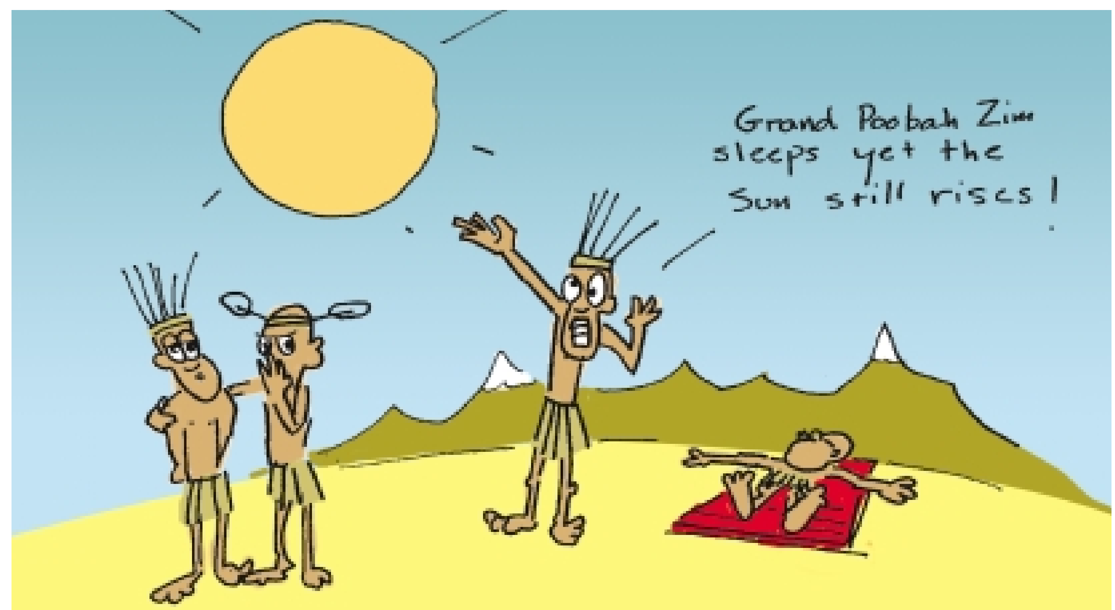
Bill Ziemba

Changing Correlations: Rising VIX and Violent Market Moves

Once reliable correlations now present a mounting challenge as the markets descend further into fear and instability. What fun!



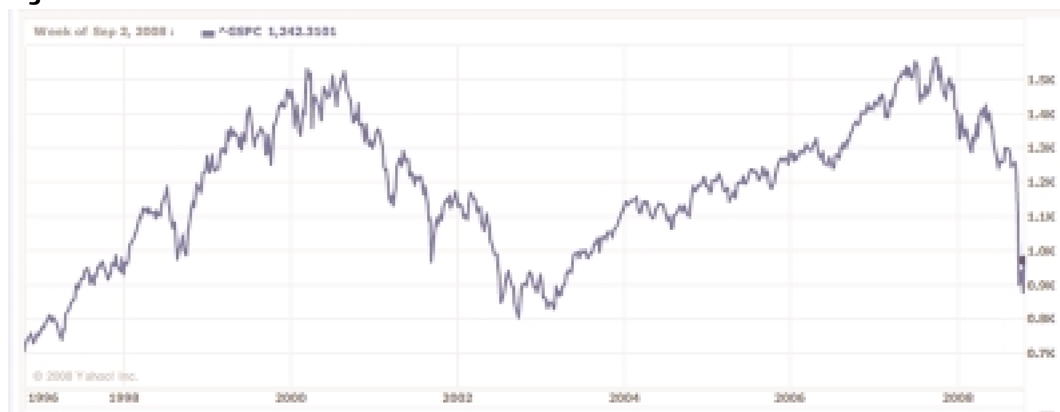
The moment the tribe decided to abandon their potato yield: semiconductor sector correlation strategy

Why are the world economy and its financial markets in so much trouble? In Figure 1, the Case–Shiller US home price index shows that there has been a dramatic decline in US house prices since they peaked in 2005. The decline is close to 20 percent, with larger declines in areas that have increased the most in price since 2002. With some $16 trillion of US mortgages versus a total value of US housing of about $40 trillion, there is a lot of trouble here, and millions of houses are being foreclosed on. Indeed, one of every five houses in the USA has a mortgage greater than its market value. The situation is similar in essentially all of those countries that have given loans to unqualified buyers. And many of those with qualified mortgages are not in good shape either There is the odd US bank that did not make these risky loans, but most made them.

