Introduction to Indices and Mutual Funds

Week 2: Chapter 2, 4

Market Indices (Chapter 2)

- What is an index?

- Why are stock market indices important?

- What are the difference ways in which the indices are calculated?

- What is the difference between some common indices?

Equity Indices

- An equity index can be viewed as a portfolio of stocks. Different indices differ in the way this portfolio is created.
- Why is an equity index useful?
- 1. It is a convenient way of keeping track of the market as a whole.
- 2. It serves as a benchmark for measuring the performance of active fund managers.
- 3. It can be used as an a convenient and surprisingly effective investment strategy- for example, passively investing in the S&P 500 over the last 10 years would have helped you beat the vast majority of active fund managers.
  - According to the Capital Asset Pricing Theory, investing in a portfolio of the riskfree asset (US treasuries) and a "market portfolio" is the optimal investment strategy. A equity index can be a proxy for the market portfolio.

Different Ways in which an Index is Constructed

- 1. **An index may differ in the choice of stocks**.
  - For instance, the DJIA has 30 blue-chip stocks, while the Wilshire 5000 has about 7000 stocks. You may also have indices that are based on size, sector, country, or investing styles.
- 2. **An index can differ in the way the weights of each stock in the index is determined.**
  - For example, the weights may be determined by the price of the each stock in the index (e.g. DJIA), by the market capitalization of the stock (e.g. S&P 500), by a float-adjusted market capitalization (e.g. NYSE Composite), or may be kept fixed.

Weights Used in Index Construction

- **1. Price Weighted:** DJIA.

  – The weight of each stock in the index depends on the price of the stock.

- **2. Capitalization Weighted**: S&P 500, Wilshire 5000.

  – The weights depend on the capitalization, or the size of the company. The greater the market cap of the stock, the greater its weight.

- 3. **Float-Adjusted Cap Weighted**: NYSE Composite.

  – The weight are based on the market capitalization of free-floating shares, i.e., shares that are generally available to the public for trading (excluding, for example, shares held by a family trust).

- **4. Equal Weighted:** Wilshire 5000 equal weighted (now defunct).

  – Each company is equally weighted. E.g. if index consists of 100 stocks, the weight of each stock is 1%. 5

Price-Weighted Index

- The weight of each stock is the ratio of its price to the sum of the prices of all stocks that are included in the index. *This is equivalent to stating that we buy 1 share of each stock in the index.*

- E.g.. Suppose the index comprises only of 2 stocks: KO and PEP. If price of KO is 45 and the price of PEP is 50, then the weight of KO will be [45/(45+50)] = 0.474, and weight of PEP is 0.526 .

- How will we define the index value? One way is to use the average, (45+50)/2=47.5. Of course, this is arbitrary and we can normalize it to 100, by dividing by an arbitrary divisor "d".

- Example: Suppose we want the index to be 100. Then, (45+50)/(d) = 100. Thus, if we use d=0.95, we would start our index at a level of 100. Now, suppose the next day, KO=50, PEP=52. The new index level now will be (50+52)/0.95=107.3684.

Cap-Weighted Index

- The weight of each stock is the ratio of its market cap to the total market cap of the index.

  - *Example of S&P 500 (2 Jan 2003):*
  - Market Cap of all stocks = $8.376 trillion.
  - Market Cap of the largest stock (MSFT) = $287 billion. Therefore, the weight of MSFT in the S&P 500 is 287/8376=3.43%.
  - Market Cap of the smallest stock (McDermott International,MDR) = $298 million. Therefore, the weight of MDR in the S&P 500 is 0.298/8376=0.0036%.

- In a cap weighted index, much of the movements of the index will be determined by price movements in the largest stocks. Price movements in the smallest stocks in the index will typically have negligible effect on the index.

Float Cap-Weighted Index

- The weight of each stock is the ratio of its free-float market cap to the total free-float market cap of the index.

- *Example of NYSE Composite: A company's outstanding shares are adjusted by block ownership to reflect only truly tradable and investable shares. Block-held shares are excluded if they have the following ownership:*
  - 1. Cross-Ownership: shares held by other companies.
  - 2. Government Ownership.
  - 3. Private Ownership – shares held by founder/charitable trusts.
  - 4. Restricted shares – shares that are not allowed to be traded during a certain time period.

Equal-weighted

- The weight of each stock in the index is the same. Thus, if there are n stocks, the weight of each stock is (1/n). Thus, if there are 100 stocks in the index, the weight of each stock will be 0.01.

  - Example: If you construct an equal weighted index of two stocks, KO and PEP, the weight of both KO and PEP will be 0.5.

