Math Methods – Financial Price Analysis

Mathematics GR5360

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Blackjack or 21

Blackjack or 21

Blackjack or 21: Game Rules*

- *The most popular casino table game*
- *If you are looking to reduce casino edge, avoid the "shoe" games*
- *Blackjack table says "Blackjack pays 3 to 2"*
- *Buy at least 20 times your anticipated average bet worth of chips or 50 times the minimal bet, for example, $1,250 for a $25 table*
- *Place your bet into your circle or box, big chips at the bottom of your bet stack*
- *Basic premise of the game: you want a hand value that is closer to 21 than that of the dealer, without going over 21. The other players at the table are of no concern.*
- *Cards are valued as follows:*
  - *An Ace can count as 1 or 11;*
  - *The cards 2-9 are valued at their face value;*
  - *10, Jack, Queen, and King are all valued at 10;*
  - *Suits have no meaning;*
  - *A hand with an Ace is called "soft".*

* www.blackjackinfo.com

Blackjack or 21: Game Rules

- *Once all the bets are made, the dealer will deal the cards to the players*
- *He will make two passes around the table starting at his left (your right) so that the players and the dealer have two cards each*
- *The dealer will flip one of his cards over, exposing its value*
- *In the hand-held games, the player's cards are dealt face down and the players pick up the cards*
- *Once the cards are dealt, play proceeds around the table, starting at the first seat to the dealer's left*
- *Each player in turn indicates to the dealer how he wishes to play the hand*
- *After each player has finished his hand, the dealer will complete his hand, and then pay or collect the player bets*

Blackjack or 21: Game Rules

- *The dealer must play his hand in a specific way, with no choices allowed. There are two popular rule variations that determine what total the dealer must draw to*
- *"Dealer stands on all 17s". The dealer must continue to take cards ("hit") until his total is 17 or greater. An Ace in dealer's hand is always counted as 11 if the dealer is not going over 21. For example, (Ace,8) would always be 19 and the dealer would stop drawing cards. Also, (Ace,6) is 17 and the dealer will stand. (Ace,5) is only 16, so the dealer would hit until the hand value is 17 or more.*
- *"Dealer hits soft 17". Hands such as (Ace,6), (Ace,5,Ace), and (Ace,2,4) are all examples of soft 17. The dealer hits these hands and stands on soft 18 or higher, or hard 17 or higher.*
- The dealer has no choices to make in the play of his hand. He must simply hit until he reaches at least 17 or busts by going over 21.

Blackjack or 21: Game Rules

- *A blackjack, is a total of 21 in your first two cards*. A blackjack is therefore an Ace and any ten-valued card, with the additional requirement that these are your first two cards.
- If you split two Aces, for example, and then draw a ten-valued card on one of the Aces, this is not a blackjack, but rather a 21.
- The distinction is very important because a winning blackjack pays the player odds of 3 to 2: a bet of $25 wins $37.5 if the player makes a blackjack.
- Blackjack is paid immediately.
- A player's blackjack beats any dealer's total other than blackjack, when there is a push or tie.

Blackjack or 21: Player's Choices

- Surrender. One of the least common decisions, but this decision must be made before any other choice.
- Not every game offers surrender.
- Surrender is folding your hand at the cost of half of the original bet.
- You must make this decision prior to taking any other action.
- In early surrender a player may choose to surrender before the dealer checks his cards for a blackjack.
- The player is offered late surrender after the dealer checked for a blackjack.

Blackjack or 21: Player's Choices

- Hitting/Standing. The most common decision a player must make is whether to draw another card to the hand ("hit"), or stop at the current total ("stand").
- You indicate that you want another card by tapping the table behind your cards with a finger.
- You will be required the hand signals rather just announcing "hit" or "stand" to the dealer. This is to eliminate any confusion or ambiguity in what you choose.
- If you go over 21, or "bust", the dealer will collect your bet, and remove your cards from the table immediately.
- When you decide to stand, just wave your hand in a horizontal motion over your cards.

Blackjack or 21: Player's Choices

- Doubling Down. One of the most profitable player's options. Only can be done with a two-card hand, before another card has been drawn.
- Doubling down allows you to double your bet and receive one, and only one, additional card to the hand.
- For example, when you hold a total of 11, say a (6,5), against a dealer's upcard of 5. In this case, you have a good chance of wining the hand by drawing one additional card, so you might as well increase your bet.
- Note that you give up the ability to draw more than one additional card for being able to double the bet.

Blackjack or 21: Player's Choices

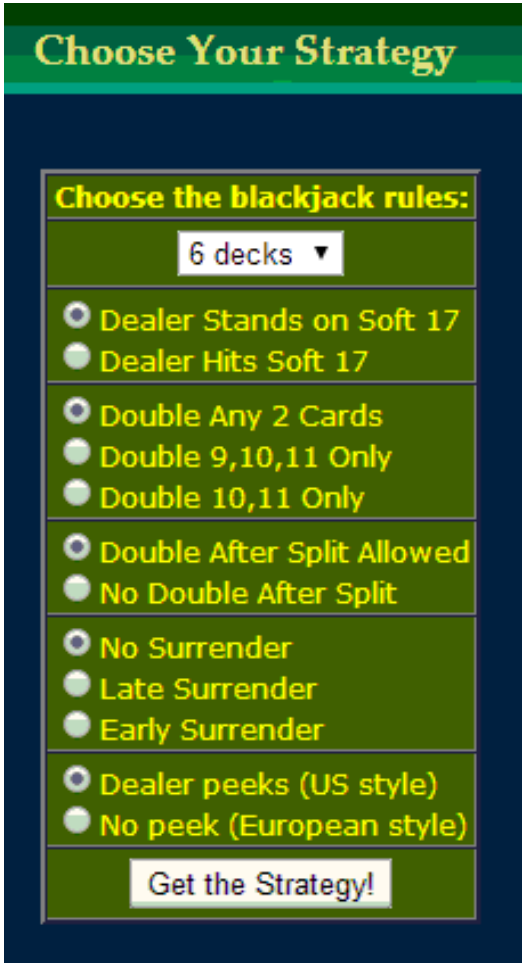
- Splitting Pairs. When you are dealt a matching pair of cards ignoring suits, you can split your hand into two separate hands and play them independently.
- For example, (8,8) is the worst possible player hand, and splitting it can improve your situation.
- Place a matching bet beside the original bet in the circle.
- Sometimes "Double after Split" is allowed.
- Often a player is allowed to split up to 3 times, thus making up to 4 separate hands.
- Any 10-valued cards can be split, such as (Jack, Queen).
- After splitting Aces casino restricts player to draw only one additional card on each Ace.
- Also, if you draw a 10-valued card on your split Ace, the hand is not considered a blackjack, but just a 21.
- Always split the Aces!

Blackjack or 21: Player's Choices

- Insurance and Even Money. If the dealer turns an up card of an Ace, he will offer "insurance" to the players.
- Insurance bet is made up to half of your original bet in the insurance betting stripe.
- The dealer will see if he has a 10-valued card under his Ace, and if he does have a blackjack, your winning insurance will be paid 2:1. You lose your original bet unless you have a blackjack. If the dealer does not have a blackjack, you lose your insurance bet.
- If you have a blackjack, the dealer is likely to offer you "Even Money". This is totally equivalent to an insurance bet.

Blackjack or 21: Optimal Strategy

- Basic Strategy. Foundation of winning in blackjack is to utilize proper basic strategy in playing your hands. “Proper” means that each decision you make on hitting, standing, doubling and splitting pairs is the correct mathematical play for that hand. No second-guessing, intuition or gut-feels. The correct basic strategy for blackjack game depends on the rules of the casino where you are playing. Here is a very typical set-up: 6 decks, S17, DA2, DAS, No Surrender. Without any card counting, a player who uses correct basic strategy can reduce house advantage to less than 0.8% under worst rules and under 0.5% under typical rules.



Blackjack or 21: Basic Strategy

BlackjackInfo.com
Blackjack Basic Strategy Chart

6 decks, S17, DAS, No Surrender, Peek										
Estimated casino edge for these rules: 0.44 %										
	Dealer Upcard									
Your Hand	2	3	4	5	6	7	8	9	10	A
5	H	H	H	H	H	H	H	H	H	H
6	H	H	H	H	H	H	H	H	H	H
7	H	H	H	H	H	H	H	H	H	H
8	H	H	H	H	H	H	H	H	H	H
9	H	D	D	D	D	H	H	H	H	H
10	D	D	D	D	D	D	D	D	H	H
11	D	D	D	D	D	D	D	D	D	H
12	H	H	S	S	S	H	H	H	H	H
13	S	S	S	S	S	H	H	H	H	H
14	S	S	S	S	S	H	H	H	H	H
15	S	S	S	S	S	H	H	H	H	H
16	S	S	S	S	S	H	H	H	H	H
17	S	S	S	S	S	S	S	S	S	S
A,2	H	H	H	D	D	H	H	H	H	H
A,3	H	H	H	D	D	H	H	H	H	H
A,4	H	H	D	D	D	H	H	H	H	H
A,5	H	H	D	D	D	H	H	H	H	H
A,6	H	D	D	D	D	H	H	H	H	H
A,7	S	DS	DS	DS	DS	S	S	H	H	H
A,8	S	S	S	S	S	S	S	S	S	S
A,9	S	S	S	S	S	S	S	S	S	S
2,2	P	P	P	P	P	P	H	H	H	H
3,3	P	P	P	P	P	P	H	H	H	H
4,4	H	H	H	P	P	H	H	H	H	H
5,5	D	D	D	D	D	D	D	D	H	H
6,6	P	P	P	P	P	H	H	H	H	H
7,7	P	P	P	P	P	P	H	H	H	H
8,8	P	P	P	P	P	P	P	P	P	P
9,9	P	P	P	P	P	S	P	P	S	S
T,T	S	S	S	S	S	S	S	S	S	S
A,A	P	P	P	P	P	P	P	P	P	P
Dlr	2	3	4	5	6	7	8	9	10	A

Key:

H = Hit S = Stand P = Split
D = Double (Hit if not allowed)
DS = Double (Stand if not allowed)

Blackjack or 21: Optimal Strategy

- Card Counting. Blackjack is beatable! Since multiple hands are dealt to players between shuffles, a smart player can use information about cards that have already been dealt to predict something about the cards to come.
- Unlike other casino games like roulette and craps where the previous spins or rolls have no impact on future decisions, each hand in blackjack depletes the remaining deck of the cards that were used. Card counting can provide the player a mathematical advantage over casino.
- Card counting is not just for math geniuses despite misleading media portrayals ("*Rain Man*", "*21*"). Most players who are willing to put some time and effort can beat the casino in the game of blackjack.

Blackjack or 21: Optimal Strategy

- Multi-deck games are beaten primarily by a large betting spread. You bet small when house has the edge and you bet much bigger when you have the edge.
- High/Low count system. Cards 2,3,4,5,6 =+1, cards 7,8,9=0, and cards 10,J,Q,K,A=-1. In a complete deck there are equal number of +1 and -1 counts, such count is "balanced".
- Running Count divided by the number of remaining decks is the True Count (TC).
- Betting with the True Count: optimal bet size is equal to 76% of the player's advantage. We will shortly derive this Kelly Criterion.
- Example: for a $3,000 bankroll and TC=2, optimal bet size is 0.0038*$3,000=$11.40.

