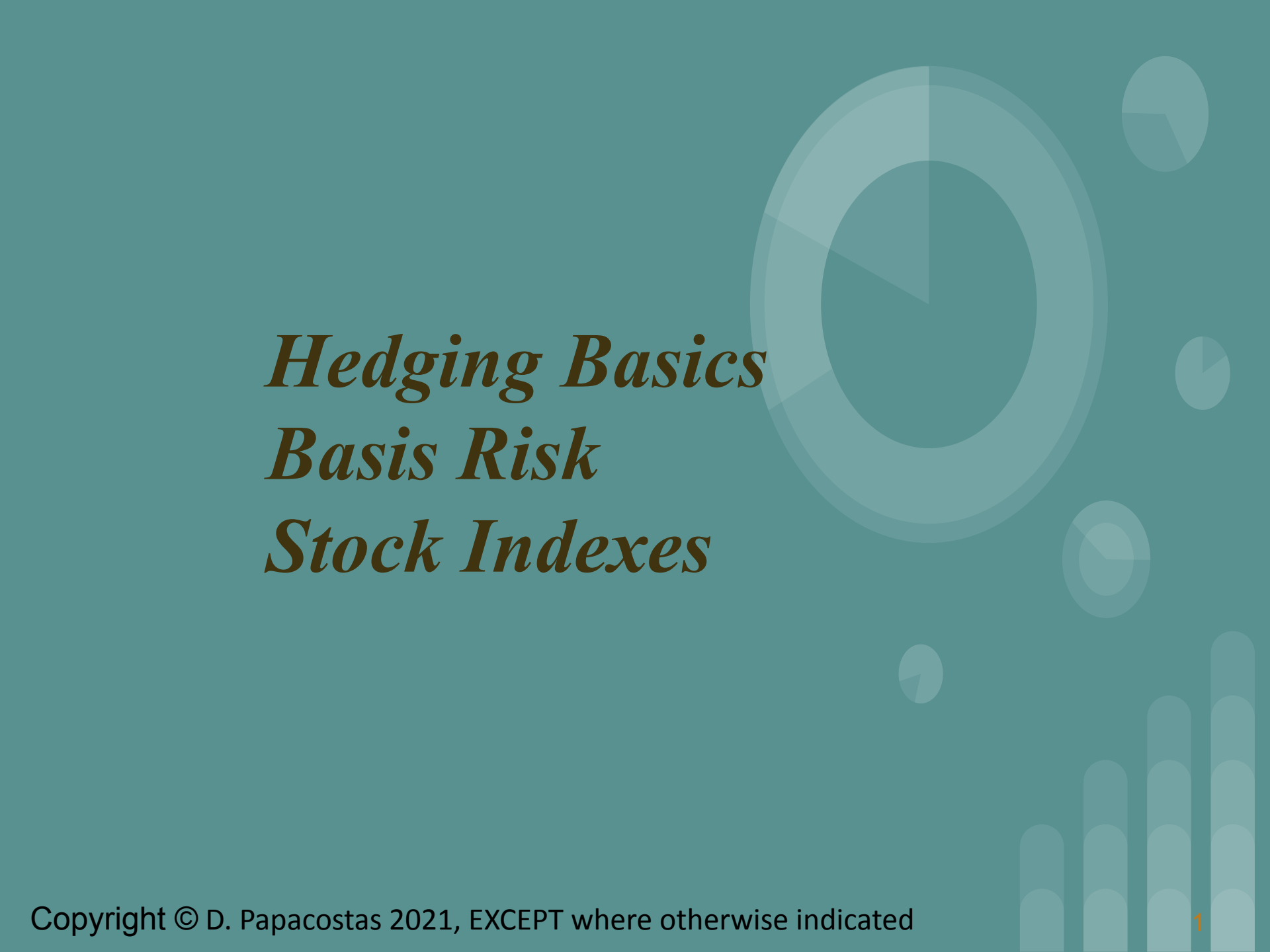




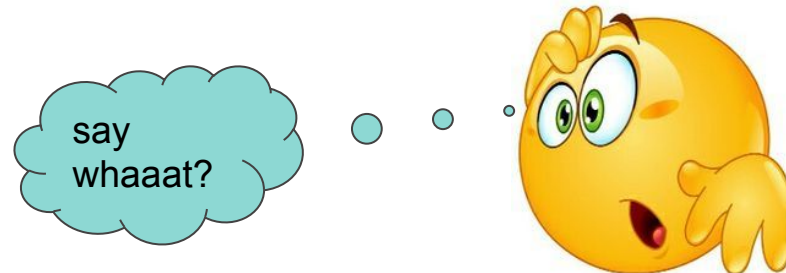
Hedging Basics

Basis Risk

Stock Indexes

Long Hedges

- Buying (going long) a forward or futures to hedge, is appropriate when you know you will need to purchase an asset in the future and want to lock in the price
- Which means.... right now you are short the underlying for that future date.



Short Hedges

- Selling (going short) a forward or futures to hedge, is appropriate when you know you will need to sell an asset in the future and want to lock in the price
- Which means.... right now you are long the underlying for that future date

Hedging Example

- Oil producer will have 10 million barrels of WTI produced for Sep 2021. Her books are marked at the prevailing market price.

Spot WTI on 2/8/20 is \$40.25

Sep futures **CLU0** is \$42.78

Recall the contract size is 1,000 barrels

Hedging Example

where did the numbers come from?



Hedging Example

- Oil producer will have 10 million barrels of WTI produced for Sep 2021. Her books are marked at the prevailing market price.