The UK is another example where such subprime loans were very prevalent. Indeed, UK bank accounts frequently take salaries and pay everything from one account. ING, of the Netherlands, had good, prudent policies and keeps their mortgages, so has avoided most of the trouble. In countries like Canada, where you simply cannot get the banks to loan you money for a house well beyond your means to pay the mortgage, there is not much trouble from Canadian mortgages. But there is much indirect trouble everywhere as a result of the US loans being diced, repackaged, and resold as derivative instruments deemed safe by regulators and scoped up by banks, pensions, insurance companies, and other financial institutions around the world. Also, the USA is the only country I know where mortgages are nonrecourse loans. Canada has only a few large banks, with conservative management and regulations, so despite a housing bubble there too, the prices have not collapsed yet. But even there, a decline is starting to emerge. None of the major

Figure 1: Case–Shiller home price indices

Figure 2: S&P 500 Source: Yahoo Finance



[S&P 500, 12 years to October 31, 2008. Source: Yahoo Finance]

[Nasdaq, 12-years to October 31, 2008. Source: Yahoo Finance]

Canadian banks are in serious trouble, despite having some poison subprime US derivatives based on US housing. Canadian banks are buying US regional banks and consolidating them.

This housing bubble, which exists in most of the world, was basically caused by the Alan Greenspan low interest rates policy to get the USA out of the internet bubble. People all over the would soured on stocks when the S&P 500 fell basically by half, from 1,520 on September 1, 2000 to 776 on October 9, 2002. Inflation adjusted at 764, and the current value (October 31, 2008), 960.75, is even lower! The 2000–2002 fall in the S&P 500 was mainly in three areas: information technology, telecommunications, and large cap stocks. Yet 41 percent of the 500 stocks did not fall and 19 percent declined by 10 percent or less annualized. The Nasdaq fell much more, as the figures show.

Figure 3: Euro, 1999 to October 31, 2008. Source: Yahoo Finance

Equally weighted, the S&P 500 lost only 3 percent, so it was a decline of a section of the market that was overpriced. These were small cap stocks with values to $10 billion or less. See Ziemba (2003) for more on this episode in history.

With cheap and easily attainable money and a distaste for risky equities, relatively safe property seemed the way to go. And the bubble was everywhere. In 2005, I gave a talk in Bolzano, Italy, a nice mountain town above Verona. Housing there, at 8,000 C per square meter, with a high euro was out of sight. The Grand Canal in Venice was not much more!

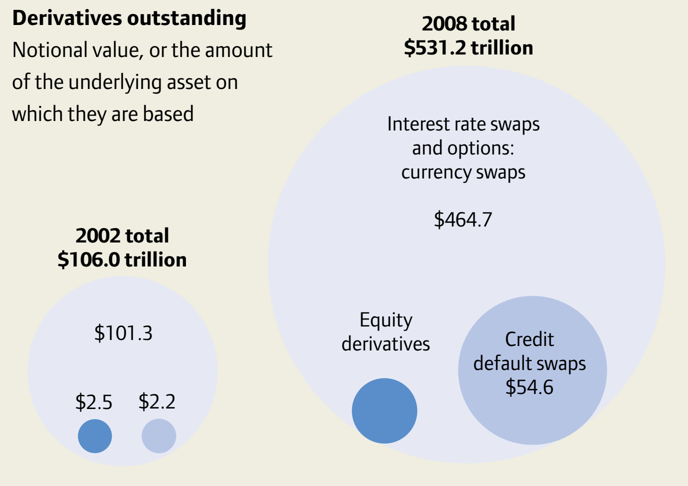
The easy money policy had three parts: cheap money, easy to get, and attainable, even if you were not qualified to pay it back. The assumption was that housing had only one way to go – up. So, the expected increase in price was relied on to build equity. The US dollar under this policy fell dramatically against many currencies and commodities such as gold and oil. The fall in the US dollar was due to a combination of the low interest rate, the US twin trade and budget deficits, and the willingness of foreigners to hold US assets to pay for the huge US appetite for cheap foreign goods. Commodities rose as demand from China and other countries accelerated. In early January 2002, the euro bought 0.87 dollarsand it peaked in 2008 at 1.60 dollars.

All such bubbles must eventually pop, and the commodities peaked in June to early July 2008. Trend models exited commodities such as oil in July 2008, taking large losses from the earlier 2008 profits. My daughter, and sometimes co-author, Rachel Ziemba, of RGEmonitor, actually called the fall in oil when it was at $147 per barrel that it would hit $100 before $200 (Ziemba, 2008). Currently, oil is under $70 a barrel and never hit the real price high of over $100 in the 1973–74 period.