True Count	Advantage	% Optimum Bet
-1 or lower	-1%	0%
0	-0.5%	0%
1	0%	0%
2	0.5%*76%	0.38%
3	1.0%*76%	0.76%
4	1.5%*76%	1.14%
5	2.0%*76%	1.52%
6	2.5%*76%	1.90%
7	3.0%*76%	2.28%

Kelly Criterion

J. L. Kelly, "A New Interpretation of Information Rate",
The Bell System Technical Journal, July 1956

N tampered coin flips : H - number of "heads", T - number of "tails"

$H+T=N$, for $N\to+\infty$ such that

$\frac{H}{N}\to p, \frac{T}{N}\to q=1-p$. No "standing on the edge" outcomes.

$p=\frac{1}{2}+\varepsilon, \varepsilon>0$ - "heads" outcome is slightly more probable than "tails".

I. Betting it all

V_0 - initial amount of money

1. $2\cdot V_0$ win;
2. $2^2\cdot V_0$ win;
3. $2^3\cdot V_0$ win;
4. 0 loss.

Exponential growth followed by ruin ("gambler's ruin").

Kelly Criterion

II. Fractional Betting

Bet $l \cdot V_0$ only

$$\text{cash balance: win} -l \cdot V_0 + V_0 + 2 \cdot l \cdot V_0 = V_0 \cdot (1+l)$$
$$\text{loss} -l \cdot V_0 + V_0 = V_0 \cdot (1-l).$$

After N tosses:

$$\begin{cases} V_N = V_0 \cdot (1+l)^W \cdot (1-l)^L \\ W + L = N. \end{cases}$$

For $N \to +\infty$ the process becomes:

$$\begin{cases} \dfrac{V_N}{V_0} = (1+l)^{pN} \cdot (1-l)^{qN} \\ p + q = 1 \end{cases}.$$

Notice that only $G(l) = \dfrac{1}{N} \cdot \log \dfrac{V_N}{V_0}$ is independent of N.

Maximization problem: $G(l) = p \cdot \log(1+l) + q \cdot \log(1-l) \to \max$

subject to: $p + q = 1$ has a solution: $l^* = \dfrac{p-q}{p+q} = 2p - 1 = 2\varepsilon.$

Example: for a 2% - edge coin, bet 4% of your equity.

St. Petersburg Paradox

A fair coin is tossed by a casino for a single player.

The winning pot starts at $2 and is doubled every time a "head" comes up.

The first time "tail" comes up, the game ends with the player winning the pot.

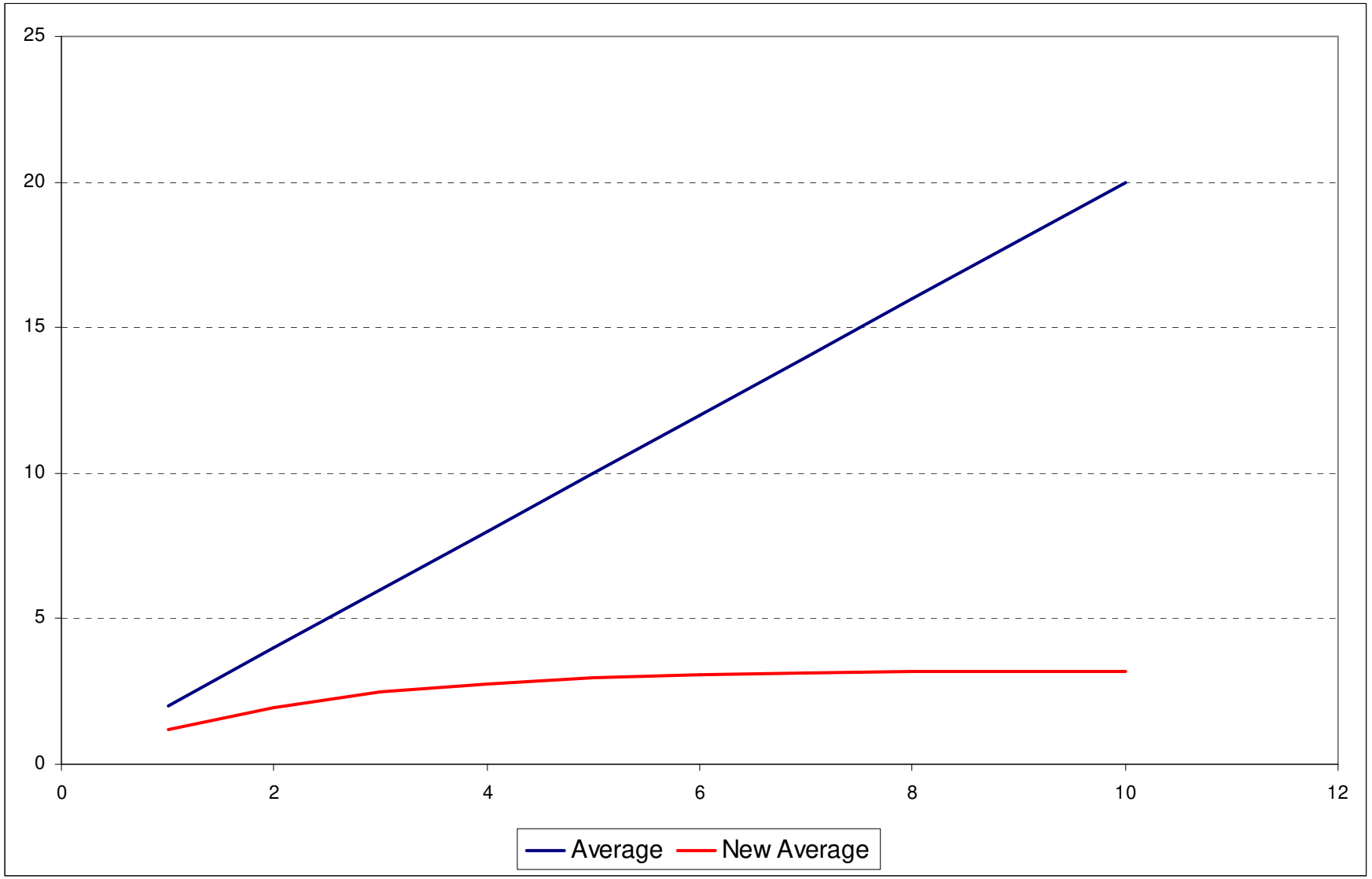
What would be a fair price for a player to pay the casino to play such a game?

Count	Payout	Probability	Weighted Payout	Average
1	4	0.500000000000000000000000	2	2
2	8	0.250000000000000000000000	2	4
3	16	0.125000000000000000000000	2	6
4	32	0.062500000000000000000000	2	8
5	64	0.031250000000000000000000	2	10
6	128	0.015625000000000000000000	2	12
7	256	0.007812500000000000000000	2	14
8	512	0.003906250000000000000000	2	16
9	1,024	0.001953125000000000000000	2	18
10	2,048	0.000976562500000000000000	2	20

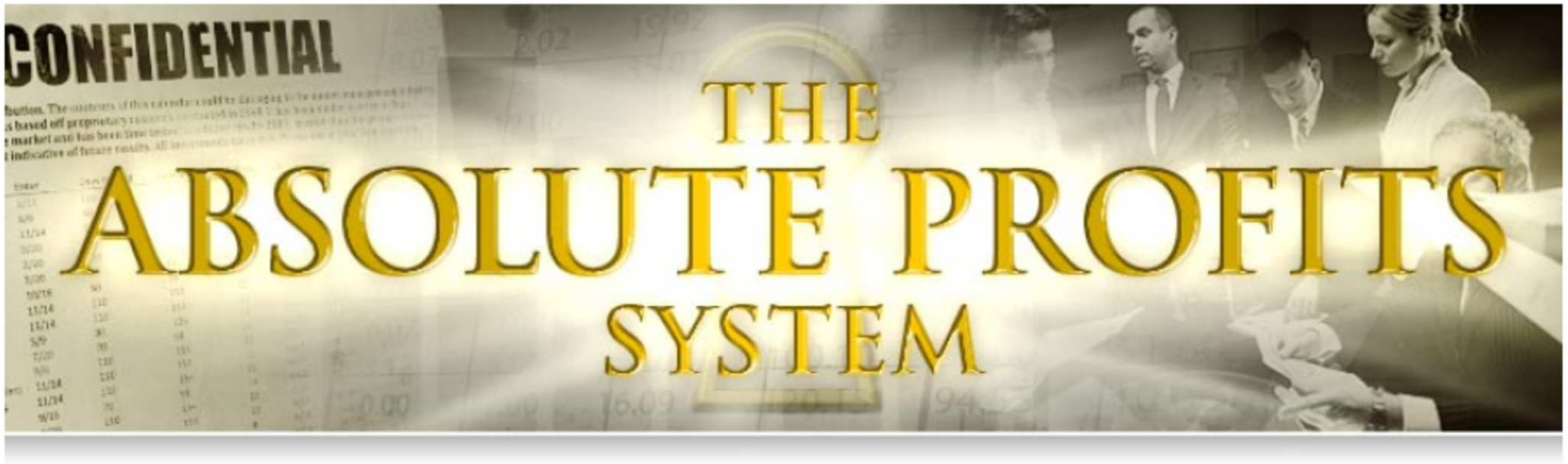
St. Petersburg Paradox

Count	Payout	Probability	Weighted Payout	Average	"Value" of Money	Re-weighted Payout	New Average
1	4	0.50000000000000000000000	2	2	2.3219	1.1610	1.1610
2	8	0.25000000000000000000000	2	4	3.1699	0.7925	1.9534
3	16	0.12500000000000000000000	2	6	4.0875	0.5109	2.4644
4	32	0.06250000000000000000000	2	8	5.0444	0.3153	2.7797
5	64	0.03125000000000000000000	2	10	6.0224	0.1882	2.9679
6	128	0.01562500000000000000000	2	12	7.0112	0.1096	3.0774
7	256	0.00781250000000000000000	2	14	8.0056	0.0625	3.1399
8	512	0.00390625000000000000000	2	16	9.0028	0.0352	3.1751
9	1,024	0.00195312500000000000000	2	18	10.0014	0.0195	3.1946
10	2,048	0.00097656250000000000000	2	20	11.0007	0.0107	3.2054
11	4,096	0.00048828125000000000000	2	22	12.0004	0.0059	3.2112
12	8,192	0.00024414062500000000000	2	24	13.0002	0.0032	3.2144
13	16,384	0.00012207031250000000000	2	26	14.0001	0.0017	3.2161
14	32,768	0.00006103515625000000000	2	28	15.0000	0.0009	3.2170
15	65,536	0.00003051757812500000000	2	30	16.0000	0.0005	3.2175
16	131,072	0.00001525878906250000000	2	32	17.0000	0.0003	3.2178
17	262,144	0.00000762939453125000000	2	34	18.0000	0.0001	3.2179
18	524,288	0.00000381469726562500000	2	36	19.0000	0.0001	3.2180
19	1,048,576	0.00000190734863281250000	2	38	20.0000	0.0000	3.2180
20	2,097,152	0.00000095367431640625000	2	40	21.0000	0.0000	3.2181
21	4,194,304	0.00000047683715820312500	2	42	22.0000	0.0000	3.2181
22	8,388,608	0.00000023841857910156200	2	44	23.0000	0.0000	3.2181
23	16,777,216	0.00000011920928955078100	2	46	24.0000	0.0000	3.2181
24	33,554,432	0.00000005960464477539060	2	48	25.0000	0.0000	3.2181
25	67,108,864	0.00000002980232238769530	2	50	26.0000	0.0000	3.2181
26	134,217,728	0.00000001490116119384770	2	52	27.0000	0.0000	3.2181
27	268,435,456	0.00000000745058059692383	2	54	28.0000	0.0000	3.2181
28	536,870,912	0.00000000372529029846191	2	56	29.0000	0.0000	3.2181
29	1,073,741,824	0.00000000186264514923096	2	58	30.0000	0.0000	3.2181
30	2,147,483,648	0.00000000093132257461548	2	60	31.0000	0.0000	3.2181