- The problem with equal weighted indexes is that it is difficult to replicate with a real stock portfolio, as the every stock price movement leads to the portfolio having to be re-balanced.

- Example: Suppose you have an equal-weighted portfolio of two stocks, KO and PEP. Assume you invest a total of $100, with $50 in each of these two stocks. Now KO increases in price by 10%, while PEP remains the same. Your investment in KO is now $55, while your investment in PEP is still $50. To make your investment in KO and PEP equal, you will have to sell $2.50 of KO stock, and use that money to buy $2.50 of PEP stock.

Updating an Index, When You Know the Weights

- How do you update the index price level?
- Consider an index of N stocks. The weight of stock "i" is w_i.
- Suppose on 1/1/2002, the index is at I(t), and each stock has a price of $P_i(t)$. The next day each of the stock price moves to $P_i(t+1)$. What should be the new index level?
- We can compute the new index level by noting that the index return is the same as the return on the portfolio of N stocks.
- The return of each stock is $R_i = [P_i(t+1) - P_i(t)] / P_i(t)$.
- The portfolio return is $SUM(w_i R_i)$.
- If the new index level is I(t+1), then the return of the index is $[I(t+1)-I(t)]/I(t) = SUM(w_i R_i)$.
- Thus, from the portfolio return we can calculate the index ₁₀ value.

Updating an Index, When You Know the Weights: An Example

- Suppose we construct an index of two stocks, KO and PEP. The weights of KO and PEP are 0.474 and 0.526, respectively. The index level is at 100, and the price of KO=45, PEP=50.
- The following day, KO=50, PEP=52. Thus, the return of KO is (50-45)/45=0.1111%, and that of PEP is (52-50)/50=0.04%.
- The return of your portfolio of two stock is (0.474x0.1111+0.526x0.04) = 0.0737.
- What is the new index level? If we denote the new index level as I, then the index return is (I-100)/100. But this should be equal to 0.0737.
- Therefore, (I-100)/100 = 0.0737. So the new index level is 107.37.

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Updating an Index Using the Divisor

- Index Level = (Value of portfolio)/divisor.
- Example: DJIA.
    - On 24/1/03 close, the dollar value of a portfolio of 1 share in each of the 30 stocks was $1,185.93.
    - The divisor for the DJIA is 0.14585278.
    - Thus, the DJIA index level is (1185.93/0.14585278) = 8,131.01.

Ensuring Continuity of Index Prices (1/3)

- In managing an index, it is important to maintain continuity of an index when certain events happen that cause the index weights or composition to change for reasons other than of price changes. Example of these are:

- 1. Additions/deletions of firms in index.

- 2. Stock splits and reverse splits, stock dividends.

- 3. Corporate actions like mergers, spin-offs, rights offerings.

- The index level before and after these events must be the same to ensure continuity (even though the weights/composition may change).

- The typical way to do this is to adjust the divisor that is used to calculate the index.

Continuity of Index Prices
An Example

- Consider our previous example of the price-weighted index of KO and PEP, where the divisor was 0.95. The KO price was 45 and PEP price was 50, and the index level was 100 [95/0.95=100].

- Suppose you replaced PEP in the KO-PEP index of the previous example with BUD with a price of 47. If we change the divisor from 0.95 to 0.92, we would have continuity in the index price, as (45+50)/0.95 = (45+47)/0.92=100 [keeping the index level unchanged].

- The formula to get the new divisor is:

- New Divisor = Current Divisor x (New Portfolio Value / Current Portfolio Value).

- For our example: New Divisor = 0.95(92)/(95) = 0.92.

Examples of Different Indices

- With a few exceptions (notably the Dow), most indices are now capitalization weighted, including the S&P 500, and almost all the Wilshire indices. Thus, the differences between indices are largely due to differences in the stocks that comprise the index.

- Over time, many different indices have been introduced to give to represent different sub-sets of the markets. For example, indices have been constructed to represent companies of different sizes (large, midcap, small), or that fall into different style categories (value vs. growth), or different industry sectors (utilities, internet, etc).

Dow Jones Industrial Average (DJIA)

- First started by Charles Dow in 1896.

- Number of stocks: 30.

- The composition does not change very frequently. In particular, the DJIA included Microsoft and Intel into the index only on November 1, 1999.

- The divisor (used to calculate the index level) has often changed over time; the current divisor is 0.14585278.

S&P 500 (1/3)

- The S&P 500 is probably the second most famous index after the Dow (although its market impact is definitely greater than the Dow as about $700 billion of index funds is directly tied to this index)

- Number of stocks: 500 US stocks, chosen by the S&P Index Committee (probably based on factors like size, liquidity, or industry).