As readers of my columns and Ziemba and Ziemba (2007) know, the bond-stock model correctly predicted the 2000–2002 crash period.

Figure 4: Growth of a complex market.
Source: *The New York Times*

The market for financial instruments known as derivatives — contracts itended to hedge against risk whose values are derived from underlying assets — has increased fivefold since 2002. While Alan M. Greenspan was a champion of them and opposed regulating them others warned of their risk.



There were actually two bond-stock crash signals: the first was in April 1999 and the second was in late 2001. Please see those columns or the book (Ziemba and Ziemba, 2007) on this. The bond-stock model also predicted the equity crashes in Iceland and China, two places where interest rates were too high compared to earnings.

Getting back to the current crisis, the growth of derivatives worldwide and the misuse of them by supposedly knowledgeable analysts that we professors have trained, and bank, insurance, and pension fund administrators underestimating the risks, is illustrated by the gigantic size of the worldwide derivative markets. Figure 4 shows that there has been a fivefold increase in derivatives since 2002.

Growth of derivatives

There are a lot of equity derivatives in the trillions of dollars, but this is swamped by credit default swaps. My colleague, Professor Ed Altman of the Stern School, NYU, correctly predicted much of the current problems with such instruments at a conference in May 2008 that I attended in Florence. The big elephant in the room relates to the interest rate swaps and options and currency swaps. Basically, interest rates. Many such derivatives were repackaging of the unsound subprime housing and other loans. The rating agencies which gave AAA ratings are at fault here as well. It's a case of the fox guarding the chicken coop, as the sellers of these derivatives paid the ratings agencies, so there was no independence. See Altman's website for more on this. Even the best experts, such as Alan Greenspan and my esteemed late University of Chicago colleague, Professor Merton Miller, bought into the academic view that derivatives provide greater liquidity and hedging, so are safe. At a low level, they are, but at $531 trillion there is a lot of scope for trouble.

The vast number of instant, narrow, expert financial engineers turned out by the best universities without grounding in economics and history has been part of the problem, as the risks they were creating were only numbers to many of them.

Greenspan, asked at a Congressional hearing: "...aren't you concerned with such a growing concentration of wealth that if one of these huge institutions fails that it will have a horrendous impact on the national and global economy?", he replied: "No, I am not, I believe that the general growth in large institutions have occurred in the context of an underlying structure of markets in which many of the larger risks are dramatically – I should say, fully – hedged."

Miller: "Despite all the hullabaloo in the press, and all the bad publicity surrounding derivatives, banks are safer today, not riskier. .... no serious danger of a derivatives induced financial collapse really exists."

Warren Buffett (2002 BH shareholder letter): "Large amounts of risk, particularly credit risk, have become concentrated in the hands of relatively few derivatives dealers. The troubles of one could quickly infect the others. .... Derivatives are weapons of mass destruction."

Buffett has been a derivative critic, calling them instruments of mass destruction. There are many reasons why this sage great investor, arguably the world's best, understands things so well. As a Berkshire Hathaway shareholder, I read his annual reports, and hidden in the footnotes are a number of derivative trades. But Buffett well understands the effects of leverage, so only bets when he has a huge advantage, and the risk of a bad scenario will only cost him 1–2 percent of his total portfolio. For example, he has short puts on the S&P 500 – a disaster area for most of this year, but the time to expiry is 15 years! He does not win in all such bets, but he is usually ahead on most of them.

Berkshire has had a great record over the 40+ years since Berkshire was founded in 1965, but even they have fallen into a bear market in 2008 (20 percent decline; see Figures 5 and 6). The smaller B shares peaked at 4,950 in the week of December 3, 2007, and on October 31, 2008 they were at 3,840. Still, they have outperformed the equity markets.

Buffett makes investments that resemble a full Kelly bettor. His geometric mean, the quantity maximized in the Kelly strategy, has been high. For example, from 1977 to 2000, it was 32.07 percent versus 16.7 percent for the S&P 500. The BH record since 2000 has been less spec-

Figure 5: Berkshire Hathaway B shares – 10 years to October 31, 2008. Source: Yahoo Finance