St. Petersburg Paradox



Abundant Investment "Advice" in Public Media



These 38 "Prime Season Dates" Could Turn Every $1,000 You Have Into $49,000

Abundant Investment “Advice” in Public Media

Long-Term Trend-Followers

Trend-Following CTAs and Indices

#	Tag Name	Full Name
1	Abraham	Abraham Diversified Program
2	Campbell	Campbell Managed Futures
3	Chesapeake	Chesapeake Diversified Program
4	Eckhardt	Eckhardt Standard Program
5	Dunn	Dunn World Monetary and Agriculture Program
6	Hyman	Hyman Beck & Company Global Portfolio
7	Walsh	Mark J. Walsh & Company Standard Program
8	Millburn	Millburn Diversified Program
9	Rabar	Rabar Diversified Program
10	TF Index	Equal-Weighted Index of the 9 TF CTAs
11	BARCCTA	Barclay CTA Index
12	BARCCTA1	Barclay CTA Index Adjusted in Risk to TF Index

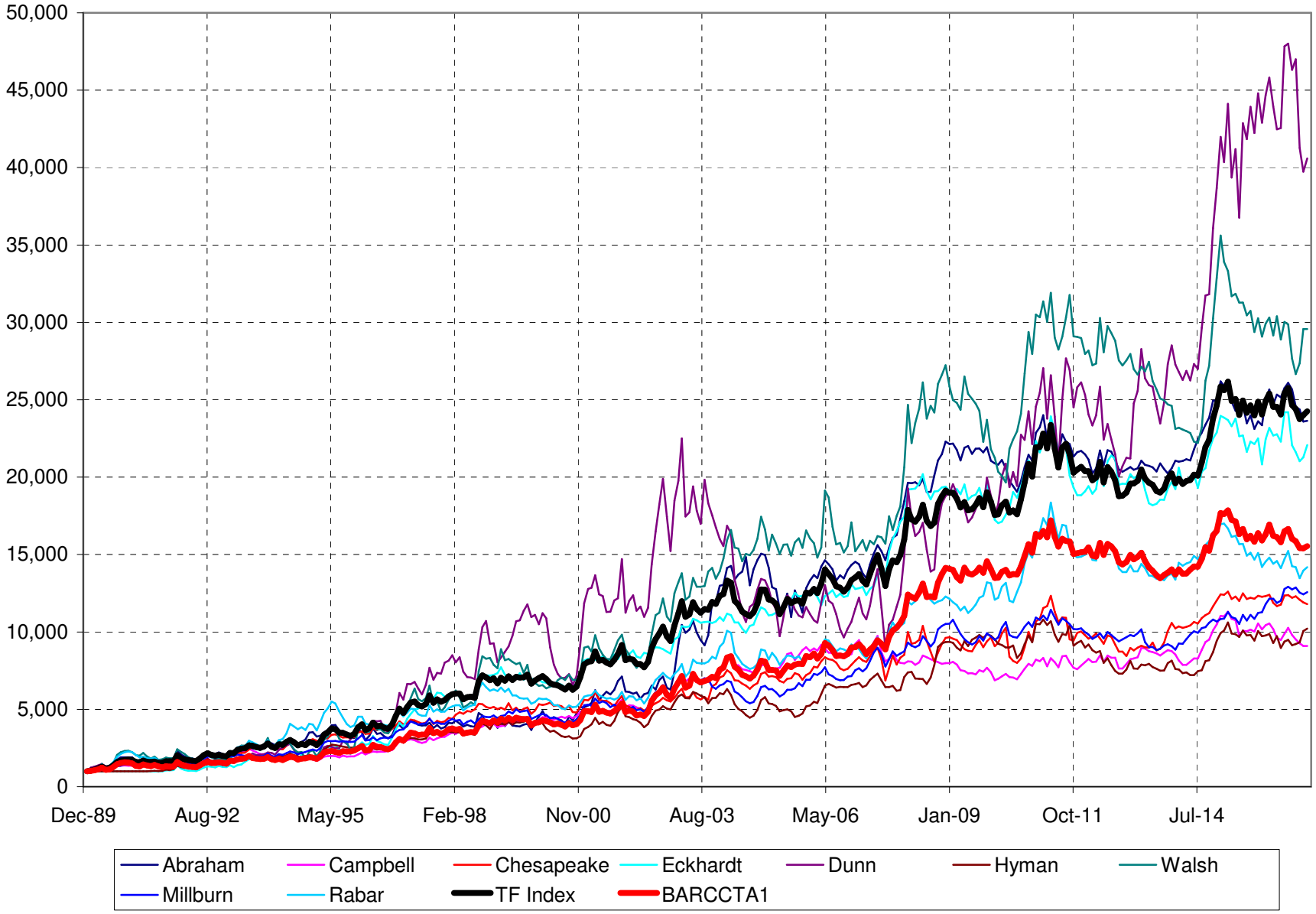
Long-Term Trend-Followers

Monthly Returns and Statistics:

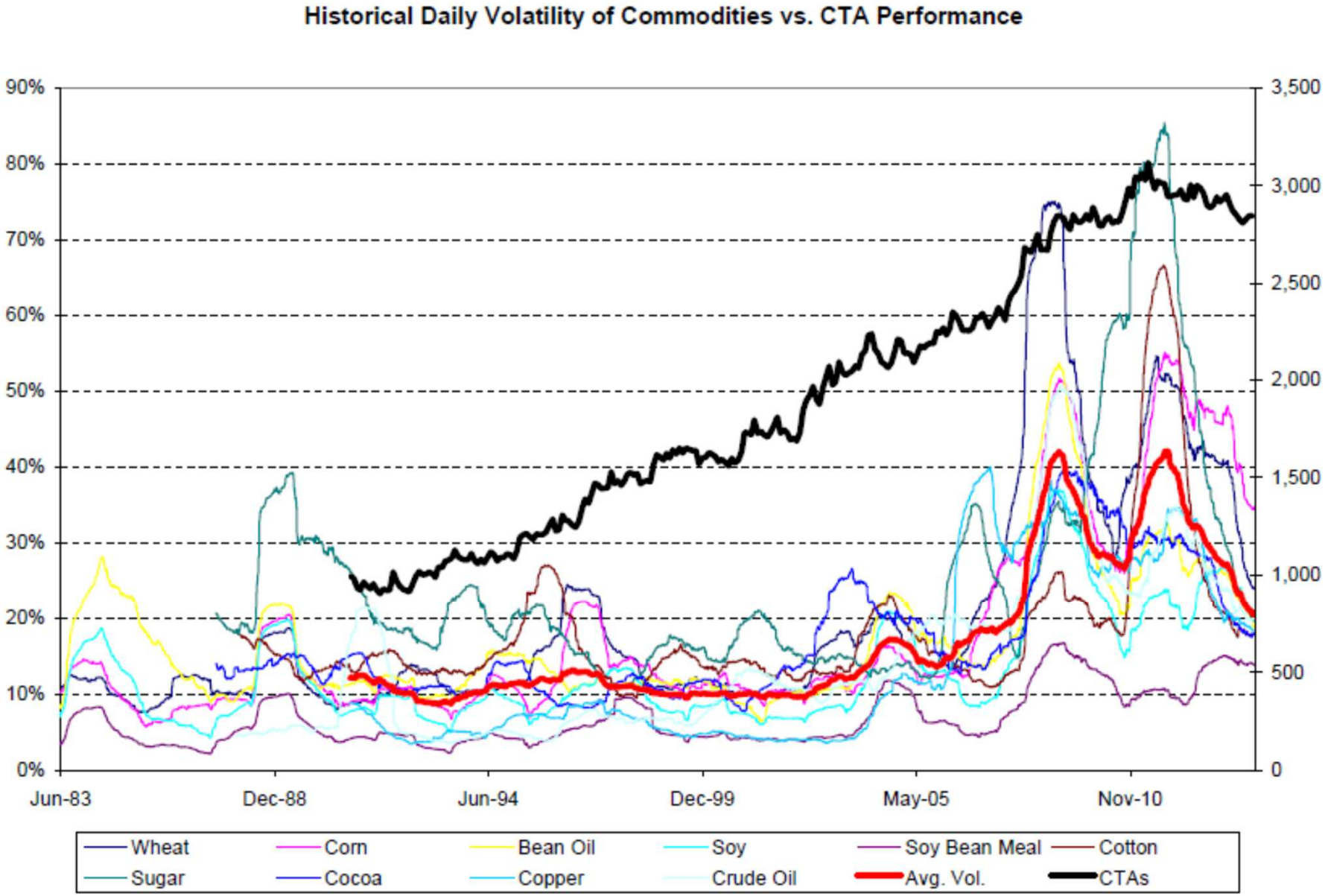
	1	2	3	4	5	6	7	8	9	10	11	12
Month	**Abraham**	**Campbell**	**Chesapeake**	**Eckhardt**	**Dunn**	**Hyman**	**Walsh**	**Millburn**	**Rabar**	**TF Index**	**BARCCTA**	**BARCCTA1**
Jan-90	3.65%	3.00%	0.49%		23.45%		-1.40%	3.72%	1.89%	4.97%	1.54%	3.49%
Feb-90	1.81%	0.59%	3.37%		5.35%		6.10%	3.88%	7.76%	4.12%	0.79%	1.79%
Mar-90	9.45%	3.37%	8.62%		6.11%		13.90%	3.06%	12.16%	8.10%	3.02%	6.84%
Apr-90	12.90%	4.62%	4.37%		6.80%		23.40%	2.41%	16.71%	10.17%	4.54%	10.28%
May-90	-7.90%	-11.50%	-4.61%		-11.23%		-20.60%	-5.21%	-13.61%	-10.67%	-5.49%	-12.43%
Jun-90	2.49%	8.29%	1.77%		3.99%		3.80%	3.46%	9.50%	4.76%	1.23%	2.79%
Jul-90	20.08%	10.04%	6.25%		1.37%		23.90%	14.78%	16.06%	13.21%	5.62%	12.73%
Aug-90	18.54%	12.30%	15.15%		2.07%		36.80%	3.31%	21.80%	15.71%	6.69%	15.15%
Sep-90	8.57%	2.59%	0.60%		3.76%		8.80%	2.58%	10.40%	5.33%	2.78%	6.30%
Oct-90	-0.36%	1.25%	1.86%		-0.40%		3.20%	7.01%	4.87%	2.49%	1.15%	2.60%
Nov-90	0.31%	-1.35%	-0.25%		5.44%		1.00%	2.89%	2.51%	1.51%	-0.47%	-1.06%
Dec-90	-0.09%	-0.54%	0.11%		-1.19%		-4.30%	0.51%	-2.45%	-1.14%	-1.57%	-3.56%
Jan-91	-15.94%	-7.89%	-1.29%		-7.05%		-8.60%	-5.62%	-7.43%	-7.69%	-4.90%	-11.10%
Feb-91	1.30%	-1.59%	4.84%		-4.51%		-1.50%	1.70%	-7.75%	-1.07%	-0.83%	-1.88%
Mar-91	2.43%	20.41%	2.32%		10.30%		8.60%	3.05%	2.26%	7.05%	4.28%	9.69%
Apr-91	-13.70%	-1.87%	-2.80%		-4.49%	-0.29%	-10.00%	0.16%	-5.58%	-4.82%	-1.89%	-4.28%
May-91	2.94%	2.81%	0.27%		-4.99%	1.80%	-7.40%	-0.80%	-1.17%	-0.82%	-1.61%	-3.65%
Jun-91	2.11%	1.49%	-1.25%		-0.46%	1.29%	6.90%	1.98%	3.32%	1.92%	2.66%	6.02%
Jul-91	-1.52%	-7.96%	-1.75%		-2.54%	-0.86%	-10.30%	-3.84%	-8.12%	-4.61%	-3.36%	-7.61%
Aug-91	-6.33%	3.79%	-3.32%	-1.00%	9.93%	1.52%	2.10%	-5.97%	-2.93%	-0.25%	-1.92%	-4.35%
...	...	...	...	...	...	...	...	...	...	...	...	...
Apr-16	2.56%	-5.54%	-1.76%	0.31%	-3.38%	4.74%	4.20%	-2.16%	1.16%	0.01%	-0.21%	-0.48%
May-16	-0.71%	-1.38%	0.85%	-2.06%	0.16%	-7.79%	-4.90%	1.14%	-3.13%	-1.98%	-0.94%	-2.12%
Jun-16	2.40%	4.17%	4.98%	8.53%	12.42%	4.63%	3.90%	6.33%	4.10%	5.72%	2.02%	4.58%
Jul-16	1.29%	3.96%	0.23%	-0.03%	0.38%	1.14%	-0.50%	1.11%	3.63%	1.25%	0.35%	0.80%
Aug-16	-1.61%	-4.50%	-1.34%	-8.80%	-3.54%	-3.72%	-7.40%	-1.29%	-6.49%	-4.30%	-1.66%	-3.76%
Sep-16	-4.32%	-2.94%	0.73%	-2.04%	1.46%	0.97%	-3.60%	1.04%	-0.42%	-1.01%	-0.46%	-1.04%
Oct-16	-0.80%	-2.62%	-1.77%	-2.71%	-12.18%	1.19%	2.60%	-2.69%	-5.05%	-2.67%	-1.24%	-2.80%
Nov-16	-3.15%	-1.83%	-1.45%	1.27%	-3.72%	7.77%	8.10%	-0.88%	3.67%	1.09%	-0.03%	-0.07%
Dec-16	0.21%	0.00%	-0.97%	3.69%	2.17%	1.50%	0.00%	1.20%	1.63%	1.05%	0.40%	0.91%
Avg. RoR:	**14.33%**	**9.39%**	**10.62%**	**14.04%**	**18.92%**	**10.70%**	**17.16%**	**10.51%**	**11.82%**	**13.34%**	**5.16%**	**11.69%**
StdDev:	**23.13%**	**15.54%**	**17.07%**	**19.35%**	**32.51%**	**18.41%**	**31.15%**	**14.98%**	**20.12%**	**17.45%**	**7.70%**	**17.45%**
Sharpe Ratio:	**0.62**	**0.60**	**0.62**	**0.73**	**0.58**	**0.58**	**0.55**	**0.70**	**0.59**	**0.76**	**0.67**	**0.67**
Worst DD:	**27.18%**	**31.77%**	**31.58%**	**27.11%**	**60.22%**	**33.28%**	**43.04%**	**22.94%**	**29.82%**	**19.67%**	**10.10%**	**21.81%**
Avg. DD:	**7.67%**	**9.13%**	**7.22%**	**6.08%**	**16.21%**	**8.72%**	**12.14%**	**6.05%**	**11.98%**	**6.05%**	**2.87%**	**6.57%**

