



UNIVERSITY OF CALGARY
HASKAYNE SCHOOL OF BUSINESS

Investments & Portfolio Management

Usefulness of Derivatives for Portfolio Management

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Not only the future is uncertain, but negative returns, even sustained negative returns experienced during market downturns, are common place, across all asset classes.

- Market downturns and negative cumulative returns can delay or even prevent investors reaching their goals, go against their preferences and not comply with their constraints.
- There is no easy and cost-less solution to address that issue, even partially.

Limits to diversification

- It has been observed that correlations, within, across asset classes and even globally across markets, tend to increase when securities markets are under duress, at therefore decrease the benefits of diversification at times when investors need diversification the most.
- Given their nature, systemic risks, like macro-economic drivers, cannot be diversified away (maybe a little but not much).
- See video on Coursera [here](#).

Hedging refers to techniques that offset particular sources of risk.

Static hedging (e.g. 'immunizing' by matching an asset portfolio to the portfolio of liabilities)

- Consist in matching a position (asset or liability) with its opposite having the same characteristics (expected cash flows or expected value, and risk exposures).
- As long as the initial position to be hedged is maintained, and assuming a valid static hedge position has been put in place, the hedge is expected to hold under various market conditions without having to re-balance-it.

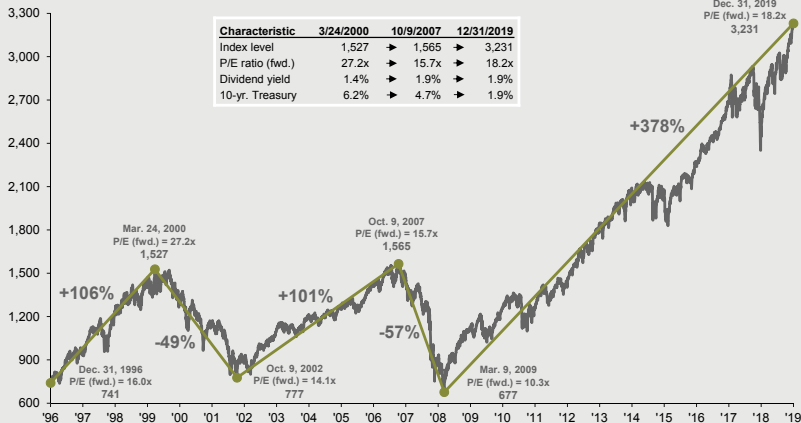
Dynamic hedging

- Dynamic hedging refers to various strategies that use changes in current market conditions and/or expected changes in market conditions to vary the degree of hedging used.
- Conceptually attractive, but in real life when many investors use such strategies simultaneously they work less than expected, not at all, or can even be counterproductive (e.g. portoflio insurance, which is deemed to have contributed to Black Monday).

What is the evidence (i.e. past data) telling us about negative returns?

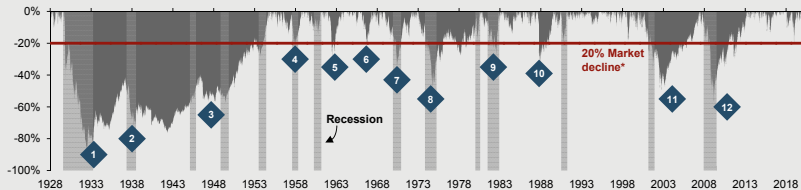
- Negative returns can be sustained through time for a long time. Such bear market can erase all cumulative returns gained through the just preceding bull market (e.g. US 1996 to 2000 to 2002, and then again 2002 to 2007 to 2009).
 - ▶ A bear market is defined as a 20% or more decline from the previous market high.
 - ▶ Bull markets nevertheless deliver on average returns that more than compensate for bear markets (i.e. about four times more return, +162% vs -42%).
- Even if the average return for a year is positive, some intra-year declines are likely to take place and can be significant.
- On average, the first year after an equity market peak almost cancels all returns earned in the year before the peak.

