FN452: Asset management and portfolio analysis

Passive equity portfolio

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Passive vs. active management

Total actual return = [Expected return] + [“Alpha”]

= [Risk-free rate + Risk premium] + [“Alpha”]

- **Passive equity portfolio management** typically holds stocks so the portfolio’s returns will track those of a benchmark index over time
- This approach is generally referred to as *indexing*
- Rebalancing is necessary as the composition of the benchmark changes and cash distributions must be reinvested
- **Active equity portfolio management** is an attempt to outperform an equity benchmark on a risk-adjusted basis
- Two main ways to add alpha: *tactical adjustments* (e.g. equity style or sector timing) or *security selection* (stock-picking) skills

Passive strategies

- A passive strategy attempts to design a set of stock holdings that replicates the performance of a specific benchmark, **not** outperform the benchmark
- Popular indices include the S&P 500, the NASDAQ Composite Index, and the Wilshire 5000
- Benchmarks also exist for various **sectors of the stock market**, such as small cap stocks (Russell 2000, S&P SmallCap 600), for value- or growth-oriented stocks (S&P SmallCap 600 value and S&P SmallCap 600 Growth)
- **Various regions**, such as global stock markets (MSCI ACWI), developed ex-US markets (MSCI World ex-US Index), emerging markets (MSCI Emerging Markets Index)

Passive strategies

- Without access to superior analysts, a portfolio manager or investor should manage their portfolios passively to match the performance of the aggregate market
- For many active managers, the annual costs of trying to beat the market (1% to 2% of the portfolio's assets) are difficult to overcome
- Passive strategies, however, are not costless
  - Cash flows into and out of an index fund
  - Mergers, bankruptcies, index rebalancing

Passive strategies

Methods of indexing portfolio investing

- Index mutual funds
  - Mutual funds represent established security portfolios managed by professional investment companies (e.g. Fidelity, Vanguard)
  - The fund manager attempts to replicate the composition of the particular index
  - A prominent example of an index fund is Vanguard's 500 Index Fund (VFIAX), which is designed to mimic the S&P 500 index
  - Index mutual funds provide an inexpensive way for investors to acquire a diversified portfolio (VFIAX has the annual expense ratio of 0.04%)

Passive strategies

Vanguard 500 Index Fund Admiral Shares (VFIAX)

Also available as an ETF (starting at the price of one share).

Overview | Price & Performance | Portfolio & Management | Fees & Minimums | Distributions | News & Reviews

Product summary

As the industry's first index fund for individual investors, the 500 Index Fund is a low-cost way to gain diversified exposure to the U.S. equity market. The fund offers exposure to 500 of the largest U.S. companies, which span many different industries and account for about three-fourths of the U.S. stock market's value. The key risk for the fund is the volatility that comes with its full exposure to the stock market. Because the 500 Index Fund is broadly diversified within the large-capitalization market, it may be considered a core equity holding in a portfolio.

View prospectus and reports

Fund facts

Asset class	Domestic Stock - General
Category	Large Blend
Expense ratio as of 04/28/2020	0.04%
Minimum investment	$3,000 Available as an ETF (starting at the price of one share).
Fund number	0540
CUSIP	922908710
Fund advisor	Vanguard Equity Index Group

Source: https://investor.vanguard.com/mutual-funds/profile/overview/vfiax

Passive strategies

Price and yield

Price as of 03/19/2021		$362.34
Change	-$0.18 ↓	-0.05% ↓
30 day SEC yield as of 02/28/2021		1.47% B