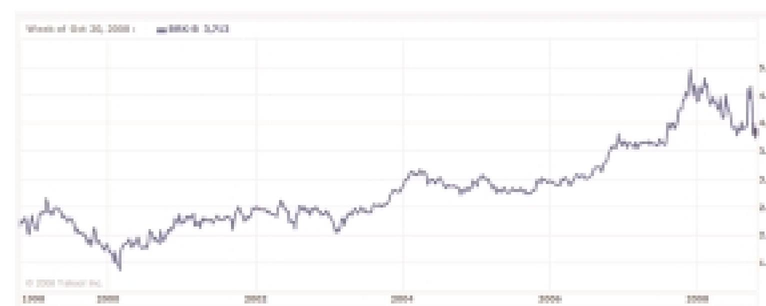


Figure 6: Comparative performance of Berkshire Hathaway and other funds, December 1985 to June 2000. Source: Ziemba and Ziemba (2007)

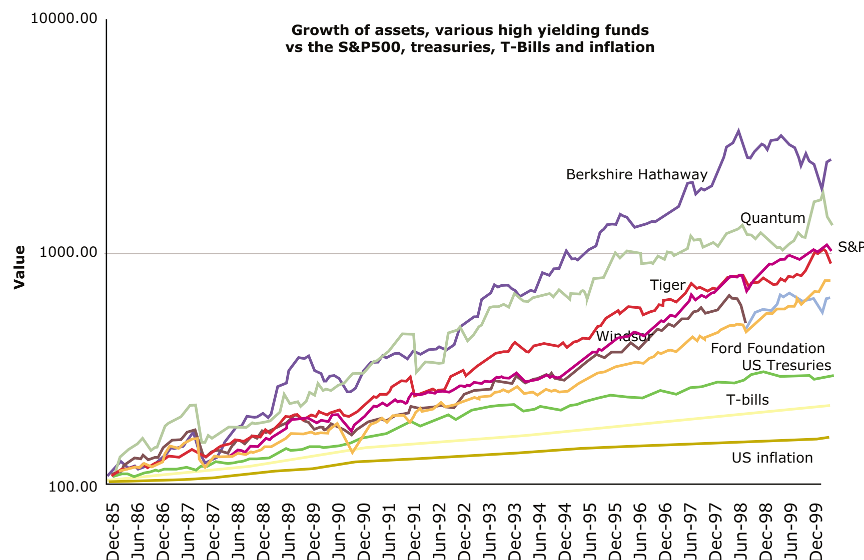
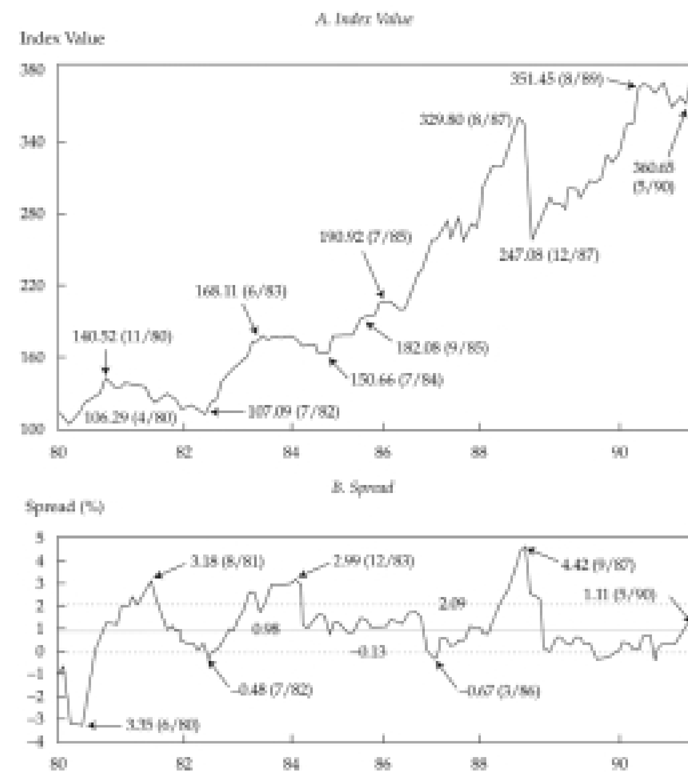


Figure 7: The bond and stock yield differential model for the S&P 500, 1980–1990. Source: Ziemba (2003)



Note: Data through 29 May 1990. Shaded lines in Panel B denote upper limit, mean, and lower limit.
Source: Based on data from Ziemba and Schwartz (1991).

tacular, but still considerably above the S&P 500 (see Figure 5). His Sharpe ratio is not high, and neither is his downside symmetric downside Sharpe ratio (see Ziemba, 2005). He simply goes for the long run – the Kelly approach!

The bond-stock measures that have been so useful in the past (see Table 2 and Figures 7 and 8; see also Ziemba and Ziemba, 2007) have not been helpful in the current crash situation, July to October 2008.