S&P 500 Price Index



Source: Compustat, FactSet, Federal Reserve, Standard & Poor's, J.P. Morgan Asset Management. Dividend yield is calculated as consensus estimates of dividends for the next 12 months, divided by most recent price, as provided by Compustat. Forward price to earnings ratio is a bottom-up calculation based on the most recent S&P 500 Index price, divided by consensus estimates for earnings in the next 12 months (NTM), and is provided by FactSet Market Aggregates. Returns are cumulative and based on S&P 500 Index price movement only, and do not include the reinvestment of dividends. Past performance is not indicative of future returns. *Guide to the Markets* – U.S. Data are as of December 31, 2019.

S&P 500 composite declines from all-time highs



Characteristics of bull and bear markets

Market Corrections	Bear markets			Macro environment				Bull markets		
	Market peak	Bear return*	Duration (months)*	Recession	Commodity spike	Aggressive Fed	Extreme valuations	Bull begin date	Bull return	Duration (months)
1 Crash of 1929 - Excessive leverage, irrational exuberance	Sep 1929	-86%	32	◆			◆	Jul 1926	152%	37
2 1937 Fed Tightening - Premature policy tightening	Mar 1937	-60%	61	◆		◆		Mar 1935	129%	23
3 Post WWII Crash - Post-war demobilization, recession fears	May 1946	-30%	36	◆			◆	Apr 1942	158%	49
4 Eisenhower Recession - Worldwide recession	Aug 1956	-22%	14			◆	◆	Jun 1949	267%	85
5 Flash Crash of 1962 - Flash crash, Cuban Missile Crisis	Dec 1961	-28%	6				◆	Oct 1960	39%	13
6 1966 Financial Crisis - Credit crunch	Feb 1966	-22%	7			◆	◆	Oct 1962	76%	39
7 Tech Crash of 1970 - Economic overheating, civil unrest	Nov 1968	-36%	17	◆	◆	◆		Oct 1966	48%	25
8 Stagflation - OPEC oil embargo	Jan 1973	-48%	20	◆	◆			May 1970	74%	31
9 Volcker Tightening - Whip Inflation Now	Nov 1980	-27%	20	◆	◆	◆		Mar 1978	62%	32
10 1987 Crash - Program trading, overheating markets	Aug 1987	-34%	3				◆	Aug 1982	229%	60
11 Tech Bubble - Extreme valuations, .com boom/bust	Mar 2000	-49%	30	◆			◆	Oct 1990	417%	113
12 Global Financial Crisis - Leverage/housing, Lehman collapse	Oct 2007	-57%	17	◆	◆	◆		Oct 2002	101%	60
Current Cycle								Mar 2009	378%	129
Averages	-	-42%	22					-	164%	54

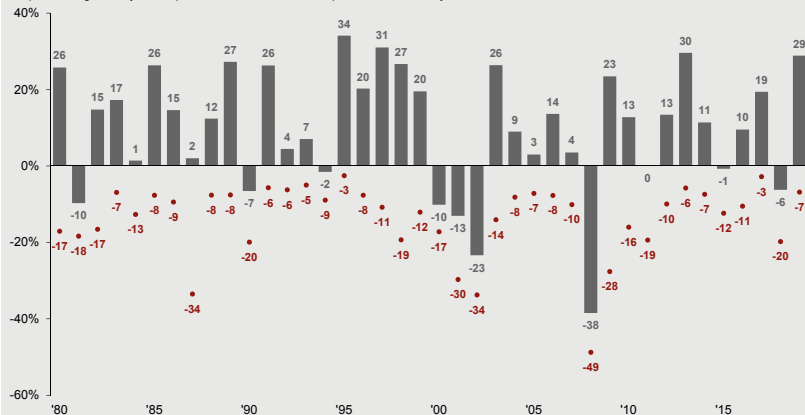
Source: FactSet, NBER, Robert Shiller, Standard & Poor's, J.P. Morgan Asset Management.