Spot WTI on 2/8/20 is \$40.25

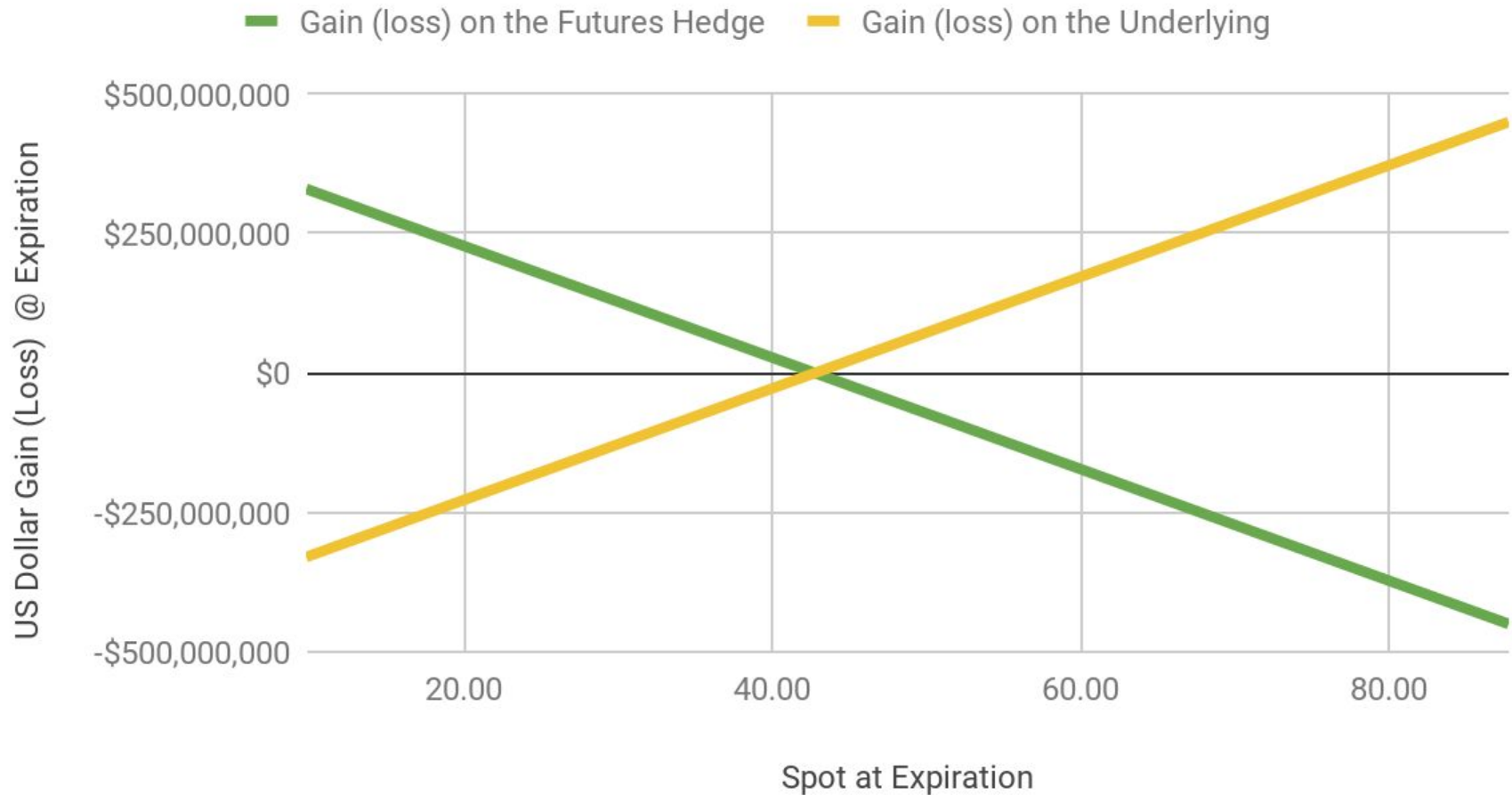
Sep futures **CLU0** is \$42.78

Recall the contract size is 1,000 barrels

1. *What is at risk if you do not hedge?*
2. *Are you long or short in the underlying?*
3. *How would you hedge this risk with futures?*

Hedging Example

Compare an Underlying vs Forward at Expiration



Arguments in Favor of Hedging

- Companies should focus on their main revenue generating activities. Hedging should be undertaken to minimize risks unrelated to the main business, such as FX, interest rates, and commodity price fluctuation.
- Tempted by their owners brilliance to master other markets
- The need to make a difference as an analyst
 - Dell Computers, Porsche, etc etc



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They
never
learn

Arguments against Hedging

- Shareholders can make their own hedging decisions...really?
- It may increase risk to hedge when competitors do not... or visa versa.
- Internal politics, human nature and explaining spending money on protection...

What's my upside if I'm right?

Hedging in the Real World

- Timing Basis Risk
 - Rarely are amounts and delivery times known with certainty or remain constant
- Asset Class Liquidity Risk
 - Not all risks have relevant futures or liquid OTC market makers

Managing Basis Risk - choice of contract

- **Timing basis.** The hedge and exposure do not coincide perfectly and the shift in the curve can result in P&L
- Choose a hedge date that is as close as possible to the hedge item delivery. Be prepared to roll. In FX this creates most of the volume and it is called a swap.

Managing Basis...choice of asset

- **Asset class basis.** Hedge using another highly correlated instrument.
- When there is no perfect asset futures or liquidity in the asset you need to hedge, hedge with an asset whose price is most highly correlated.

Optimal Hedge Ratio - Cross Asset Basis

Proportion of the exposure that should optimally be hedged is

where
$$h^* = \rho \frac{\sigma_S}{\sigma_F}$$

σ_S is the standard deviation of ΔS , the change in the spot price during the hedging period,

σ_F is the standard deviation of ΔF , the change in the futures price during the hedging period

ρ is the coefficient of correlation between ΔS and ΔF .