Figure 7 shows the 1987 crash and the two crashes in 2001 and 2002–2003. In between, before and after the market was out of the danger zone. The second 2002 crash occurred because prices fell, but earnings fell more.

In the rest of this column, I focus on the July to October 2008 period. As I write this, we are in the November, turn of the month, historically the best TOM, and the markets are rallying per the script. The S&P 500 closed at 968.75 on October 31, 2008, a gain of 14 percent in the previous four days. Of course, there is good economic news, but then good news has a way of showing up at the right times. This is right after the two historically worst months of the year, September and October (see Hensel and Ziemba, 2000). This column updates to the end of October 2008. The future remains violent. Let's go to the big issue: changing correlations and viciously high VIX.

Oil

Oil prices rose in US dollars and also in euros, until the euro reversed in August 2008.

- Refining capacity is limited and drives up the cost of fuel products (heating and auto).
- Oil peaked nominally in July 2008 at $147 and then fell to the low 90s, before recovering to about $102 and then falling back to the current level of about $65 because of the weak economy and falling demand.
- Oil prices rose in US dollars and also in euros until it reversed.
- Oil has still not reached the record real price of over $100 in the 1970s.
- There is much uncertainty in the near term, as OPEC is being tested as to whether they can impose supply constraints to raise the price.
- New supplies have higher marginal costs than the current price and will likely be delayed – it is estimated that new Canada oil sands projects require oil at $100.
- Budgets of oil exporting states require $50–60 oil and Russia's budget assumes oil is $80+.

Gold

- Since 2005, gold has been rising, peaking at $960 an ounce in July 2008. But the path had been violent. It is currently at 718.20, down 18 percent in October, the largest monthly decline in nearly 30 years.
- Part of gold's volatility is that it moved with other commodities such as oil.
- In recent months, it has gained then fallen on a flight to safety, while commodities have fallen.
- Some investors may worry about the difficulty of selling gold or gold options.
- Gold is far below the long-term real price – having reached $800 in the late 1970s.
- Given the great uncertainty in the world economy, gold looks strong as an asset class, but, like all assets, it has been very volatile in 2008 and relatively weak now. The safe haven aspect has

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Table 2: The 2000–2003 crash in the S&P 500. April 1999 enters the danger zone

year	month	S&P500 Index	a PER	b 30-yr gov't bond	c=1/a return on stocks	b-c crash signal	year	month	S&P500 Index	a PER	b 30-yr gov't bond	c=1/a return on stocks	b-c crash signal
1995	Jan	470.42	17.10	8.02	5.85	2.17	1997	Jul	954.29	23.67	6.78	4.22	2.56
	Feb	487.39	17.75	7.81	5.63	2.18		Aug	899.47	22.53	6.71	4.44	2.27
	Mar	500.71	16.42	7.68	6.09	1.59		Sep	947.28	23.29	6.70	4.29	2.41
	Apr	514.71	16.73	7.48	5.98	1.50		Oct	914.62	22.67	6.46	4.41	2.05
	May	533.40	16.39	7.29	6.10	1.19		Nov	955.40	23.45	6.27	4.26	2.01
	Jun	544.75	16.68	6.66	6.00	0.66		Dec	970.43	23.88	6.15	4.19	1.96
	Jul	562.06	17.23	6.90	5.80	1.10	1998	Jan	980.28	24.05	6.01	4.16	1.85
	Aug	561.88	16.20	7.00	6.17	0.83		Feb	1049.34	25.09	6.00	3.99	2.01
	Sep	584.41	16.88	6.74	5.92	0.82		Mar	1101.75	27.71	6.11	3.61	2.50
	Oct	581.50	16.92	6.55	5.91	0.64		Apr	1111.75	27.56	6.03	3.63	2.40
	Nov	605.37	17.29	6.36	5.78	0.58		May	1090.82	27.62	6.10	3.62	2.48
	Dec	615.93	17.47	6.25	5.72	0.53		Jun	1133.84	28.65	5.89	3.49	2.40
1996	Jan	636.02	18.09	6.18	5.53	0.65		Jul	1120.67	28.46	5.83	3.51	2.32
	Feb	640.43	18.86	6.46	5.30	1.16		Aug	97.28	27.42	5.74	3.65	2.09
	Mar	645.50	19.09	6.82	5.24	1.58		Sep	1017.01	26.10	5.47	3.83	1.64
	Apr	654.17	19.15	7.07	5.22	1.85		Oct	1098.67	27.41	5.42	3.65	1.77
	May	669.12	19.62	7.21	5.10	2.11		Nov	1163.63	31.15	5.54	3.21	2.33
	Jun	670.63	19.52	7.30	5.12	2.18		Dec	1229.23	32.34	5.47	3.09	2.38
	Jul	639.96	18.80	7.23	5.32	1.91	1999	Jan	1279.64	32.64	5.49	3.06	2.43
	Aug	651.99	19.08	7.17	5.24	1.93		Feb	1238.33	32.91	5.66	3.04	2.62
	Sep	687.31	19.65	7.26	5.09	2.17		Mar	1286.37	34.11	5.87	2.93	2.94
	Oct	705.27	20.08	6.95	4.98	1.97		Apr	1335.18	35.82	5.82	2.79	3.03
	Nov	757.02	20.92	6.79	4.78	2.01		May	1301.84	34.60	6.08	2.89	3.19
	Dec	740.74	20.86	6.73	4.79	1.94		Jun	1372.71	35.77	6.36	2.80	3.56
1997	Jan	786.16	21.46	6.95	4.66	2.29		Jul	1328.72	35.58	6.34	2.81	3.53
	Feb	790.82	20.51	6.85	4.88	1.97		Aug	1320.41	36.00	6.35	2.78	3.57
	Mar	757.12	20.45	7.11	4.89	2.22		Sep	1282.70	30.92	6.50	3.23	3.27
	Apr	801.34	20.69	7.23	4.83	2.40		Oct	1362.92	31.61	6.66	3.16	3.50
	May	848.28	21.25	7.08	4.71	2.37		Nov	1388.91	32.24	6.48	3.10	3.38
	Jun	885.14	22.09	6.93	4.53	2.40		Dec	1469.25	33.29	6.69	3.00	3.69