*A bear market is defined as a 20% or more decline from the previous market high. The related market return is the peak to trough return over the cycle. Periods of "Recession" are defined using NBER business cycle dates. "Commodity spikes" are defined as movement in oil prices of over 100% over an 18-month period. Periods of "Extreme Valuations" are those where S&P 500 last 12 months' P/E levels were approximately two standard deviations above long-run averages, or time periods where equity market valuations appeared expensive given the broader macroeconomic environment. "Aggressive Fed Tightening" is defined as Federal Reserve monetary tightening that was unexpected and/or significant in magnitude. Bear and Bull returns are price returns.

Guide to the Markets - U.S. Data are as of December 31, 2019.

S&P 500 intra-year declines vs. calendar year returns

Despite average intra-year drops of 13.8%, annual returns positive in 30 of 40 years



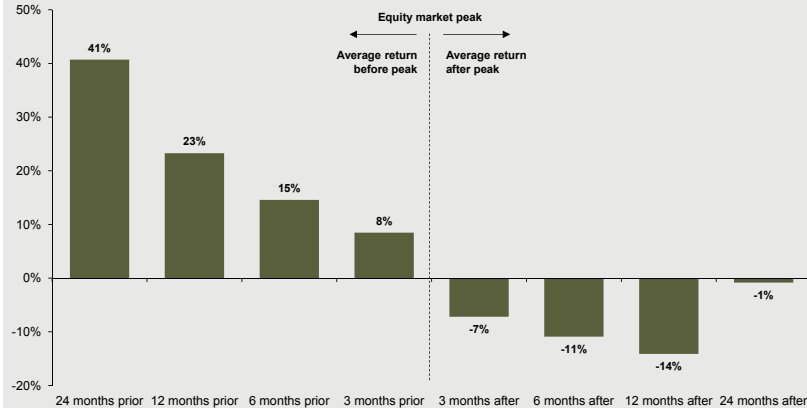
Source: FactSet, Standard & Poor's, J.P. Morgan Asset Management.

Returns are based on price index only and do not include dividends. Intra-year drops refers to the largest market drops from a peak to a trough during the year. For illustrative purposes only. Returns shown are calendar year returns from 1980 to 2019, over which time period the average annual return was 8.9%.

Guide to the Markets – U.S. Data are as of December 31, 2019.

Average return leading up to and following equity market peaks

S&P 500 total return index, 1945 - 2019

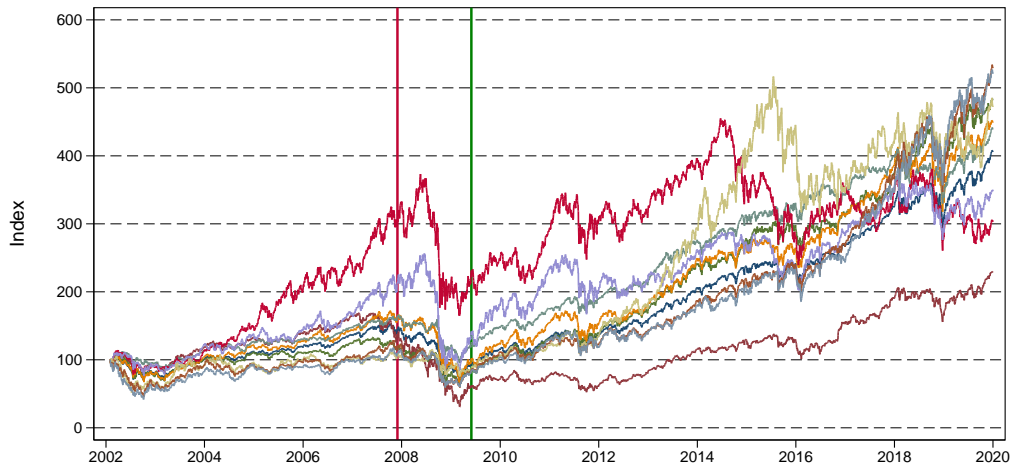


Source: FactSet, Robert Shiller, Standard & Poor's, J.P. Morgan Asset Management.