- Weights:by market capitalization.

- Total market value on 1/2/2003 (1/2/2002): $8.376 ($10.527) trillion

S&P Weights (1/2/2003)
10 Largest Firms

MRK	Merck & Co.	1.56
IBM	International Bus. Machines	1.63
AIG	American Int'l. Group	1.88
JNJ	Johnson & Johnson	1.96
C	Citigroup Inc.	2.23
PFE	Pfizer, Inc.	2.32
WMT	Wal-Mart Stores	2.72
XOM	Exxon Mobil Corp.	2.85
GE	General Electric	3.03
MSFT	Microsoft Corp.	3.43

S&P 500 (3/3)

- The 10 (30) largest firms had a combined weight of 23.61% (43.49%) as of January 2, 2003.
- The bottom 250 firms had a combined weight of 10.80% (10.47% in 1/2002, 8.32% in 11/99).
- The total weight of firms below $2 billion is about 1% (61 firms).
- The median market cap is $7 Billion, but this is not meaningful as there are lots of small firms.
- Thus, much of the movements in the S&P 500 is determined by the large firms, in particular, by large, growth stocks.

Dow vs. S&P 500 – Last 5 Years
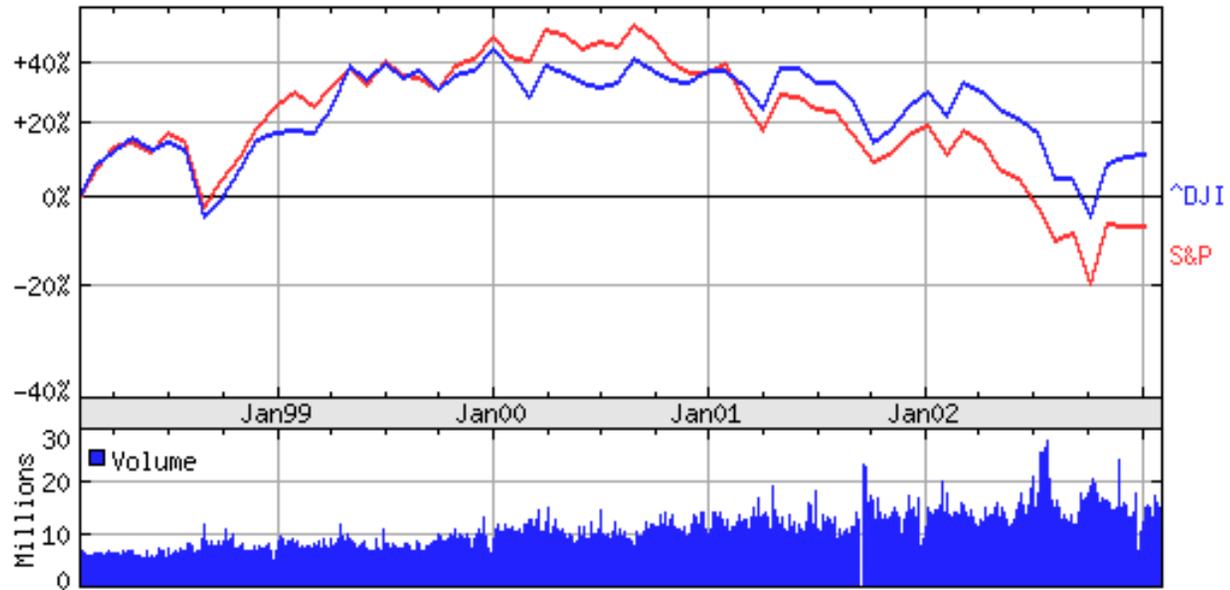
Wilshire 5000

- A very broad total market index. Created in 1974, with data from 1971.

- Number of stocks : >5,800 stocks (of about 12,000 US public firms).

- Weights: by market capitalization (earlier, also had an equal weighted index).

- Percentage of total US capitalization: Almost 100% of total US capitalization (in comparison, the S&P 500 has 80%).

- Because of its breadth, the Wilshire has a much higher weight on small caps as compared with the S&P 500.

Other Wilshire Indices

- There are many other Wilshire indices (see http://www.wilshire.com)).

- The next slide gives the returns of the various Wilshire indices. These indices are useful to give us a quick idea of the market movements.

  - For example: which group of stocks did particularly well (badly) last year? We can answer this question by simply observing the returns on the different Wilshire indices (see next slide.) In general, growth stocks did very badly. Small-growth stocks performed the worst (-28.71%), followed by large-growth stocks (-26.42%). The best performance was in micro-cap stocks (bottom half of the Wilshire 5000) with a return of –9.41%. In fact, over the last 5 years, micro-caps have done the best.