Three important players

Hedgers

Manufacture & Offer Services

focus on the main
business reduce non
fundamental risk

take steps to minimize
risks arising from interest
rates, exchange rates, and
other market variables

Speculators

Use their capital to trade risk

focus on managing risk to
make money for their
capital investors

take steps to take on the
risk the hedgers don't want,
and in the process make a
profit

Asset Managers

Use their capital to get a good
return & preserve capital

focus on getting a good
return while managing the
inherent risk

take steps to buy and sell
equities and debt
instruments

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Trends in Equity Investing

- **Active Hedging Requires**

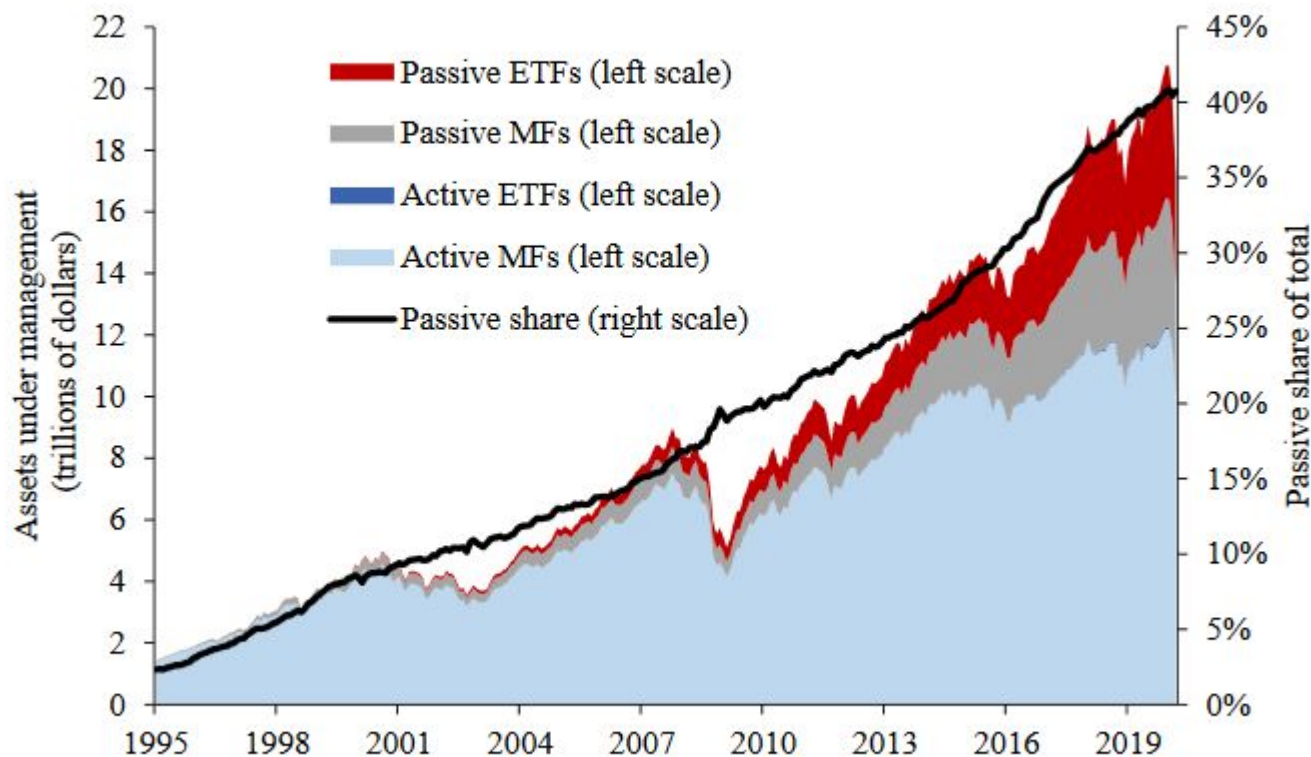
- a hands-on approach to find and buy or sell the best stocks.
- a portfolio manager or active participant.

- **Passive Investing**

- One buys-and-holds a portfolio strategy for long-term investment horizons, with minimal trading in the market.
- Index investing is the most common form of passive investing
- Investors seek to replicate and hold a broad market index or indices.
- Passive investment is cheaper, less complex

Trends in Equity Investing

Figure 1: Total assets in active and passive MFs and ETFs and passive share of total



Source: Morningstar, Inc.