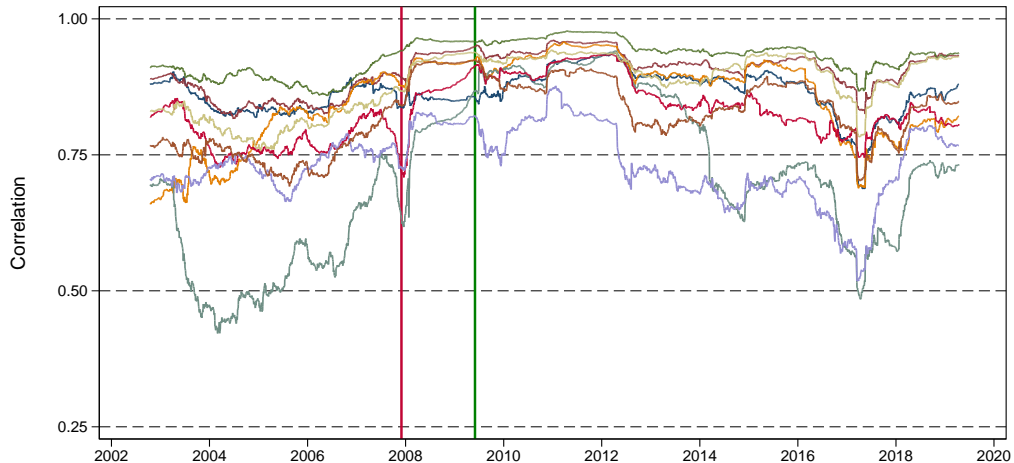
Chart is based on return data from 11 bear markets since 1945. A bear market is defined as a decline of 20% or more in the S&P 500 benchmark. Monthly total return data from 1945 to 1970 is from the S&P Shiller Composite index. From 1970 to present, return data is from Standard & Poor's. *Guide to the Markets* - U.S. Data are as of December 31, 2019.

One way to look into the effectiveness of diversification is how returns evolve and are correlated to market across industrial sectors. Let's illustrate that using ETFs (2002 to 2019).

		\bar{r}	σ	Sharpe	$\hat{\beta}$	$\hat{\rho}$
IVV	Core S&P 500	9.1%	0.139	0.66	1	1
IYG	U.S. Financial Services	7.1%	0.214	0.33	0.55	0.84
IYC	U.S. Consumer Services	10.4%	0.154	0.67	0.82	0.92
IYJ	U.S. Industrials	10.0%	0.174	0.58	0.76	0.94
IYK	U.S. Consumer Goods	9.4%	0.120	0.78	0.96	0.84
IYE	U.S. Energy	8.4%	0.209	0.40	0.45	0.67
IYM	U.S. Basic Materials	9.8%	0.217	0.45	0.52	0.85
IBB	Nasdaq Biotechnology	10.7%	0.216	0.49	0.43	0.66
IGM	Expanded Tech Sector	12.0%	0.205	0.58	0.60	0.88
IGV	Expanded Tech-Software	12.2%	0.212	0.58	0.55	0.83