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Wilshire Index Returns

As of 01-31-2003	1Yr	3Yr	5Yr
Wilshire 5000	-21.88	-13.89	-1.48
Wilshire 5000 - Price	-23.09	-15	-2.75
Wilshire 4500	-18.02	-14.65	-1.71
Wilshire 4500 - Price	-19.19	-15.71	-2.89
Wilshire Large Cap 750	-22.41	-14.54	-1.54
Wilshire Mid Cap 500	-18.39	-4.77	3.31
Wilshire Small Cap 1750	-21.9	-7.74	-0.41
Wilshire Micro Cap	-9.41	-0.06	6.74
Wilshire All Growth	-26.42	-22.83	-4.41
Wilshire All Value	-18.15	-6.77	-0.83
Wilshire Large Growth	-26.2	-22.74	-4.13
Wilshire Large Value	-18.49	-8.19	-1.17
Wilshire Mid Growth	-22.9	-17.7	-0.09
Wilshire Mid Value	-14.6	6.42	3.3
Wilshire Small Growth	-28.71	-23.39	-6.2
Wilshire Small Value	-15.94	6.11	1.39
Wilshire Small Cap 250	-20.38	-7.2	0.57
Wilshire Small Cap 250 - Price	-21.21	-7.07	0.36

Introduction to Mutual Funds

- What is a fund?
- How do we classify funds?
  - Open vs. Closed
  - Active vs. Passive
  - Fund Styles/Objectives
  - Mutual Fund, Hedge funds
  - Exchange Traded Funds
- How to read the annual report of a fund?

Classifications: Open vs Closed (1/4)

- An open-ended fund redeem or issue new shares at their net asset value on a continuous basis over the life of the fund.

- A closed-end fund issues shares only at inception of the fund, and then manages the dollars raised through the life of the fund. The shares of the fund are listed on an exchange that allows investors to buy/sell into the fund.

- Because the open-end fund allows issuance or redemption, the "price" of the fund is always it NAV (except for fees). On the other hand, the price of a closed-end fund can differ from its NAV.

Open vs. Closed End Funds (2/4)

- Often, closed-end funds trade at a discount to their NAV. Discounts of 5-15% are not uncommon. A few funds, notably country funds, have also traded at a premium. These discounts also vary over time.

- To eliminate the discount, many closed-end funds limit the life of the fund, or explicitly state that they will buy back stock in the fund. Occasionally, large investors and hedge funds have attempted to arbitrage this discount by buying large quantities of shares and forcing the fund to open-end.

- Finally, because of this discount/premium, the return on an investment on a closed-end fund be can different from the change in its NAV.

