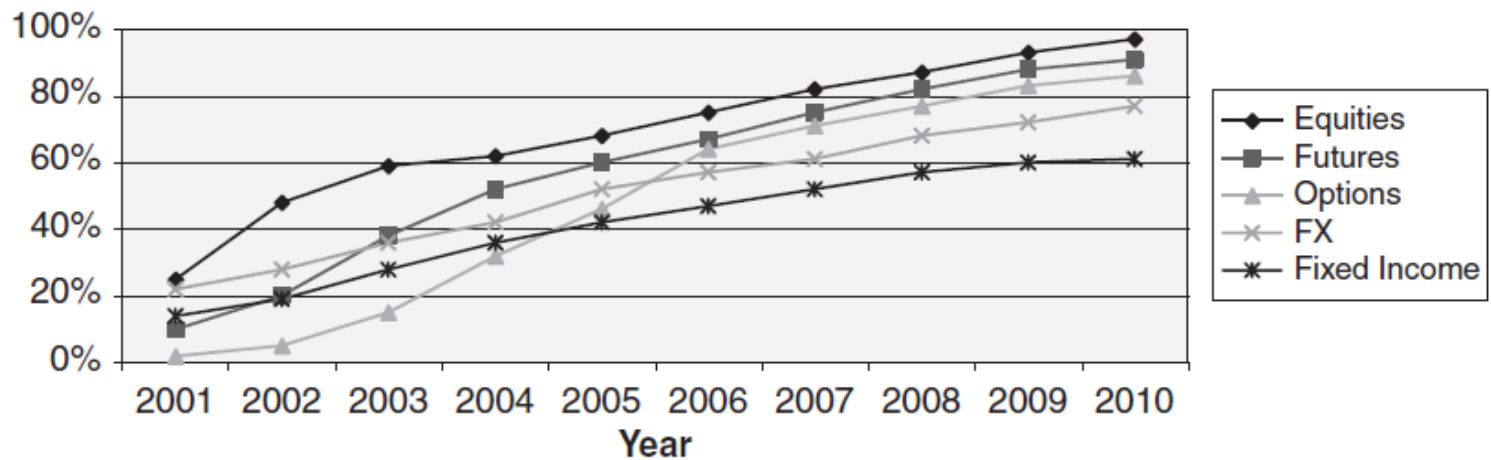


FIGURE 2.2 Adoption of electronic trading capabilities by asset class.
Source: Aite Group.

From Irene Aldridge, High Frequency Trading, Wiley 2010

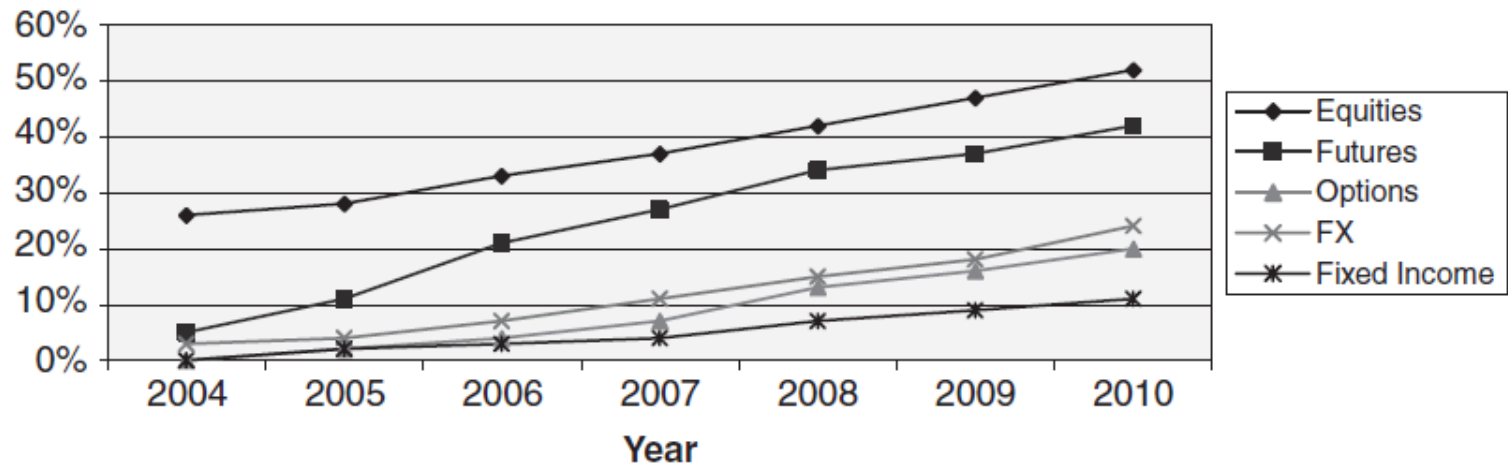
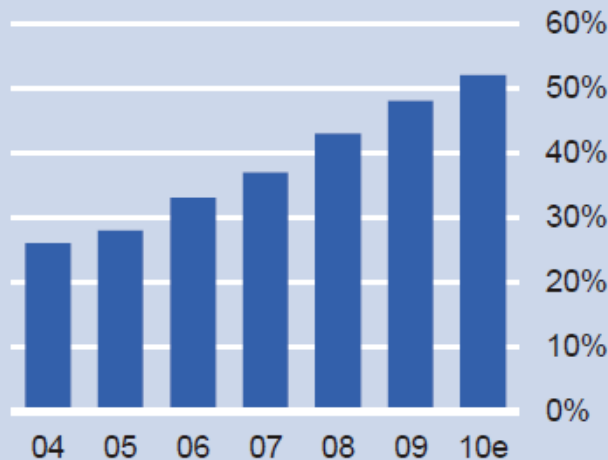