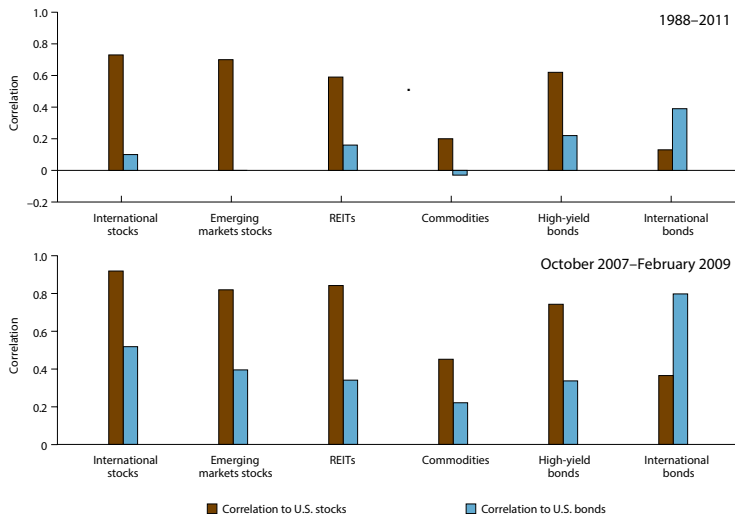
Beginning and ending of the great recession indicated respectively by a red line and a green line.



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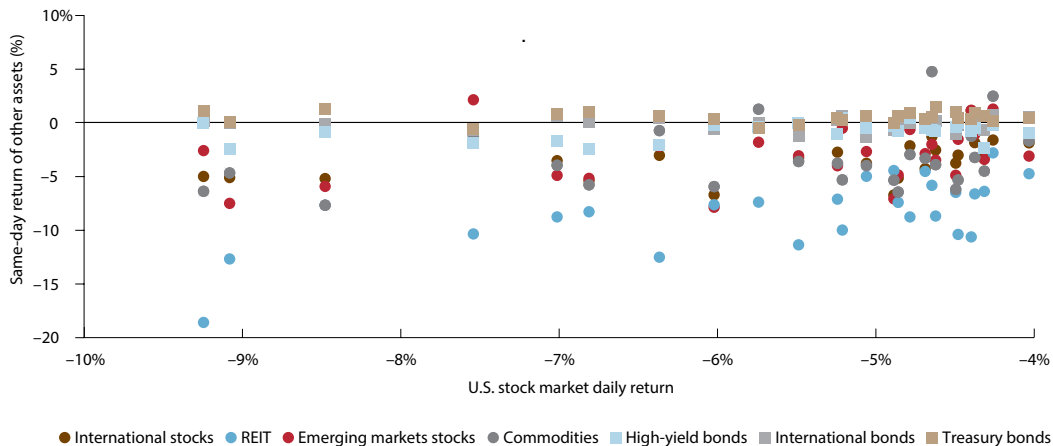
Correlations across global asset classes (source: Vanguard)

12/19



Diversification also comes as magnitude of return (source: Vanguard) 13/19

Days when U.S. stocks were down 4% or more: October 2007–December 2011



Derivatives are various types of zero-sum contracts between two counterparties which cash and risk transfer between them are governed by the market price of an underlying.

- Derivatives contracts allow for hedging and speculation, and play a critical role in modern financial risk management.
- It is deemed that usually a derivative contract is created between an hedger and a speculator.
- Most liquid derivatives are typically of relatively short duration (one month to a year).

There are four fundamental types of derivatives.

- Forwards (custom-made, non-standardized)
- Futures (standardized, exchange-traded)
- Options (standardized, exchange-traded)
- SWAPs (custom-made, non-standardized)

The underlying of a derivative can be anything as long as it is observable.

- Securities, like stocks and indexes
- Commodities, like crude oil or orange juice
- Events, like credit default or weather

A portfolio of securities (assets), or a combined portfolio of assets and liabilities, is exposed to various risks. Portfolio risk management consists in first identifying and quantifying those risks, and then deciding how to best manage them on behalf of the beneficiary of the portfolio.