Adj. Coeff.: **2.26**

Long-Term Trend-Followers



Influence of Volatility on CTA Performance



Systematic Short-Term Traders

Some Short-Term Systematic CTA Programs

#	Tag Name	Full Name
1	SAFF	Systematic Alpha Futures Program
2	FORT	FORT Global Contrarian Program
3	Paskewitz	Contrarian S&P 500 Stock Index Program
4	QIM	Quantitative Global Program
5	Quantmetrics	Quantmetrics Premier
6	Winton	Winton Futures Program

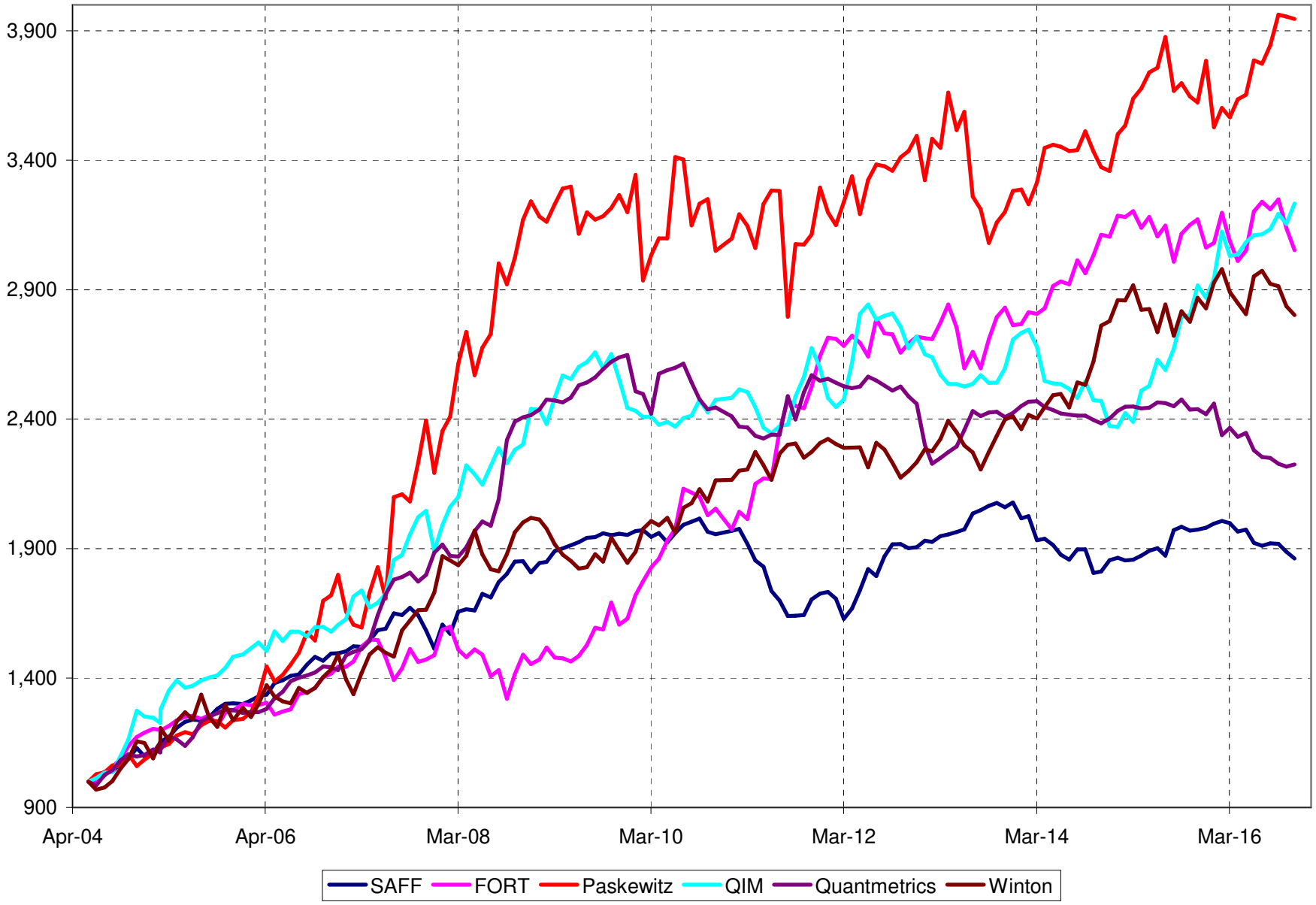
Systematic Short-Term Traders

Monthly Returns and Statistics

Month	SAFF	FORT	Paskewitz	QIM	Quantmetrics	Winton
Jun-04	1.10%	-0.30%	2.82%	1.44%	-1.51%	-3.12%
Jul-04	2.67%	2.67%	0.76%	2.07%	4.13%	0.88%
Aug-04	0.10%	3.39%	2.63%	0.10%	1.79%	2.64%
Sep-04	3.18%	2.72%	-0.53%	6.05%	3.75%	4.78%
Oct-04	1.49%	4.58%	4.54%	5.75%	2.00%	3.37%
Nov-04	3.86%	3.12%	-4.09%	9.58%	-0.67%	6.38%
Dec-04	-2.83%	1.45%	2.34%	-1.69%	0.53%	-0.58%
Jan-05	1.09%	1.25%	2.19%	-0.40%	1.92%	-5.16%
Feb-05	3.69%	-0.44%	3.32%	-1.65%	-0.98%	5.72%
Mar-05	0.26%	-0.16%	-1.23%	4.26%	1.00%	4.70%
Apr-05	1.65%	1.52%	1.24%	5.77%	4.44%	-4.03%
...	...	...	...	...	...	...
Jan-16	0.80%	0.59%	-6.79%	2.59%	1.68%	3.51%
Feb-16	0.53%	3.78%	2.13%	6.16%	-4.96%	1.76%
Mar-16	-0.40%	-3.39%	-1.00%	-2.98%	1.19%	-2.92%
Apr-16	-1.63%	-2.53%	1.92%	0.15%	-1.45%	-1.49%
May-16	0.37%	1.33%	0.50%	1.59%	0.63%	-1.50%
Jun-16	-2.59%	4.97%	3.64%	0.84%	-2.83%	5.21%
Jul-16	-0.59%	1.15%	-0.36%	0.14%	-1.12%	0.73%
Aug-16	0.47%	-0.87%	1.88%	0.62%	-0.20%	-1.72%
Sep-16	-0.07%	1.19%	3.10%	1.92%	-0.97%	-0.30%
Oct-16	-1.59%	-3.41%	-0.18%	-1.26%	-0.52%	-2.64%
Nov-16	-1.40%	-2.74%	-0.24%	2.51%	0.39%	-1.23%

RF rate 0.20%		SAFF	FORT	Paskewitz	QIM	Quantmetrics	Winton
	CRoR:	5.1%	9.3%	11.6%	9.8%	6.6%	8.6%
	StdDev:	7.0%	10.1%	15.3%	9.6%	7.7%	10.7%
	Inf. Rat.:	0.73	0.92	0.76	1.02	0.86	0.80
	Sharpe Rat.:	0.70	0.90	0.75	1.00	0.83	0.78
	% Profitable:	68.7%	62.0%	63.3%	62.0%	59.3%	56.7%
	Worst DD:	19.2%	17.4%	18.1%	16.6%	16.3%	10.3%
	Avg DD:	4.0%	2.4%	3.7%	4.1%	4.7%	2.4%