FIGURE 2.7 Adoption of algorithmic execution by asset class.
Source: Aite Group.

Un po' di dati sul trading ad alta frequenza

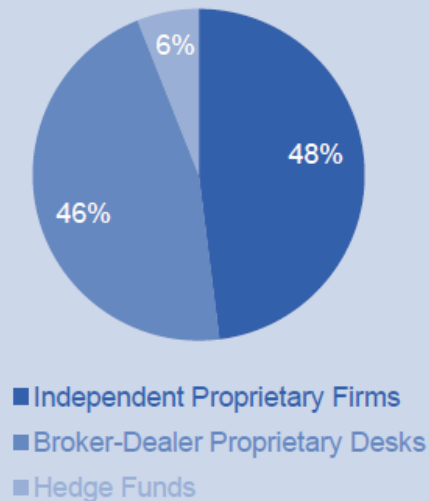
Adoption of algorithmic execution
% of total U.S. equities trading volume



Source: Aite Group, 2010

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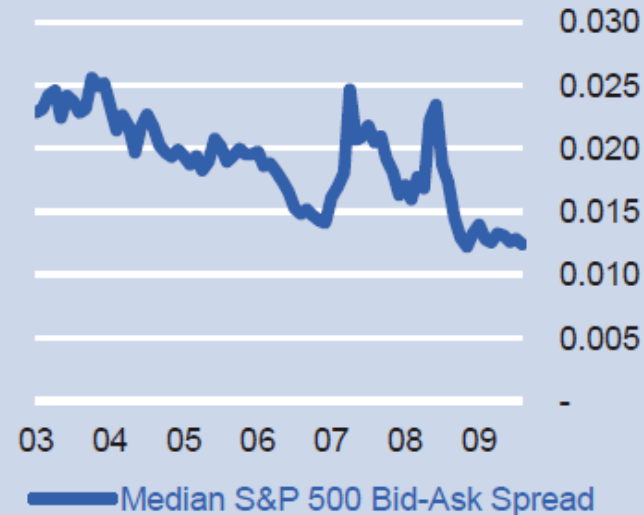
High-frequency trading volumes
U.S. equities



Source: TABB Group, 2010

4

Bid-Ask Spread Reduction
USD



Source: Georgetown University, 2011

5

Deutsche Bank Research report on High Frequency Trading, Feb 7, 2011

Mercati instabili?

- Questo tipo di mini-crolli sta allarmando alcuni specialisti che temono il manifestarsi di una instabilità intrinseca nella dinamica ad alta frequenza dei mercati borsistici:

“It’s like seeing cracks in a dam,” said James J. Angel, professor at the McDonough School of Business at [Georgetown University](#). “One day, I don’t know when, there will be another earthquake.”