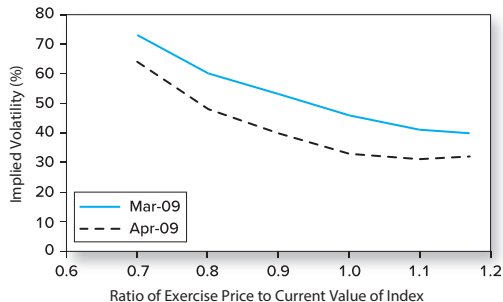
Type of risks

- Market risk (potential for adverse market price movements to erode the value of the portfolio)
 - ▶ Equity risk
 - ▶ Interest rate risk
 - ▶ Currency risk
 - ▶ Commodity risk
- Volatility risk (changes in the volatility of a risk factor)

The risk profile of a portfolio can be altered (decreased or increased) by using natural hedges (e.g. immunization) or derivatives. However, misuse of derivatives are known to have created large-scale financial debacles, several of which led to the demise or loss of reputation for the firms involved.

A portfolio of long equity positions can be protected against market declines by buying put options.

- The protection depends on how close to market prices are the exercise prices of the put options.
- But, as the price of a put option is higher the higher its exercise (strike) price, such protection could prove costly if the market decline does not occur (i.e. the options expire worthless).
- Furthermore, options mature and such protection need to be rolled-over at maturity.
- The price of options is also driven by volatility, so when the protection would be most useful its price will be much higher (and the rollover would be at much higher price for protection).



The lower the 'moneyness', i.e. the lower the exercise price of the option in relation to the market price of the underlying, the higher the implied volatility, and therefore the higher the price of the option.

So, it is possible to buy protection only against severe declines in market prices at a lower cost, but the relative price is higher.

It is possible to use futures to hedge a given risk exposure.

- e.g. use stock market index futures to hedge a long equity exposure, by selling on the future exchange the required amount of futures on the appropriate equity index.

It is also possible to use a SWAP to hedge a given risk exposure.

- e.g. enter into a credit default SWAP, 'CDS', to hedge the credit-risk exposure of a given fixed-income position.

Using futures and SWAPs allow to hedge your entire position or partially hedge it, at your choice.

- However what has been hedged result in a risk transfer that will likely simultaneously reduce both the portfolio risk and its return.
- An equity position that has been hedged using stock market index futures will be approximately market neutral, therefore unlikely to deliver an equity premium.
- A fixed income position that has been hedged through a CDS had its credit risk removed, therefore unlikely to deliver a credit risk premium.
- So, this is often done on a temporary or strategic basis when uncertainty is expected to become temporarily high or as a component of an investment strategy to remove a specific risk.

Diversification is the cornerstone of portfolio management and allows for an improved risk-reward trade-off by reducing unsystematic risk for which there is no reward.

However, the effectiveness of diversification can vary according to market circumstances (i.e. correlations turning out to be higher than expected).

- Diversification could prove to be less potent than expected i) across securities within an asset class, ii) across market sectors within an asset class, iii) across asset classes, and iv) even across different economies.
- However, diversification using an equity-bond mix has proven often to work well in mitigating systemic risk like the business cycle.

Hedging portfolio risk using natural hedges or derivatives should be investigated and implemented if found beneficial under a cost-benefit approach (especially to ensure a portfolio performance that would better match the investor's goals, preferences and circumstances).

Learning Objectives covered

- Chapter 20: L01, pages 662 and 663 (protective puts)
- Chapter 21: L01, pages 715 to 717, example 21.7, and L06
- Chapter 22: L01 and example 22.5
- Chapter 23: L02 (including example 23.4), pages 785 to 785 (including example 23.7)

Concept checks

- Chapter 20: Concept checks 1 and 2 (solutions provided at the end of the chapter).
- Chapter 21: Concept checks 1 and 2 (solutions provided at the end of the chapter).
- Chapter 22: Concept check 1 (solution provided at the end of the chapter).
- Chapter 23: Concept check 4 (solution provided at the end of the chapter).

Exercises

- None (but have a good look at examples 20.3, 21.7, 22.5, 23.4, and 23.7 of the textbook)