been replaced by a weak economy, weak commodity scenario.

US stock market

• The long bond interest rate is low but earnings are dropping fast. Still, the bond-stock measure is not in the danger zone, and has not been there since late 2001.

• Put prices greatly exceed call prices, so my short-term crash measure is not applicable either.

• Subprime mortgage and credit market problems are far from resolved, even with all the new interventions.

• Growth stocks like AAPL have had rollercoaster rides – returned to or exceeded pre-August 16, 2007 highs and then have fallen again.

• Hedge fund computer valuation models, which failed in August 2007, became long the actual good stocks and short the weaker ones. In the September to October 2008 steep decline, again, the good was sold.

• Correlations were changing fast on pairs of stocks. One day A and B would move together with an S&P move, another day they would diverge with no A or B news and a similar S&P move.

• There have been a number of sharp rallies in the bear market, but the trend has been down.

• The VIX volatility fear index has been sharply rising, reaching record levels.

• Market turbulence is likely to continue for at least a year, as there is much uncertainty about the full extent of the housing downturn and the subprime losses.

• The decision not to save Lehman – possibly politics between them and Paulson's former firm Goldman Sachs – was a savage blow to the equity and other markets.

• While the Fed and Treasury are innovating in attempts to avert a severe recession, they cannot do this. Fiscal policy is needed, but there is no latitude for this, given the twin deficits. The new $700 billion fund to purchase bad debt is a response to this ... its effect? Letting banks use this money to pay dividends does not seem wise as a way to loosen credit.

Currencies

• US Treasury Secretary Henry Paulson, former Chairman and CEO of Goldman Sachs, said in 2007 that there was still a strong dollar policy.

• At the time, Goldman Sachs research forecasted further dollar declines and a euro going to the 1.45 area.

• The trade-weighted euro peaked in 1985 at 1.45. The euro zone cannot exist well with the euro so high, so the rise seems limited.

• The euro peaked in 2008 at 1.60; then, in the third quarter of 2008 it fell to 1.37, then back to 1.46, and now is about 1.26, all part of the 2008 high volatility.

• The euro's decline was matched and exceeded by those of the pound and commodity currencies. Late in 2007 and early in 2008, the worsening economic outlook and Fed rate cuts contributed to further declines in the dollar as investors continued to turn to the currencies of hawkish central banks in the face of higher global inflationary threats.

• In the third quarter, a reassessment of global outlook, not just the US, contributed to a dollar rally, unwinding of carry trades, and a shift away from anything seen as risky.

Europe

• The outlook looks bleak there as well, perhaps even worse than in the USA.

• The euro and pound sterling have fallen dramatically and are still shaky.

• London has finally had a shock in the main thing they do: financial services.

• Italy, Portugal, and other countries are close to collapse.

Iceland

• The bond-stock measure predicted Iceland's stock market to crash, and it did. Interest rates were 14 percent short, 9–10 percent long!