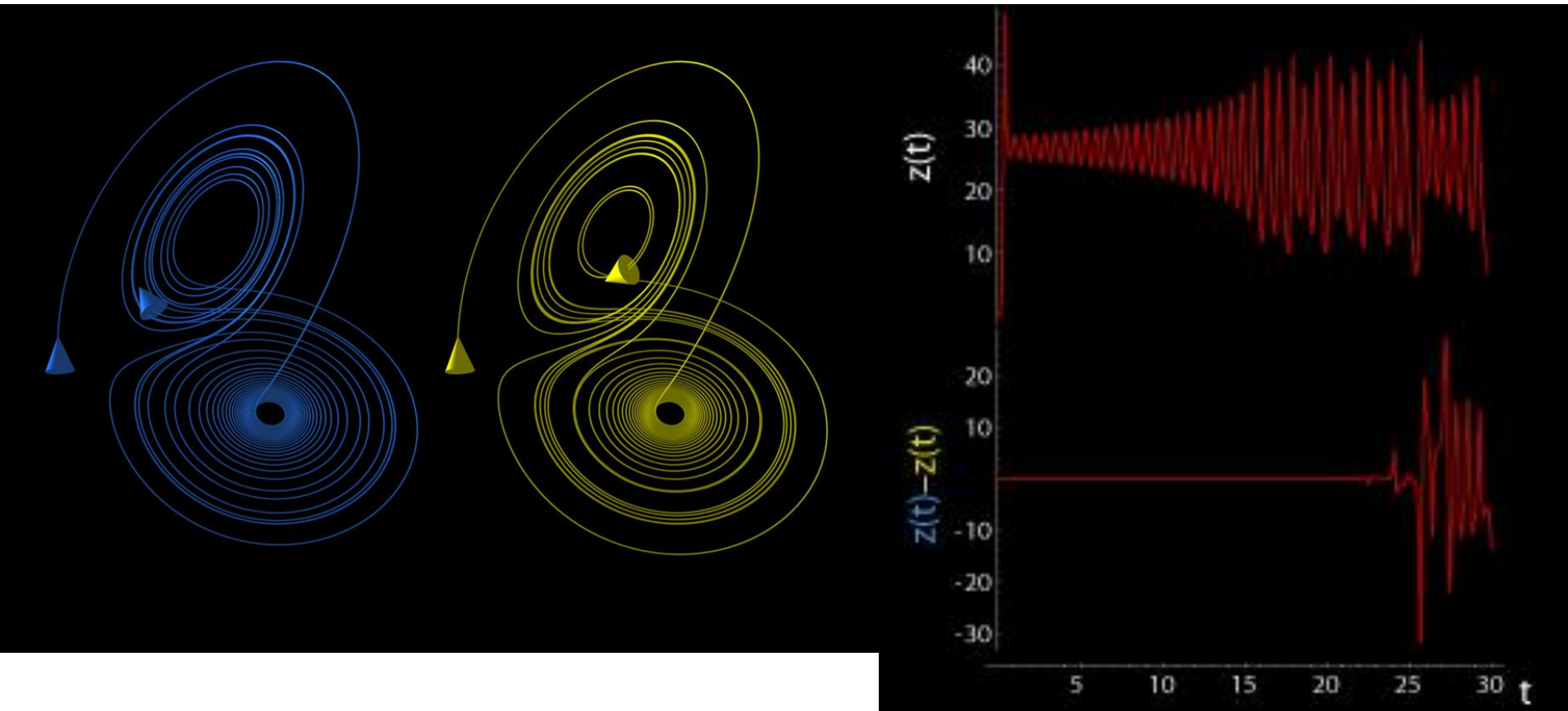
Andrew W. Lo, director of the Laboratory for Financial Engineering at [M.I.T.](#), said: “I am worried about the potential instability that these technologies create in market dynamics. The U.S. equity markets have become the Wild, Wild West.”

- Questo tipo di instabilità richiama alla mente i fenomeni di instabilità che caratterizzano i sistemi deterministici caotici:

Bernard Donefer, a professor at Baruch College in Manhattan, says the stock market has become so complicated that assigning blame for the “flash crash” reminds him of the butterfly effect in chaos theory, where a butterfly flapping its wings leads to a tornado.

“What we have here is somebody doing what’s in the best interest of their firm, and there was a cascade from there because we have such a complex market structure,” says Mr. Donefer. “So do we blame the butterfly?”