Systematic Short-Term Traders



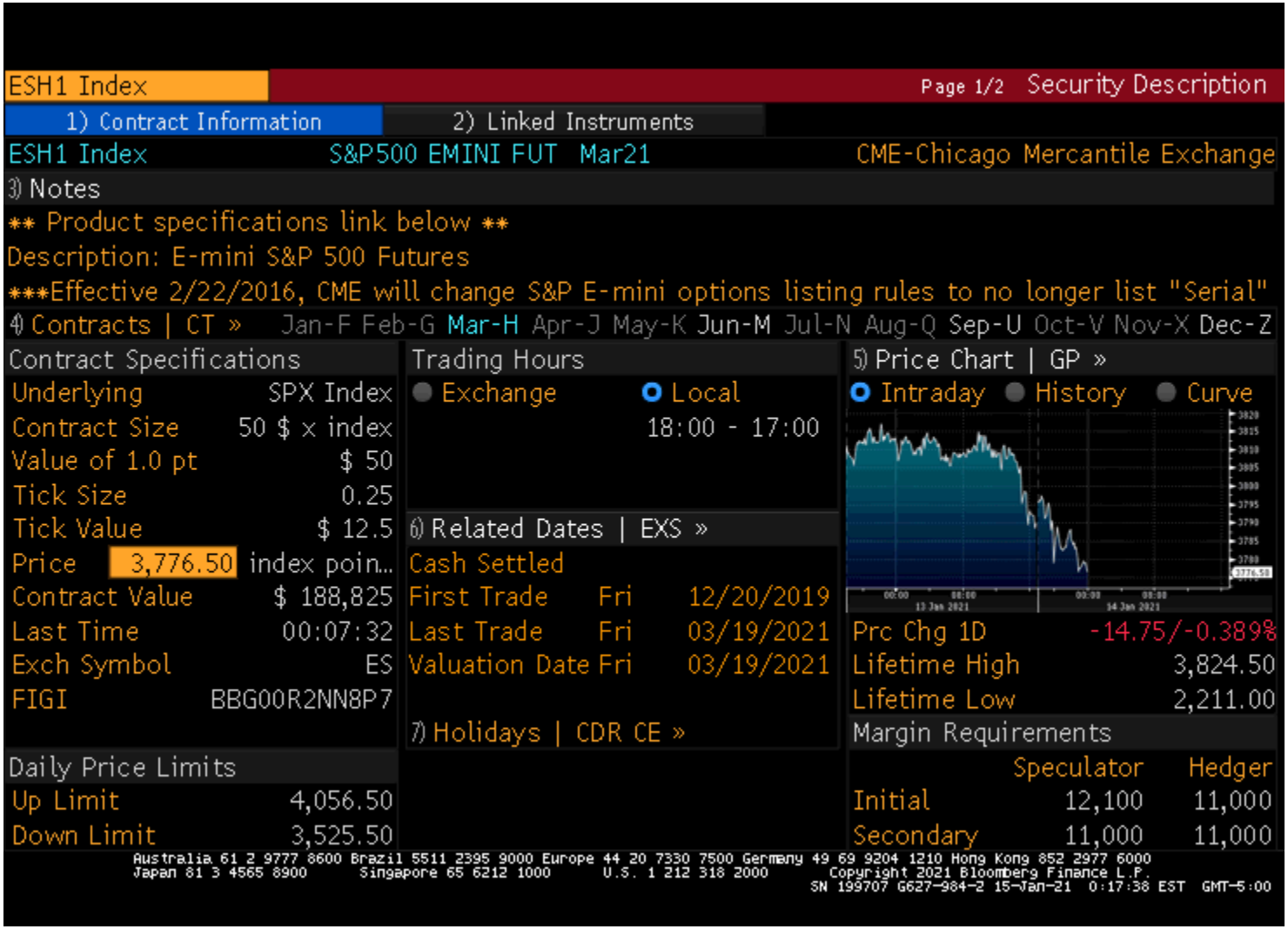
Futures Markets

- Exchange-traded *futures contract* is a standardized contract between two parties to buy or sell a specified asset of standardized quantity and quality for a price agreed upon today (the futures price) with delivery and payment occurring at a specified future date, the *delivery date*.
- The contracts are negotiated at a *futures exchange*, which acts as an intermediary between the two parties.
- The party agreeing to buy the underlying asset in the future, the "buyer" of the contract, is said to be "*long*", and the party agreeing to sell the asset in the future, the "seller" of the contract, is said to be "*short*".
- While the futures contract specifies a trade taking place in the future, the purpose of the futures exchange is to act as intermediary and minimize the risk of default by either party. The exchange requires both parties to put up an initial amount of cash, the *margin*.
- Additionally, since the futures price will generally change daily, the difference in the prior-agreed upon price and the daily futures price is *settled daily* also (variation margin). The exchange will draw money out of one party's margin account and put it into the other's so that each party has the appropriate daily loss or profit.
- If the margin account goes below a certain value, then a *margin call* is made and the account owner must replenish the margin account. This process is known as *marking to market*.
- On the delivery date, the amount exchanged is not the specified price on the contract but the *spot value*, that is the original value agreed upon, since any gain or loss has already been previously settled by marking to market.

Exchange-Traded Futures Expiry Months

1	Jan	F
2	Feb	G
3	Mar	H
4	Apr	J
5	May	K
6	Jun	M
7	Jul	N
8	Aug	Q
9	Sep	U
10	Oct	V
11	Nov	X
12	Dec	Z

Futures Contract S&P 500 E-Mini: Description



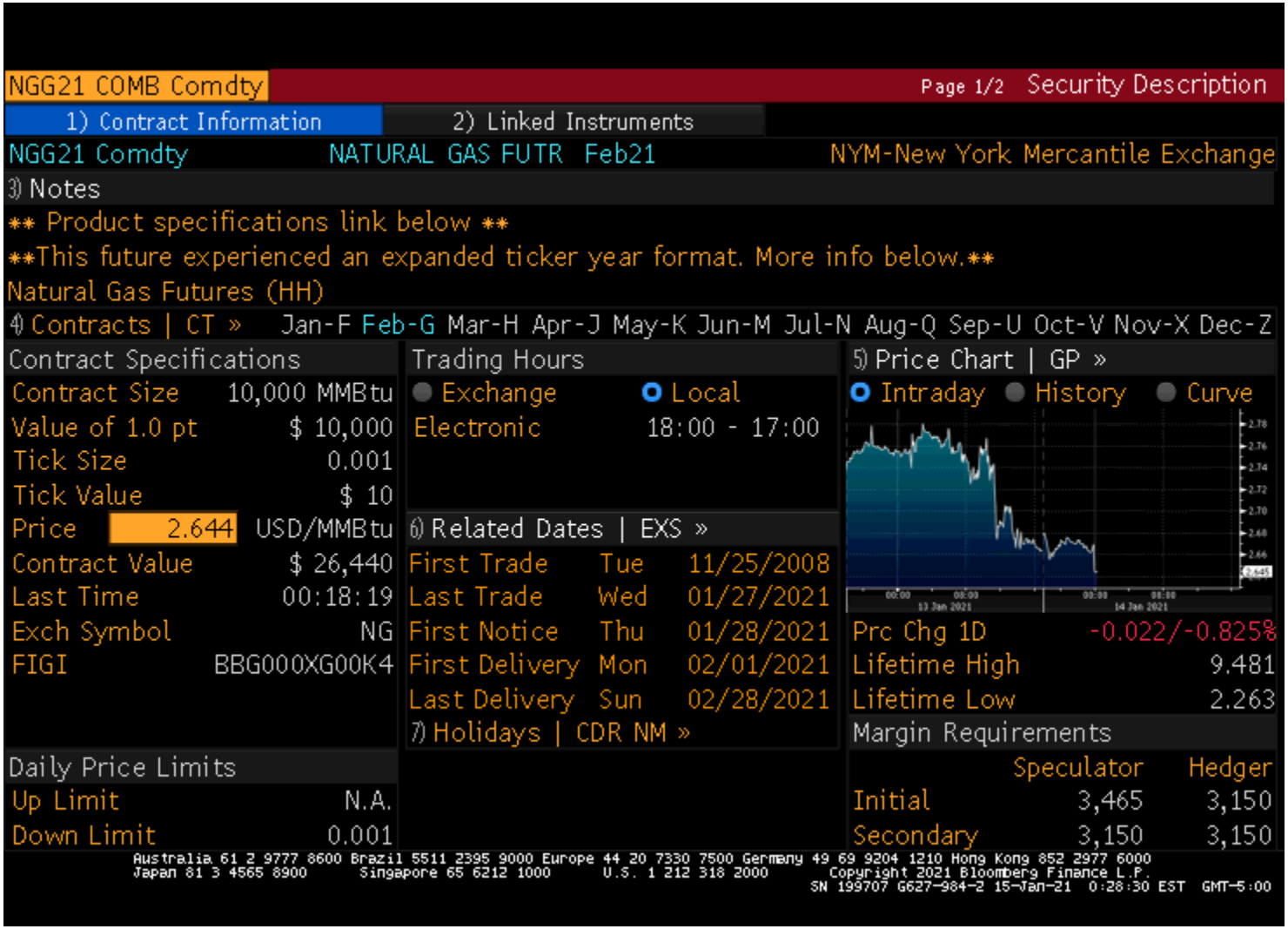
Futures Contract S&P 500 E-Mini: Contract Table

Futures Contract S&P 500 E-Mini: Price Graph

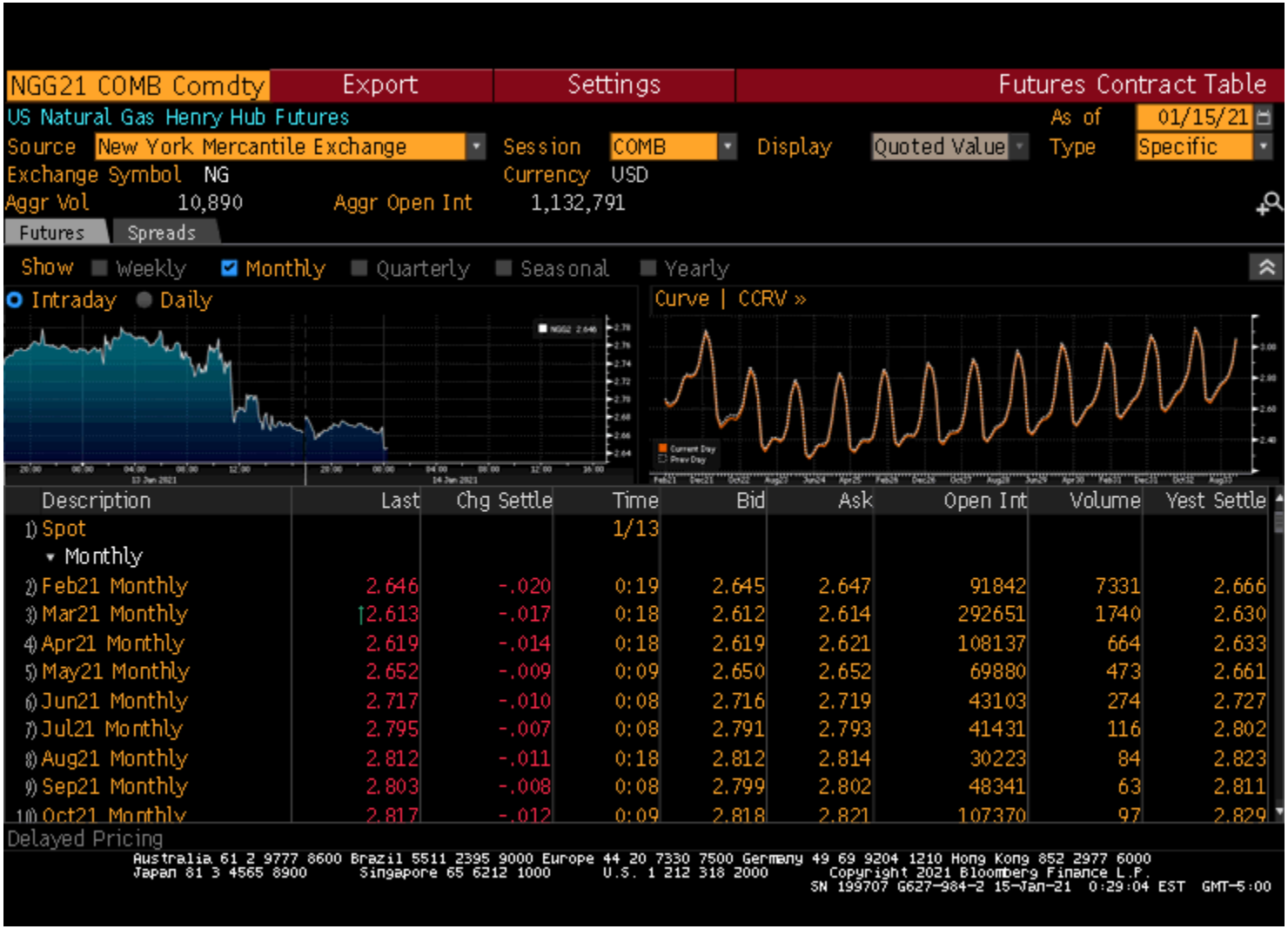
Futures Contract S&P 500 E-Mini: Roll Rule