Figure 8: Fed model, 1980–2003, logs of bond-stock yields. Source: Ziemba (2003)</

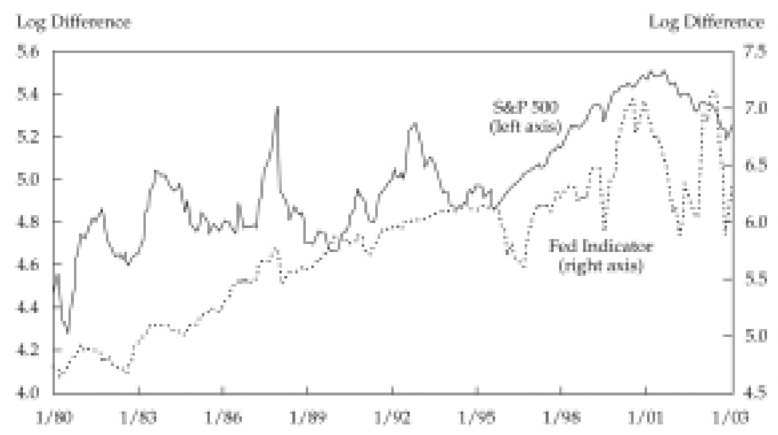
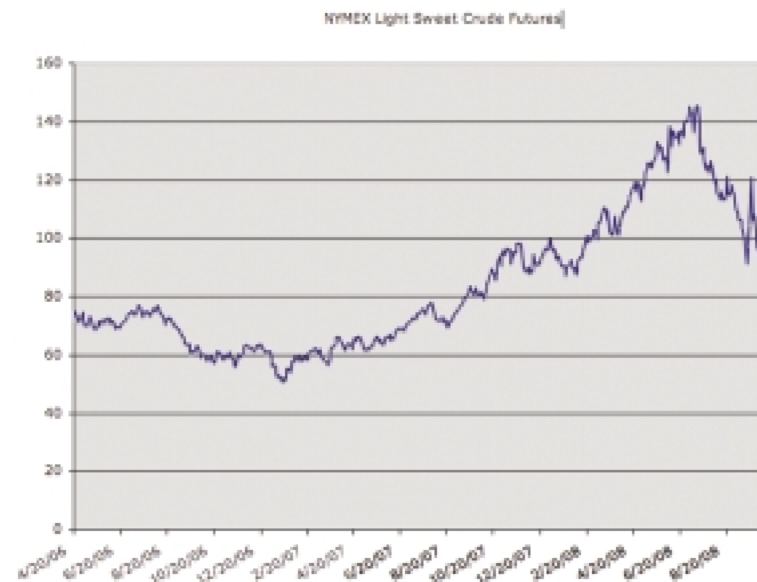


Figure 9: Oil prices. Source: Bloomberg



• PEs were low, but the earnings part fell and the banks had too much leverage.
• Now, interest rates are 18 percent and the currency has declined 44 percent in the past year. The chapter in Ziemba and Ziemba (2007) gives background on Iceland and how fragile it was: a mouse that roared and was stepped on by the credit crisis elephant.
• The banking sector assets were more than 10 percent GDP, meaning that the Iceland government could not bail them out.
• Iceland was equal to a hedge fund, so that they are now seeking a loan from the Russians and maybe the IMF (they are negotiating for $2 billion).
• They are arguing with the British government for repayment over dealings with the collapse of the Kaupthing Bank. Iceland is frozen. Indeed, 1.34 billion of the deposits of 8,000 people are not redeemable now and may never be paid back. These types of counterparty risk abound with Lehman and other failed institutions not returning money to rightful owners.

Across the board, European governments are seeking to support their banks, increasing insured deposit levels, and some have nationalized failing institutions. But some of the banks are too big to fail and too big to save (e.g., some of the German banks). EU leaders are now trying to act in concert. EE countries are exposed to EU and with C/A deficits.

What is a subprime loan and why have they caused so much trouble in so many places?

Subprime loans: loans to borrowers who don't qualify for best interest or with terms that make the borrower eventually unqualified as with zero downpayment, zero interest.

In general: lending institutions inherently get it wrong. When times are good, they tend to be greedy and try to maximize loan profits, but then they are very lax in their evaluation of borrowers' ability to pay current and future mortgage payments.

Japan in the late 1980s: real estate and stocks, eventually 5T/5T was lost = 10T

Now, the lending organizations sell off the mortgages and they are cut, diced, bundled into packages like CMOs and CDOs, and sold to others, who have trouble figuring out what's in them but look at the rating agency's stamp of approval.