La farfalla



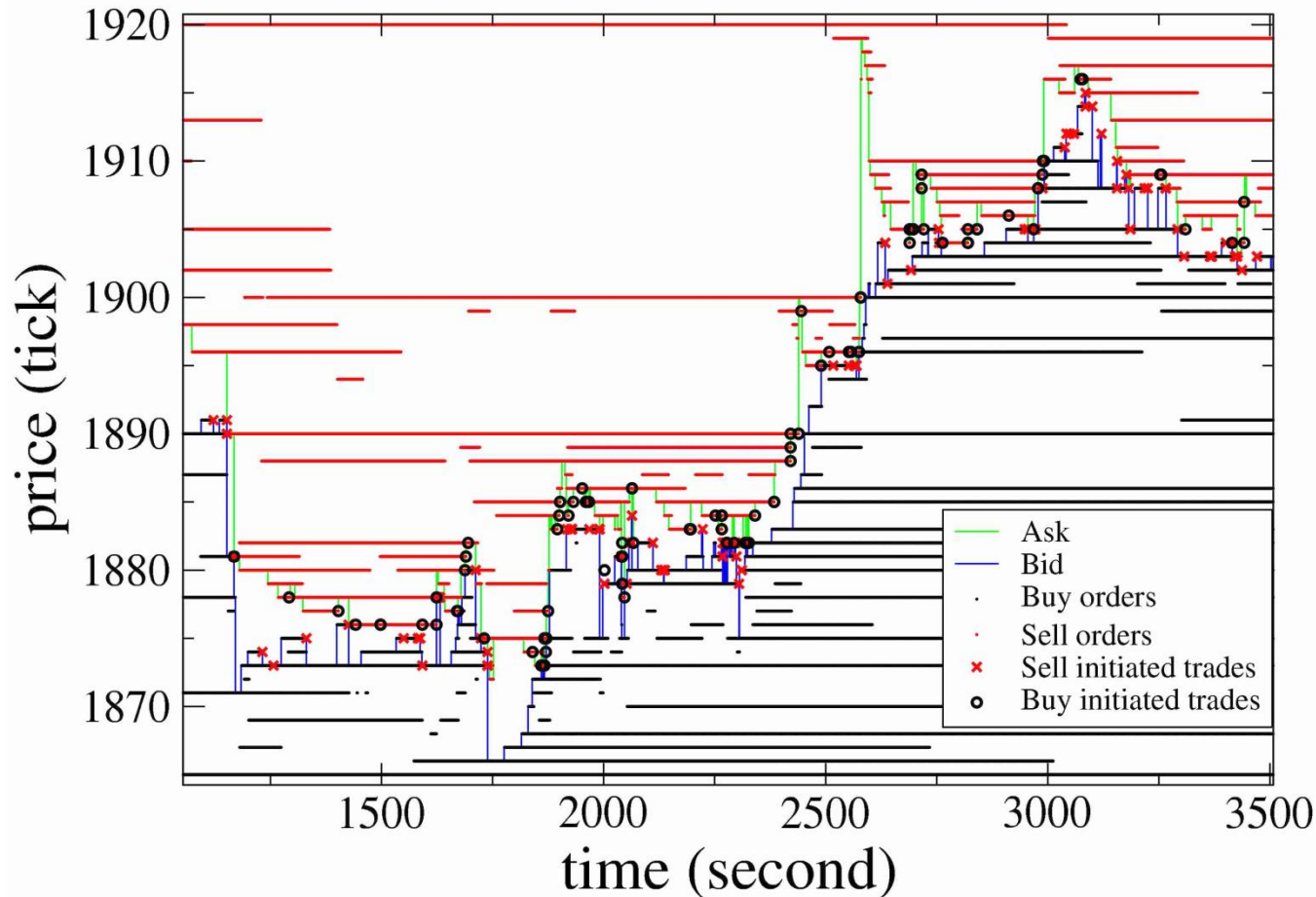
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- <http://en.wikipedia.org/wiki/Image:LorenzCoordinatesBig.png>

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Il ping-pong degli ordini

Representation of limit order book dynamics



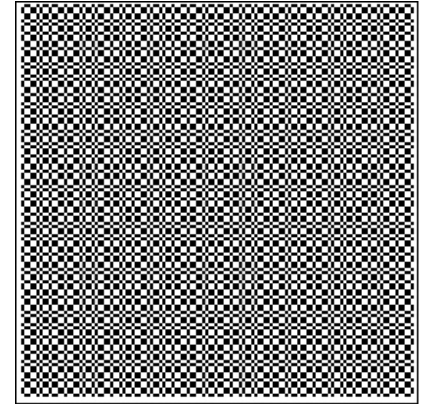
(Ponzi, Lillo, Mantegna 2007)



E se non ci fosse un colpevole?

Randomness vs. pseudorandomness

It may well be that the universe itself is completely **deterministic** (though this depends on what the “true” laws of physics are, and also to some extent on certain ontological assumptions about reality), **in which case randomness is simply a mathematical concept**, modeled using such abstract mathematical objects as probability spaces. Nevertheless, the concept of *pseudorandomness*- objects which “behave” randomly in various statistical senses - still makes sense in a purely deterministic setting. A typical example are the digits of $\pi=3.1415926535897932385\dots$ this is a deterministic sequence of digits, but is widely believed to behave pseudorandomly in various precise senses (e.g. each digit should asymptotically appear 10% of the time). **If a deterministic system exhibits a sufficient amount of pseudorandomness, then random mathematical models (e.g. statistical mechanics) can yield accurate predictions of reality, even if the underlying physics of that reality has no randomness in it. (Terence Tao)**



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