						-6			
PreFix	**Expiry**	**Year**	**PostFix**	**Ticker**	**Last Trade**	**Roll Date**			
ES	U	1997	97	ESU97	9/18/1997	9/10/97	ES	U97	9/10/1997
ES	Z	1997	97	ESZ97	12/18/1997	12/10/97	ES	Z97	12/10/1997
ES	H	1998	98	ESH98	3/20/1998	3/12/98	ES	H98	3/12/1998
ES	M	1998	98	ESM98	6/18/1998	6/10/98	ES	M98	6/10/1998
ES	U	1998	98	ESU98	9/17/1998	9/9/98	ES	U98	9/9/1998
ES	Z	1998	98	ESZ98	12/17/1998	12/9/98	ES	Z98	12/9/1998
ES	H	1999	99	ESH99	3/18/1999	3/10/99	ES	H99	3/10/1999
ES	M	1999	99	ESM99	6/17/1999	6/9/99	ES	M99	6/9/1999
ES	U	1999	99	ESU99	9/16/1999	9/8/99	ES	U99	9/8/1999
ES	Z	1999	99	ESZ99	12/16/1999	12/8/99	ES	Z99	12/8/1999
ES	H	2000	00	ESH00	3/16/2000	3/8/00	ES	H00	3/8/2000
...	...	...	...	...	...	...	...	...	...
ES	U	2019	19	ESU19	9/20/2019	9/12/19	ES	U19	9/12/2019
ES	Z	2019	19	ESZ19	12/20/2019	12/12/19	ES	Z19	12/12/2019
ES	H	2020	20	ESH20	3/20/2020	3/12/20	ES	H20	3/12/2020
ES	M	2020	20	ESM20	6/19/2020	6/11/20	ES	M20	6/11/2020
ES	U	2020	20	ESU20	9/18/2020	9/10/20	ES	U20	9/10/2020
ES	Z	2020	20	ESZ20	12/18/2020	12/10/20	ES	Z20	12/10/2020
ES	H	2021	1	ESH1	3/19/2021	3/11/21	ES	H21	3/11/2021
ES	M	2021	1	ESM1	6/18/2021	6/10/21	ES	M21	6/10/2021
ES	U	2021	1	ESU1	9/17/2021	9/9/21	ES	U21	9/9/2021
ES	Z	2021	1	ESZ1	12/17/2021	12/9/21	ES	Z21	12/9/2021
ES	H	2022	2	ESH2	3/18/2022	3/10/22	ES	H22	3/10/2022

Futures Contract Natural Gas: Description



Futures Contract Natural Gas: Contract Table



Futures Contract Natural Gas: Price Graph

Futures Contract Natural Gas: Roll Rule

-3

PreFix	Expiry	Year	PostFix	Ticker	Last Trade	Roll Date			
NG	F	1999	99	NGF99	12/29/1998	12/24/98			
NG	G	1999	99	NGG99	1/27/1999	1/22/99	NG	G99	1/22/1999
NG	H	1999	99	NGH99	2/24/1999	2/19/99	NG	H99	2/19/1999
NG	J	1999	99	NGJ99	3/29/1999	3/24/99	NG	J99	3/24/1999
NG	K	1999	99	NGK99	4/28/1999	4/23/99	NG	K99	4/23/1999
NG	M	1999	99	NGM99	5/26/1999	5/21/99	NG	M99	5/21/1999
NG	N	1999	99	NGN99	6/28/1999	6/23/99	NG	N99	6/23/1999
NG	Q	1999	99	NGQ99	7/28/1999	7/23/99	NG	Q99	7/23/1999
NG	U	1999	99	NGU99	8/27/1999	8/24/99	NG	U99	8/24/1999
NG	V	1999	99	NGV99	9/28/1999	9/23/99	NG	V99	9/23/1999
NG	X	1999	99	NGX99	10/27/1999	10/22/99	NG	X99	10/22/1999
NG	Z	1999	99	NGZ99	11/24/1999	11/19/99	NG	Z99	11/19/1999
NG	F	2000	00	NGF00	12/28/1999	12/23/99	NG	F00	12/23/1999
...	...	...	...	...	...	...	...	...	...
NG	Z	2020	20	NGZ20	11/25/2020	11/20/20	NG	Z20	11/20/2020
NG	F	2021	21	NGF21	12/29/2020	12/24/20	NG	F21	12/24/2020
NG	G	2021	21	NGG21	1/27/2021	1/22/21	NG	G21	1/22/2021
NG	H	2021	21	NGH21	2/24/2021	2/19/21	NG	H21	2/19/2021
NG	J	2021	21	NGJ21	3/29/2021	3/24/21	NG	J21	3/24/2021
NG	K	2021	21	NGK21	4/28/2021	4/23/21	NG	K21	4/23/2021
NG	M	2021	21	NGM21	5/26/2021	5/21/21	NG	M21	5/21/2021
NG	N	2021	21	NGN21	6/28/2021	6/23/21	NG	N21	6/23/2021
NG	Q	2021	21	NGQ21	7/28/2021	7/23/21	NG	Q21	7/23/2021
NG	U	2021	21	NGU21	8/27/2021	8/24/21	NG	U21	8/24/2021
NG	V	2021	21	NGV21	9/28/2021	9/23/21	NG	V21	9/23/2021
NG	X	2021	21	NGX21	10/27/2021	10/22/21	NG	X21	10/22/2021
NG	Z	2021	21	NGZ21	11/26/2021	11/23/21	NG	Z21	11/23/2021

Futures Facts Table

updated: 1/11/2018

	Ticker, Alphabetical				Local Currency Values						Pit Session, Exchange Time			
	TickData	Bloomberg	Description	Currency	Contract Value	Point Value	Tick Value	Margin	Bloomberg Price	TickData Price	Time Open	Time Close	Slpg	PV Multiplier
1	AD	AD	Australian Dollar	USD	78,750	1,000	10	1,375	78.75	0.7875	7:20	14:00	24	100
2	BN	RX	EURO Bund (f.k.a. as German Bund)	EUR	161,070	1,000	10	2,616	161.07	161.07	8:00	18:00	18	1
3	BO	BO	SoyBean Oil	USD	20,058	600	6	660	33.43	33.43	9:30	13:15	39	1
4	BP	BP	British Pound	USD	84,625	625	6.25	1,980	135.40	1.3540	7:20	14:00	28	100
5	BZ	DU	Schatz, German 2-year Notes	EUR	111,965	1,000	5	241	111.965	111.965	8:00	18:00	11	1
6	CB	CN	Canadian Government Bond, 10-year	CAD	133,920	1,000	10	2,109	133.92	133.92	8:20	15:00	43	1
7	CC	CC	Cocoa	USD	19,410	10	10	1,265	1,941	1,941	8:00	11:50	103	1
8	CD	CD	Canadian Dollar	USD	79,810	1,000	5	1,210	79.81	0.7981	7:20	14:00	23	100
9	CF	CF	CAC 40 Index	EUR	55,035	10	5	4,390	5,503.50	5,503.5	8:00	20:00	23	1
10	CL	CL	WTI Crude Oil (West Texas Intermediate, a.k.a. Swe	USD	63,580	1,000	10	2,145	63.58	63.58	9:00	14:30	46	1
11	CN	C_	Corn	USD	17,438	50	12.5	605	348.75	348.75	9:30	13:15	66	1
12	CT	CT	Cotton Number 2	USD	39,825	500	5	2,200	79.65	79.65	10:30	14:20	101	1
13	DA	GX	DAX Index	EUR	331,700	25	12.5	24,134	13,268.00	13,268.00	8:00	20:00	33	1
14	DX	DX	Dollar Index	USD	92,070	1,000	5	1,980	92.070	92.070	8:20	15:00	17	1
15	EC	EC	Euro	USD	150,075	125,000	6.25	2,310	1.2006	1.2006	7:20	14:00	21	1
16	ED1	ED	90-day Eurodollar, 1-st contract	USD	245,450.0	2,500	12.5	165	98.180	98.180	7:20	14:00	16	1
17	EN	NI	Nikkei 225 Index	JPY	11,847,500	500	2,500	396,000	23,695	23,695	7:45	14:30	25,291	1
18	ER	RTA	Russell 2000 Index (E-Mini)	USD	78,085	100	10	2,420	1,561.60	1,561.60	9:30	16:15	25	1
19	ES	ES	S&P 500 Index (E-Mini)	USD	137,575	50	12.5	4,950	2,751.50	2,751.50	8:30	15:15	16	1
20	FT	Z	FTSE-100 Index	GBP	77,080	10	5	3,261	7,708.00	7,708.00	8:00	17:30	33	1
21	FV	FV	U.S. 5-year Treasury Note	USD	115,648.4	1,000	7.8125	616	115.648438	115.648438	7:20	14:00	13	1
22	GC	GC	Gold 100 oz	USD	132,300	100	10	3,850	1,323.00	1,323.00	8:20	13:30	65	1
23	GL	G_	Long Gilt, 10-year British Bond	GBP	123,850	1,000	10	2,200	123.85	123.85	8:00	18:00	27	1
24	HG	HG	Copper	USD	80,762.5	250	12.5	3,080	323.05	323.05	8:10	13:00	59	1
25	HI	HI	Hang Seng Index	HKD	1,559,950	50	50	92,435	31,199	31,199	9:45	16:15	443	1
26	HO	HO	Heating Oil	USD	87,528.0	420	4.2	3,410	208.40	2.0840	9:00	14:30	70	100
27	JB	JB	Japanese Government 10-year Bond (a.k.a. JGB)	JPY	150,270,000	1,000,000	10,000	450,000	150.27	150.27	9:00	15:00	10,285	1
28	JO	JO	Orange Juice	USD	20,475	150	7.5	1,320	136.50	136.50	10:00	13:30	183	1
29	JY	JY	Japanese Yen	USD	112,900	1,250	6.25	2,475	90.320	0.90320	7:20	14:00	53	100
30	KC	KC	Coffee	USD	46,050	375	18.75	2,310	122.80	122.80	9:15	13:30	194	1
31	ME	PE	Mexican Peso	USD	25,635	5,000	5.0	1,210	5.1270	0.051270	7:20	14:00	28	100
32	NG	NG	Natural Gas	USD	30,620	10,000	10	2,420	3.063	3.063	9:00	14:30	93	1
33	NQ	NQ	NASDAQ 100 Index (E-Mini)	USD	134,095	20	5	4,950	6,704.75	6,704.75	8:30	15:15	13	1
34	PA	PA	Palladium	USD	108,100	100	5	6,050	1,081.00	1,081.00	8:30	13:00	147	1
35	PT	PT	S&P/TSX 60 Index	CAD	192,920	200	20	9,216	964.60	964.60	9:30	16:15	47	1
36	SB	SB	Sugar Number 11, World	USD	15,882	1,120	11.2	1,047	14.18	14.18	9:00	13:00	57	1
37	SF	SF	Swiss Franc	USD	128,650	1,250	12.5	3,080	102.92	1.0292	7:20	14:00	26	100
38	SM	SM	Soybean Meal	USD	31,270	100	10	1,320	312.70	312.70	9:30	13:15	57	1
39	SV	SI	Silver	USD	85,025	5,000	25	4,400	17.005	1,700.50	8:25	13:25	243	0.01
40	SW	SM	Swiss Market Index	CHF	94,250	10	10	4,309	9,425	9,425	9:00	17:30	53	1
41	SY	S_	Soy Beans	USD	47,450	50	12.5	1,595	949.00	949.00	9:30	13:15	36	1
42	TU	TU	U.S. 2-year Treasury Note	USD	213,797	2,000	15.625	374	106.898438	106.898438	7:20	14:00	19	1
43	TW	TW	MSCI Taiwan Index	USD	40,010	100	10	1,430	400.10	400.10	8:45	13:50	93	1
44	TY	TY	U.S. 10-year Treasury Note	USD	123,094	1,000	15.625	1,045	123.0938	123.0938	7:20	14:00	19	1
45	UR	ER	3-month Euribor	EUR	250,800	2,500	12.5	136	100.320	100.320	7:00	17:00	17	1
46	US	US	U.S. Long Bond (a.k.a. U.S. 30-year Bond)	USD	150,312.5	1,000	31.25	2,750	150.313	150.313	7:20	14:00	47	1
47	WC	W_	Wheat	USD	21,663	50	12.5	1,045	433.25	433.25	9:30	13:15	31	1
48	XX	VG	DJ Euro Stoxx 50 Index	EUR	35,930	10	10	2,534	3,593.00	3,593.00	8:00	20:00	13	1
49	YM	DM	Dow Jones Industrial Average (Mini)	USD	127,455	5	5	3,685	25,488	25,488	8:30	15:15	16	1
50	LC	LC	Live Cattle	USD	47,440	400	10	1,650	118.600	118.600	9:05	13:00	35	1
51	ST	L_	90-day Sterling (a.k.a. Short Sterling)	GBP	124,306.3	1,250	6.25	185	99.445	99.445	7:30	18:00	16	1
52	FC	FC	Feeder Cattle	USD	70,688	500	12.5	3,080	141.375	141.375	9:05	13:00	116	1
53	LH	LH	Lean Hogs	USD	28,330	400	10	1,320.0	70.83	70.83	9:05	13:00	39	1
54	CO	CO	Brent Crude	USD	69,130	1,000	10	2,700	69.13	69.13	14:00	19:30	48	1
55	BL	OE	Euro-BOBL 5-year	EUR	131,200	1,000	10	1,046	131.200	131.200	8:00	18:00	32	1
56	MG	MFS	MSCI EAFE Index (E-Mini)	USD	105,760	50	5	3,960	2,115.20	2,115.20	8:30	15:15	93	1
57	BX	UB	Euro-BUXL 30-year	EUR	162,120	1,000	20	5,651	162.12	162.12	8:00	18:00	183	1
58	PL	PL	Platinum	USD	49,455	50	5	1,760	989.10	989.10	8:20	13:05	148	1
59	XB	XB	Gasoline RBOB	USD	77,024	420	4.2	3,080	183.39	1.8339	9:00	14:30	91	100
60	GO	QS	Low Sulphur Gasoil Futures	USD	61,325	100	25	2,600	613.25	613.25	14:00	19:30	53	1
61	BT	IK	Euro BTP Italian Government Bond	EUR	135,430	1,000	10	3,098	135.43	135.43	8:00	18:00	33	1
62	MI	FA	S&P 400 MidCap E-Mini	USD	195,920	100	10	6,600	1,959.10	1,959.10	8:30	15:15	48	1
63	UB	WN	U.S. ULTRA BOND CBT	USD	163,906.3	1,000	31.25	3,630	163.906	163.906	7:20	14:00	47	1