Trends in Equity Investing

- Passive vs Active Hedging
 - Stock Indexes
 - ETFs
- A different kind of hedging than Corporations
- How to mimic an Index

Stock Index (Passive)

- Stock Index Track changes in the value of a hypothetical portfolio of stocks
- The weights of the individual stocks do not remain fixed.
- Weights can proportional to market prices, capitalization
- Index calculation and maintenance is a big business

Equity Indexes

- The S&P 500 index is a market-cap weighted index. It's calculated by taking the sum of the adjusted market capitalization of all S&P 500 stocks and then dividing it with an index divisor, which is a proprietary figure developed by Standard & Poors.

SPX Index		Display ▾	Export ▾	Alert	Member Weightings		
S&P 500 Index		505 Members			Currency LCL ▾		
Members		Historical Summary					
3) Stats		Group by None ▾		4) Fields		As of 02/27/2019 📅 ↺ 🔍	
	Ticker	Name ↑	Weight (%)*	Shares	Price	IR Address Second Line	IR Address Third Line
11)	MMM	UN 3M Co	0.519508	582.287000	209.3800	3m Center	St. Paul, Mn...
12)	ABT	UN Abbott Laboratories	0.574388	1,756.333000	76.7500	100 Abbott ...	North Chica...
13)	ABBV	UN AbbVie Inc	0.516036	1,504.216000	80.5100	1 N Waukega...	North Chica...
14)	ABMD	UW ABIOMED Inc	0.065803	45.040000	342.8700	22 Cherry Hi...	Danvers, Ma...
15)	ACN	UN Accenture PLC	0.438236	637.449000	161.3400	1 Grand Can...	Dublin, 2
16)	ATVI	UW Activision Blizzard...	0.136820	763.051000	42.0800	3100 Ocean ...	Santa Monic...
17)	ADBE	UW Adobe Inc	0.543333	488.134000	261.2200	345 Park Av...	San Jose, C...
18)	AAP	UN Advance Auto Parts...	0.050604	72.894000	162.9200	5008 Airport...	Roanoke, Va...
19)	AMD	UW Advanced Micro De...	0.090728	879.478160	24.2100	2485 August...	Santa Clara,...
20)	AES	UN AES Corp/VA	0.048794	662.297000	17.2900	4300 Wilson...	Arlington, V...
21)	AMG	UN Affiliated Managers...	0.024792	52.673000	110.4600	600 Hale Str...	Prides Cros...
22)	AFL	UN Aflac Inc	0.158658	761.279000	48.9100	1932 Wynnto...	Columbus, G...
23)	A	UN Agilent Technologi...	0.106695	318.770000	78.5500	5301 Steven...	Santa Clara,...
24)	APD	UN Air Products & Che...	0.169738	219.534000	181.4500	7201 Hamilt...	Allentown, P...
25)	AKAM	UW Akamai Technologi...	0.048301	162.866000	69.6000	150 Broadw...	Cambridge, ...
26)	ALK	UN Alaska Air Group Inc	0.033068	123.300000	62.9400	19300 Inter...	Seattle, Wa ...
27)	ALB	UN Albemarle Corp	0.041182	106.206000	91.0000	4350 Congre...	Charlotte, N...
28)	ARE	UN Alexandria Real Est...	0.062368	107.527000	136.1200	445 Park Av...	New York, N...
29)	ALXN	UW Alexion Pharmaceu...	0.126710	223.097000	133.2900	121 Seaport...	Boston, Ma ...

Why Hedge Equity Returns

- May want to be out of the market for a while. Hedging avoids the costs of selling and repurchasing the portfolio. (changing the profile of your risk)
- **Benchmarking**
- Outperformance. Suppose stocks in your portfolio have an average beta of 1.0, but you feel they have been chosen well and will outperform the market in both good and bad times. Hedging ensures that the return you earn is the risk-free return plus the excess return of your portfolio over the market.