The China Closed Ended Fund: Discount/Premium to NAV (3/4)
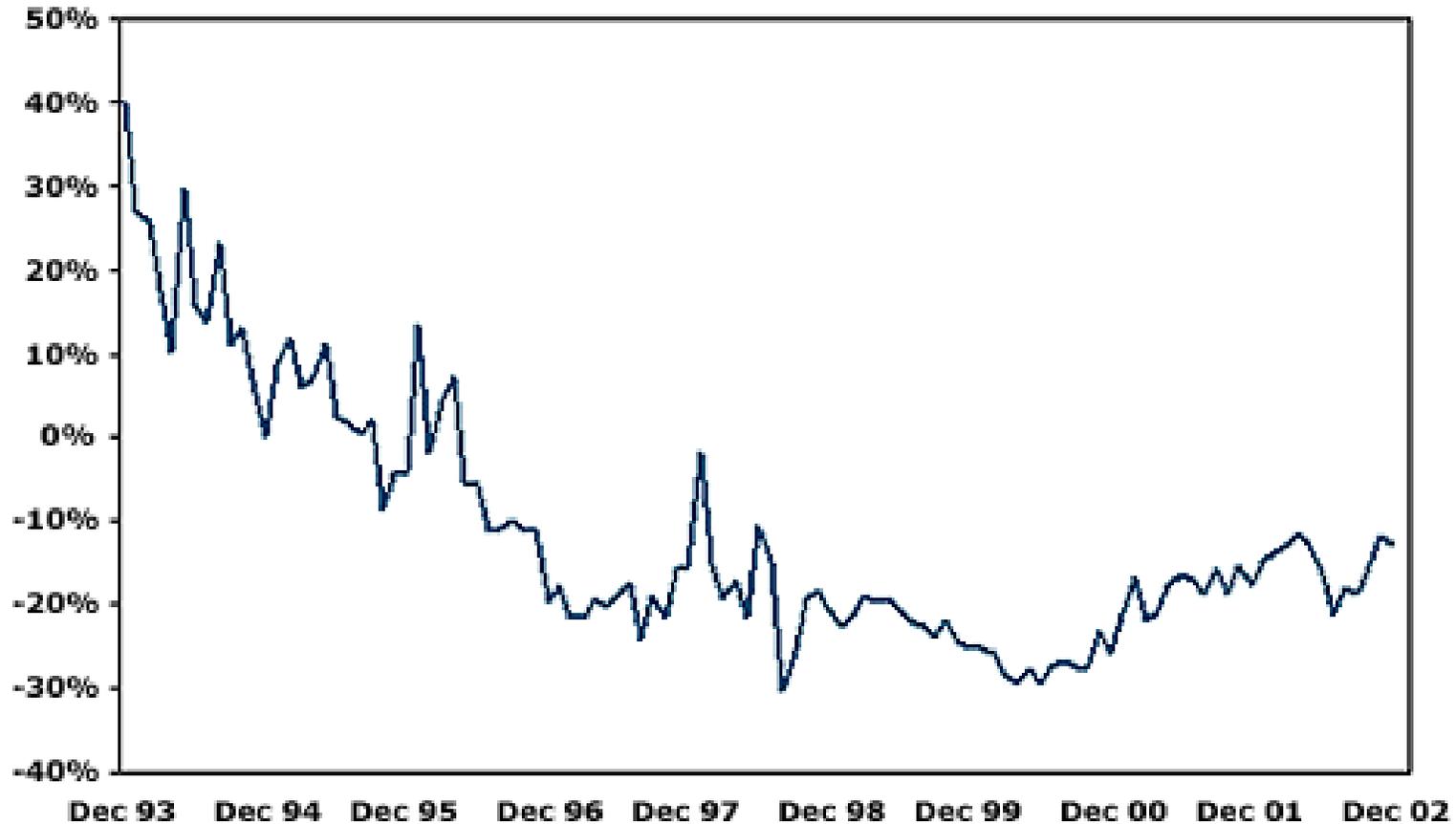
Open vs. Closed End Funds (4/4)

- It has been argued that a reason for creating a closed-end fund instead of an open-ended fund is because:

- (1) a closed-end fund can be fully invested, while an open-ended fund may have to keep cash to allow for redemption,

- (2) a closed-end fund has a wider universe of securities to invest in, as it can invest in relatively illiquid securities (as, for example, in developing markets.)

Active vs Passive Funds

- Passive.
  - Try to track their chosen index, not outperform the index.
  - The only choice the passive fund manager has to make is to which index to track.
  - Thus, how the fund performs relatively to its benchmark depends on how low it can keep its expenses.
- Active.
  - The fund manager try to outperform its benchmark index.
  - Each fund can be classified by its "style".
  - The fund attempts to track its benchmark, and yet beat it.

Stock Fund Styles

- We can also classify actively managed mutual funds by their investment styles/objectives. There are several different ways in which we can do this:

- 1. Size based classification: Large-Cap, Mid-Cap, Small-Cap, etc.

- 2. Sector classification: Utilities, Technology, Health, etc.

- 3. Growth vs Value: the classification can be based on P/E, Market/Book Value, and dividend yield.

- 4. Domestic vs International.

Mutual Funds vs Hedge Funds

- A U.S. ***"hedge fund"*** is a U.S. private investment partnership invested primarily in publicly traded securities or financial derivatives. Because they are private investment partnerships, the SEC limits hedge funds to 99 investors, at least 65 of whom must be "accredited." ("Accredited" investors often are defined as investors having a net worth of at least $1 million.).

- The reason to classify a fund as a investment partnership – as a hedge fund - is to avoid SEC rules governing mutual funds.

Hedge Funds

- There are some substantial differences between a hedge fund and a mutual fund:

- (1) A hedge fund can make a wider range of investments. It can, for example, invest in derivatives, go both long and short in the market, as well as take speculative positions in foreign exchange, commodities, etc.

- (2) A hedge fund is usually leveraged, while a mutual fund is not. (LTCM – a famous hedge fund that went bust - had borrowed more than 50 times its capital).

- (3) The fee structure of a hedge fund is very different from that of a mutual fund. Often the fund managers take 20% of the profit, beyond a certain minimum return (subject to a "high water mark").

- Examples include George Soros's Quantum Fund, and Long Term Capital Management both of which are now closed.