During July to October 2008, most hedge funds and investors lost money, and a lot of it. Most are below their benchmarks. The hedge fund group I consult for was way ahead of the curve, so did well. Nouriel Roubini, of RGEmonitor, has also been consistently right. Those who went into cash early or shorted, did well, but most did not. Figure 11, which shows the volatility of gold, oil, the euro, the pound and the S&P 500, illustrates the trouble. Fear took over markets, with a small scrap of news causing large moves in short periods. Gold has been points in a short time on several occasions. Changing correlations and the high VIX were much of the problem. Oil and gold were highly correlated in the period with August 2008 then decoupled then rejoined. Currencies have gone up with commodities and then down as they fell, with violent short-term moves. The reaction to similar news was contradictory. For example, when the US $700 billion bailout was announced, the S&P 500 exploded up. Then, when the budget did not pass, the market fell; but then when it did, it fell more.

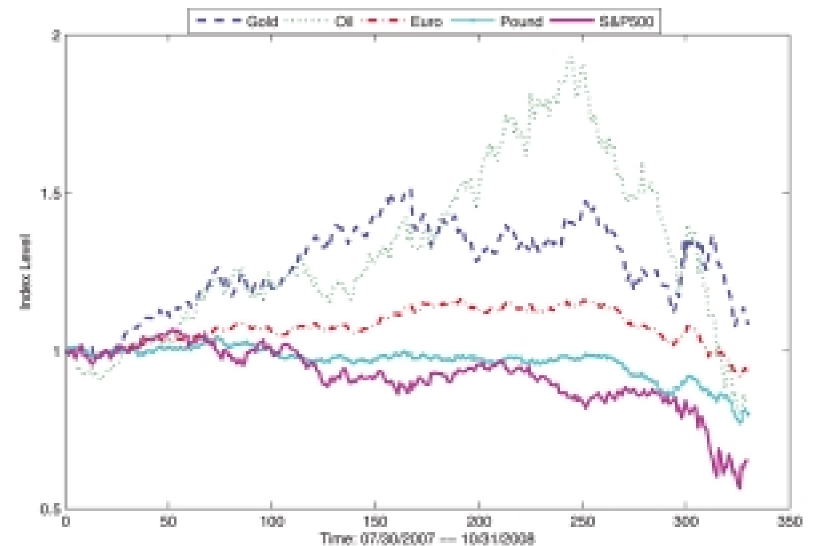
What will the new administration mean for the economy? Historically, stock markets do much better with Democratic than with Republican presidents (see Keim and Ziemba, 2000), and Obama is a huge 1:6 favorite on the betting exchanges. Look for a landslide!

Some $800 billion was lost by the top 20 Russian billionaires.

As usual, the culprit is the recipe for disaster.
• You must be well diversified in *all* scenarios. But even those who tried had trouble because of the changing correlations and differing reaction to similar news; and
• you must not overbet – and here it has been tricky as well; what was not an overbet situation

Figure 10: Gold. Source: http://www.kitco.com

Figure 11: Comparing the volatility of gold, oil, the euro, the pound, and the S&P 500



with VIX of 30 percent becomes overbet at VIX = 50 percent, and way overbet with VIX in the 70s or 80s. As shown in Figure 12, the VIX peaked at 90 and is still a very hefty 60 percent after the end of October turn of the month rally in the S&P 500.

The trouble is worldwide, and so is the volatility. The Japanese Nikkei stock average had its best week in history last week, in its worst month in history. There are some positive signs among the darkness. Buffett is buying and got free call options on GE and Goldman Sachs by effectively loaining them money at 10 percent through preferred shares. There is considerable purchasing by institutions buying for the *long term* at what they feel are cheap prices. Eventually, the darkness will lift and the stock market will precede the economy's recovery. The stakes are too high for a full collapse, so look for more and more government actions. The Fed is already $1 trillion into this, and the Treasury a lot as well. Too bad they didn't see the problem earlier, as did Roubini, Krugman, and Shiller.

The US presidential election has now occurred and, as I predicted, it was a big victory for Barack Obama and good for my Betfair and Matchbook betting exchange wagers. The turn-of-the-month of November has ended with the usual strong gain of over 15 percent with the VIX dropping from 70 to 47. The post election reaction is a return to the bad news and a 10 percent decline in the S&P 500 in the next two days and a modest rally Friday. Eventually the market will rally but it remains tense with the VIX back into the low 50s then back over 60 percent on Friday.

The VIX seems likely to remain at these high levels for the rest of the year.

Figure 12: VIX. Source: Yahoo Finance

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