Sample Hedge Fund Performance

- If we are given hedge fund performance numbers sampled monthly (very typical), which hedge fund is a good/better performer?
- "*Obviously*", it should be the hedge fund with a high positive average monthly rate of return and a high percentage of profitable months.
- Therefore, in the following example, one should prefer the fund *Ebullio* to the fund *Ansbacher* given some statistics as this:

	Ansbacher	**Ebullio**
Avg. Monthly RoR:	**0.9%**	**0.9%**
% Profitable Months:	**73.0%**	**75.0%**

Sample Hedge Fund Performance

- Let us take a closer look at the details of these funds and their statistics.
- We will consider three following hedge funds' past performance records:

1. Millennium International, Ltd.;
2. *Ansbacher* Investment Management: Elizaville Partners LP;
3. The *Ebullio* Commodity Fund.

Ansbacher Investment Management: Elizaville Partners LP

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	YTD
1996	--	--	-10.84%A	-0.63%A	1.60%A	14.85%A	-31.93%A	8.82%A	14.12%A	10.05%A	13.68%A	-10.81%A	-2.49%
1997	17.21%A	0.64%A	5.66%A	2.83%A	7.17%A	3.63%A	6.41%A	-2.22%A	1.90%A	-6.01%A	11.48%A	6.22%A	67.96%
1998	2.43%A	11.12%A	6.81%A	1.60%A	-2.46%A	5.98%A	-4.01%A	-1.97%A	-5.92%A	-5.97%A	7.27%A	8.51%A	23.72%
1999	0.01%A	3.27%A	8.37%A	-2.19%A	2.01%A	7.21%A	-4.22%A	-2.68%A	4.21%A	-7.01%A	6.03%A	7.68%A	23.47%
2000	-4.95%A	1.75%A	-5.90%A	-18.63%A	4.54%A	9.00%A	1.10%A	9.99%A	11.75%A	-6.82%A	2.13%A	-4.18%A	-4.38%
2001	7.64%A	4.33%A	-1.41%A	-19.02%A	5.07%A	3.91%A	-1.00%A	11.09%A	4.98%A	3.26%A	0.00%A	1.46%A	18.41%
2002	5.29%A	5.88%A	0.92%A	4.73%A	2.16%A	-1.35%A	-11.77%A	0.09%A	7.04%A	-15.04%A	-2.55%A	7.39%A	-0.2%
2003	0.73%A	5.17%A	5.10%A	0.61%A	0.02%A	0.77%A	0.12%A	1.93%A	0.63%A	2.32%A	1.45%A	1.76%A	22.48%
2004	1.49%A	3.12%A	0.65%A	3.20%A	1.07%A	2.30%A	1.54%A	1.34%A	2.55%A	-0.25%A	1.71%A	1.12%A	21.68%
2005	1.59%A	0.50%A	0.50%C	0.45%A	0.78%A	1.13%A	-0.68%A	2.26%A	2.16%A	-1.33%A	1.72%A	1.55%A	11.09%
2006	0.19%C	1.08%C	1.19%C	0.88%C	-0.50%C	-0.09%C	0.07%C	1.59%C	0.72%C	1.14%C	0.39%C	0.66%C	7.55%
2007	2.31%C	-2.11%C	-0.17%C	0.24%C	1.57%C	1.31%C	-0.79%C	1.04%C	0.99%C	0.54%C	-0.58%C	0.72%C	5.11%
2008	-4.48%C	-1.71%C	-5.10%C	0.85%C	1.05%C	-0.64%C	0.02%C	1.38%C	-27.90%C	-11.84%C	1.62%C	3.53%C	-38.82%
2009	2.39%C	5.16%E	-4.42%C	2.37%C	1.84%C	2.89%C	0.46%C	2.73%C	1.73%C	-0.37%C	3.73%C	3.37%C	23.81%
2010	1.58%C	2.16%C	2.36%C	-1.80%C	-6.08%C	0.87%C	1.83%C	2.15%C	1.26%C	3.47%C	-0.36%C	4.11%C	11.72%
2011	1.21%C	0.75%C	1.36%C	4.11%C	1.06%C	-1.39%C	-3.95%C	-16.17%C	-10.77%C	7.45%C	5.52%E	--	-12.65%

Return Statistics

Domicile:	US
2011 Return:	-12.65 %
Year to Date:	N/A
Highest 12 Month Return:	109.88 %
Lowest 12 Month Return:	-41.77 %
Compound Annual Return:	9.04 %
Highest Monthly Return:	17.21 %
Lowest Monthly Return:	-31.93 %
Average Gain:	3.41 %
Average Loss:	-5.78 %
Profitable Percentage:	73.02 %
Compound Monthly Return:	0.72 %
Longest Losing Streak:	4 months
Maximum Drawdown:	-41.85 %

Quantitative Statistics

Sharpe Ratio (Rolling 12):	0.37
Sharpe Ratio (Annualized):	0.29
Std. Dev. (Monthly):	6.18 %
Std. Dev. (Rolling 12):	21.68 %
Beta:	2.55
Alpha:	-0.63
R:	0.34
R Squared:	0.12

Ebullio Commodity Fund

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	YTD
2008	3.67%C	8.32%C	9.31%C	3.35%C	2.27%C	2.16%C	14.39%C	4.12%C	1.12%C	5.50%C	5.10%C	8.42%C	91.9%
2009	-1.22%C	4.82%C	2.12%C	4.52%C	2.93%C	1.66%C	3.12%C	-2.98%C	7.96%C	1.63%C	-7.72%C	10.34%C	29.25%
2010	-69.65%C	-86.25%C	14.08%C	58.85%C	-5.26%C	10.32%C	-4.73%C	2.11%C	-2.04%C	34.25%C	8.29%C	-9.06%C	-90.04%