What is Beta (Active)

- **Beta** is a measure of systematic risk, of a portfolio relative to the benchmark.
- Beta is used in the capital asset pricing model (CAPM), which calculates the expected return of an asset based on its beta and expected market returns.

Hedging Using Index Futures

No spot instrument on an index BUT there are futures

To hedge the risk in a portfolio the number of contracts that should be shorted is

$$\beta \frac{V_A}{V_F}$$

where V_A is the value of the portfolio, β is its beta, and V_F is the value of one futures contract

Example

S&P 500 futures price is 3,377

1- Value of Portfolio (V_a) is \$15,00,000 million

2- Value (V_f) is $3,377 \times \$250/\text{contract} = \$844,250$

1. What position in futures contracts on the S&P500 is necessary to hedge the portfolio?
2. What beta is implied?

Example

1. What position in futures contracts on the S&P500 is necessary to hedge the portfolio?

$$\$15\text{mm}/\$844,250 = 17.77 \text{ contracts}$$

2. What beta is implied?

$$\text{beta} = 1$$

Changing Beta

- What position is necessary to reduce the beta of the portfolio to 0.75?
- What position is necessary to increase the beta of the portfolio to 2.0?

Changing Beta

- What position is necessary to reduce the beta of the portfolio to 0.75?

$$.75 \times 15,000,000 / 844,250 = 13 \text{ contracts}$$

- What position is necessary to increase the beta of the portfolio to 2.0?

$$2 \times 15,000,000 / 844,250 = 35.5 \text{ contracts}$$

Stack and Roll - mechanics

- We can roll futures contracts forward to hedge future exposures
- Initially we enter into futures contracts to hedge exposures up to a time horizon
- Just before maturity we close them out and replace them with new contract reflecting the new exposure

Cash Flow Liquidity Issues

- In any hedging situation there is a danger that losses will be realized on the hedge while the gains on the underlying exposure are unrealized. Closed out my futures I have to MTM, but my portfolio is still open.
- This can create liquidity problems
- One example is Metallgesellschaft which sold long term fixed-price contracts on heating oil and gasoline and hedged using stack and roll
 - The price of oil fell.....

Step 3 & 4 - Mark to Market (MTM)

- All exposures are Marked to Market
- Prices must be real market prices reflecting reality
- Gains and Losses are recorded relative to the last MTM

Step 3 - Mark to Market of Exposures & Initial Hedge

Wine importer has a Euro 1MM payable in one year for wine						
	Underlying Exposre			Forward Hedge Executed		Net MTM
	Short Euros	MTM of Payable	1 Year Forward	Bought Euros	MTM of Forward	
2/20/2019	1,000,000	\$ -	1.1710	1,000,000	\$ -	\$ -
2/21/2019		\$ (9,000)	1.1800		\$ 9,000	\$ -
2/22/2019		\$ 21,000	1.1500		\$ (21,000)	\$ -
2/23/2019		\$ (529,000)	1.7000		\$ 529,000	\$ -
2/24/2019						
2/25/2019						
2/26/2019						
2/27/2019						

Step 4 - Mark to Market of Speculative Position & Margin Calculation

Go long OCT CME Copper 1 contract which is 25,000 pounds						
<u>Speculative position</u>						
	<u>Long 1 Contract</u>	<u>Price/LBS</u>	<u>MTM of Position</u>	<u>Initial Margin</u>	<u>Maintanance</u>	<u>Variation</u>
2/20/2019	25,000	2.9295	\$ -	\$ 14,648	\$ 2,700	
2/21/2019		3.0100	\$ 2,012			
2/22/2019		3.2000	\$ 6,763			
2/23/2019		2.8000	\$ (3,238)			
2/24/2019						
2/25/2019						
2/26/2019						
2/27/2019						

Step by Step Instructions for Steps 3 & 4

<https://www.dropbox.com/s/804fmnr02rt5lh5/Steps%203%20%26%204%20Video%20Feb20.mov?dl=0>