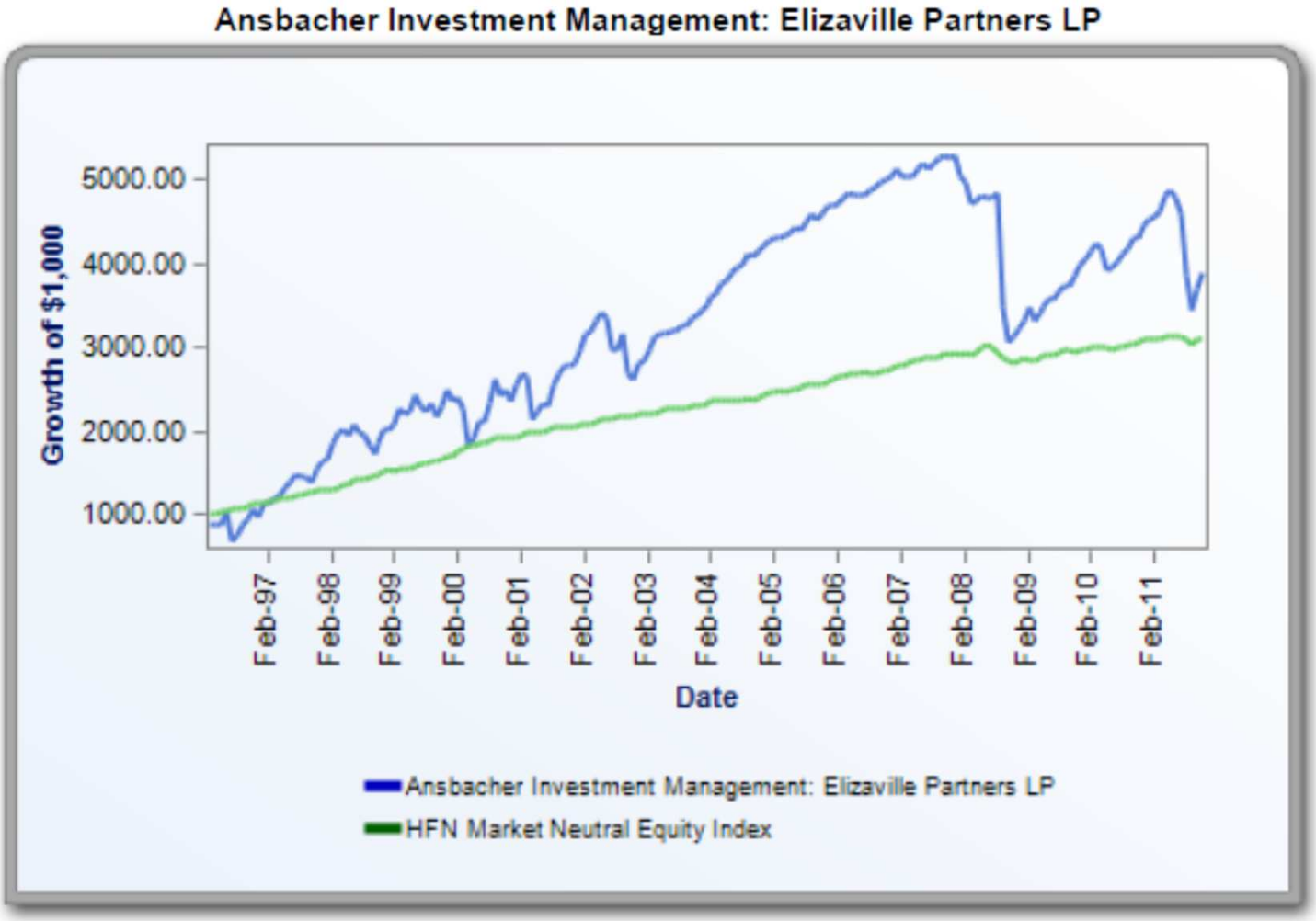
Return Statistics

Domicile:	Non-US
2010 Return:	-90.04 %
Year to Date:	N/A
Highest 12 Month Return:	91.9 %
Lowest 12 Month Return:	-94.79 %
Average Annual Return:	-12.16 %
Average Monthly Return:	1.27 %
Highest Monthly Return:	58.85 %
Lowest Monthly Return:	-86.25 %
Average Gain:	8.69 %
Average Loss:	-20.99 %
Profitable Percentage:	75 %
Compounded Monthly Return:	-3.81 %
Longest Losing Streak:	2 months
Maximum Drawdown:	-95.83 %

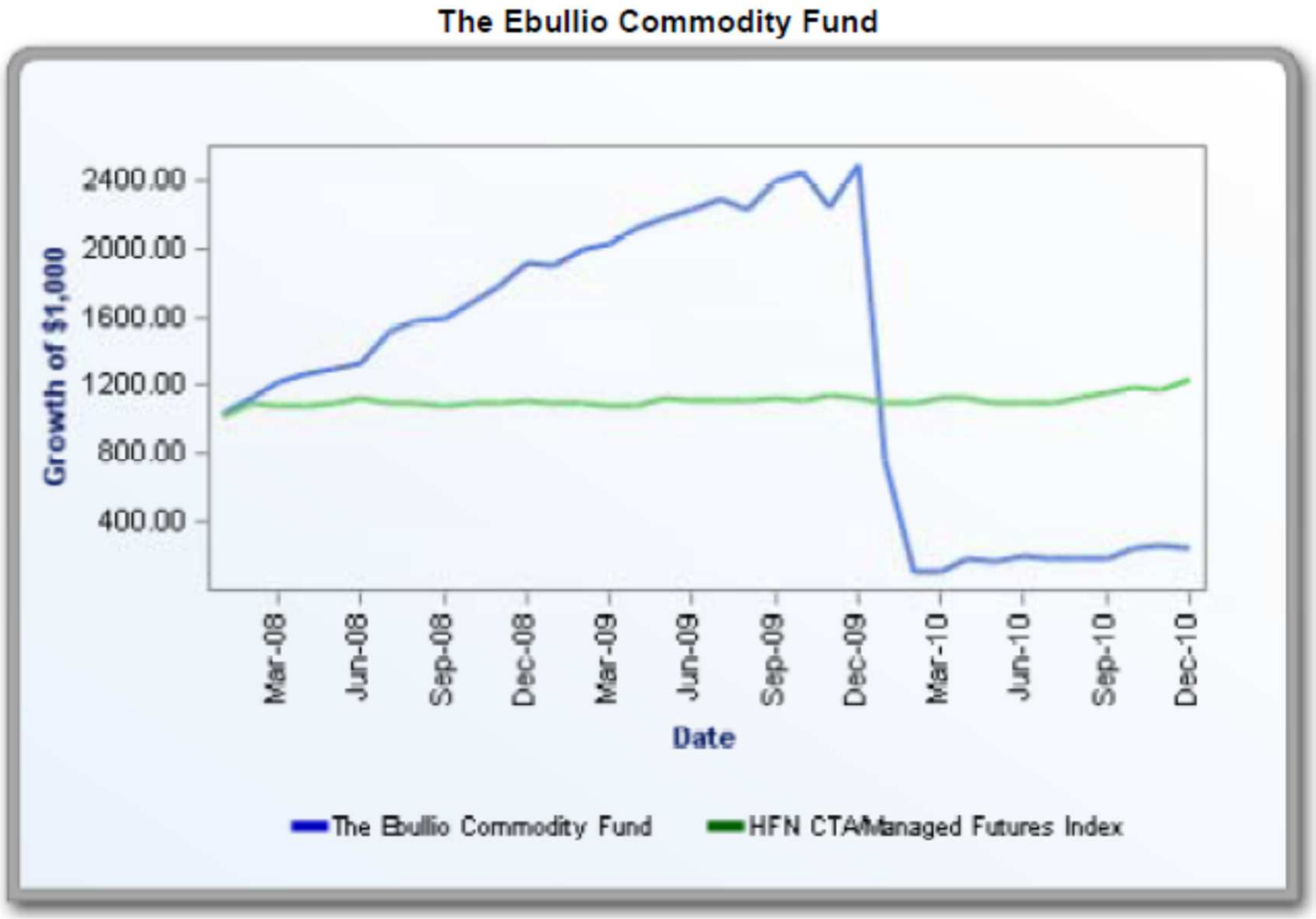
Quantitative Statistics

Sharpe Ratio (Rolling 12):	-0.22
Sharpe Ratio (Annualized):	0.13
Std. Dev. (Monthly):	22.83 %
Std. Dev. (Rolling 12):	76.81 %
Beta:	0.02
Alpha:	1.28
R:	0.01
R Squared:	0

Ansbacher Investment Management: Elizaville Partners LP



Ebullio Commodity Fund



Millennium International, Ltd.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	YTD
1990	-0.35%A	0.91%A	1.28%A	0.40%A	0.80%A	0.40%A	1.88%A	3.16%A	-0.51%A	1.89%A	0.07%A	0.59%A	10.98%
1991	1.14%A	1.13%A	2.24%A	2.53%A	1.36%A	1.60%A	-0.54%A	0.71%A	-0.17%A	-0.63%A	1.03%A	1.72%A	12.75%
1992	2.59%A	1.67%A	1.24%A	1.21%A	1.12%A	2.26%A	1.41%A	0.07%A	-2.35%A	-1.88%A	-0.66%A	0.43%A	7.21%
1993	0.54%A	0.58%A	1.15%A	1.44%A	3.01%A	0.75%A	0.90%A	2.75%A	1.11%A	0.93%A	0.98%A	2.27%A	17.66%
1994	2.15%A	1.36%A	1.82%A	0.20%A	-1.17%A	0.16%A	1.32%A	-1.74%A	0.09%A	-0.09%A	0.66%A	3.05%A	7.99%
1995	2.64%A	1.95%A	2.17%A	1.23%A	1.92%A	1.43%A	2.25%A	0.55%A	2.04%A	-0.64%A	1.11%A	2.48%A	20.84%
1996	4.20%A	1.63%A	2.56%A	3.35%A	3.12%A	0.04%A	1.42%A	2.27%A	2.14%A	0.23%A	0.69%A	1.17%A	25.26%
1997	2.33%A	1.83%A	0.70%A	1.19%A	4.05%A	1.66%A	3.22%A	0.35%A	1.51%A	2.18%A	1.31%A	2.93%A	25.83%
1998	3.75%A	2.72%A	0.68%A	1.99%A	1.33%A	-1.56%A	-2.08%A	-3.77%A	0.79%A	5.18%A	4.17%A	1.88%A	15.72%
1999	1.04%A	2.26%A	1.19%A	4.82%A	2.59%A	2.94%A	2.66%A	0.67%A	0.59%A	2.15%A	3.42%A	3.37%A	31.39%
2000	4.22%A	4.62%A	2.46%A	2.54%A	2.23%A	3.26%A	2.92%A	1.99%A	0.11%A	2.35%A	0.49%A	3.11%A	34.76%
2001	5.01%A	1.11%A	1.09%A	2.43%A	0.77%A	-0.73%A	0.11%A	1.07%A	-0.75%A	1.76%A	1.35%A	1.19%A	15.26%
2002	-0.38%A	-0.31%A	2.52%A	0.80%A	1.16%A	0.53%A	1.88%A	0.85%A	-0.35%A	0.35%A	0.54%A	1.67%A	9.61%
2003	0.73%C	0.62%C	0.63%C	1.16%C	1.27%C	1.41%C	0.67%C	1.15%C	0.88%C	0.26%C	0.49%C	1.12%C	10.89%
2004	1.83%C	1.94%C	0.77%C	0.70%C	1.24%C	0.17%C	0.54%C	0.71%C	1.06%C	1.07%C	1.80%C	1.97%C	14.68%
2005	0.92%C	1.20%C	0.95%C	0.19%C	0.54%C	1.36%C	1.71%C	0.92%C	1.04%C	0.04%C	-0.12%C	2.04%C	11.31%
2006	2.74%C	1.43%C	1.68%C	1.77%C	0.08%C	0.58%C	0.98%C	0.79%C	0.16%C	1.97%C	1.68%C	1.58%C	16.54%
2007	1.61%C	1.11%C	1.04%C	0.94%C	1.26%C	0.84%C	0.08%C	-0.89%C	0.87%C	2.34%C	0.36%C	0.95%C	10.99%
2008	0.34%C	1.74%C	-1.10%C	0.10%C	1.82%C	0.90%C	-0.61%C	-0.07%C	-4.91%C	-0.73%C	0.12%C	-0.51%C	-3.04%
2009	3.16%C	0.99%C	0.38%C	1.08%C	2.06%C	1.07%C	0.22%C	1.13%C	1.39%C	1.68%C	0.99%C	1.86%C	17.2%
2010	1.43%C	1.13%C	1.35%C	1.02%C	-1.21%C	-1.02%C	1.26%C	1.16%C	2.58%C	1.65%C	1.55%C	1.65%C	13.22%
2011	1.38%C	1.22%C	1.28%C	0.25%C	0.60%C	0.78%C	0.44%C	-0.81%C	-0.31%C	1.53%C	0.69%C	0.93%E	8.25%

Return Statistics

Domicile:	Non-US
2011 Return:	8.25 %
Year to Date:	N/A
Highest 12 Month Return:	40.39 %
Lowest 12 Month Return:	-3.04 %
Compound Annual Return:	14.95 %
Highest Monthly Return:	5.18 %
Lowest Monthly Return:	-4.91 %
Average Gain:	1.48 %
Average Loss:	-1.03 %
Profitable Percentage:	87.88 %
Compound Monthly Return:	1.17 %
Longest Losing Streak:	4 months
Maximum Drawdown:	-7.24 %

Quantitative Statistics

Sharpe Ratio (Rolling 12):	1.25
Sharpe Ratio (Annualized):	2.05
Std. Dev. (Monthly):	1.3 %
Std. Dev. (Rolling 12):	8.41 %
Beta:	0.09
Alpha:	1.12
R:	0.31
R Squared:	0.1

Millennium International, Ltd.