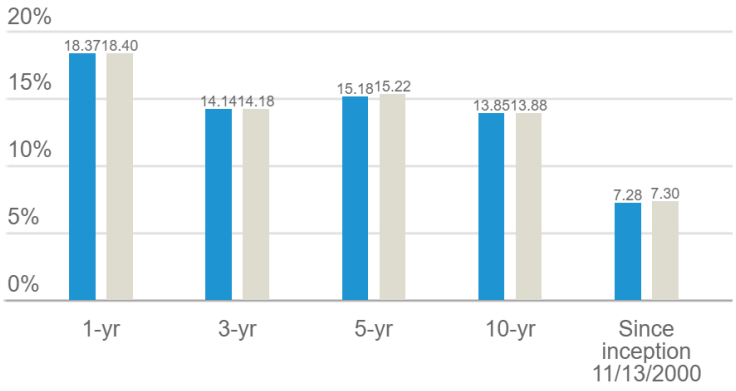
Risk potential

How the potential for risk affects your investment

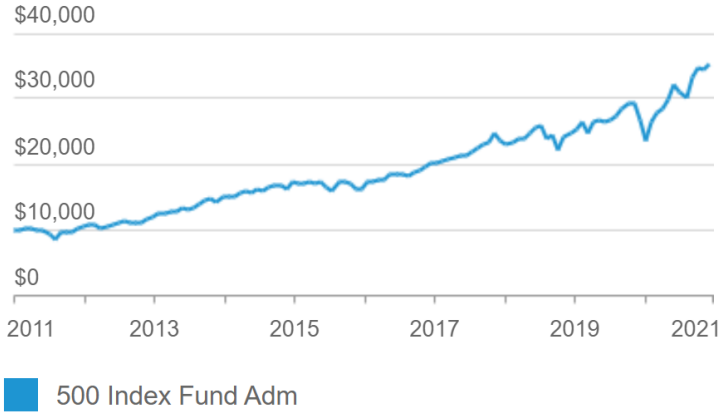
Performance

Average annual returns
as of 12/31/2020

Show Quarter-end | Month-end View as a table



Hypothetical growth of $10,000
as of 02/28/2021



Source: https://investor.vanguard.com/mutual-funds/profile/overview/vfiax

Passive strategies

Equity characteristics
as of 02/28/2021

	500 Index Fund Adm	S&P 500 Index (Benchmark)
Number of stocks	509	505
Median market cap	$158.4 billion	$158.4 billion
Price/earnings ratio	28.3x	28.3x
Price/book ratio	4.0x	4.0x
Return on equity	20.2%	20.2%
Earnings growth rate	19.1%	14.5%
Foreign holdings	0.0%	—
Turnover rate (as of fiscal year end December)	4.0%	—
Short-term reserves	—	—
Fund total net assets	$658.3 billion	—
Share class total net assets	$363.2 billion	—

Source: https://investor.vanguard.com/mutual-funds/profile/overview/vfiax

Passive strategies

Equity sector diversification

	500 Index Fund Adm as of 02/28/2021	S&P 500 Index (Benchmark) as of 02/28/2021
Communication Services	11.10%	11.10%
Consumer Discretionary	12.40%	12.40%
Consumer Staples	6.00%	6.00%
Energy	2.80%	2.80%
Financials	11.20%	11.20%
Health Care	13.10%	13.10%
Industrials	8.50%	8.50%
Information Technology	27.40%	27.40%
Materials	2.60%	2.60%
Real Estate	2.40%	2.40%
Utilities	2.50%	2.50%

Sector categories are based on the Global Industry Classification Standard system.

Source: https://investor.vanguard.com/mutual-funds/profile/overview/vfiax

Passive strategies

Month-end ten largest holdings
as of 02/28/2021

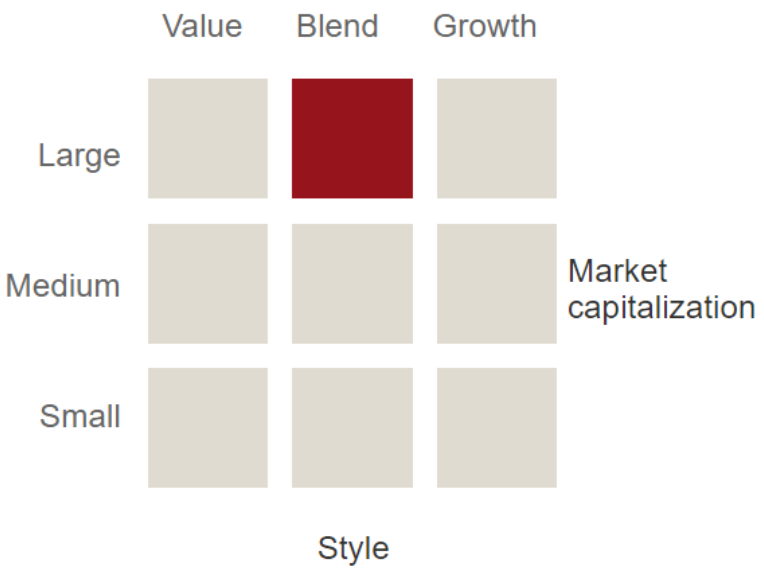
Rank/holdings	
1	Apple Inc.
2	Microsoft Corp.
3	Amazon.com Inc.
4	Alphabet Inc.
5	Facebook Inc.
6	Tesla Inc.
7	Berkshire Hathaway Inc.
8	JPMorgan Chase & Co.
9	Johnson & Johnson
10	Visa Inc.

10 largest holdings = 28.00% of total net assets

Historical volatility measures
as of 02/28/2021

Benchmark	R-squared*	Beta*
S&P 500 Index**	1.00	1.00
Dow Jones U.S. Total Stock Market Index	1.00	0.95

Stock style



Source: https://investor.vanguard.com/mutual-funds/profile/overview/vfiax

Passive strategies

Methods of indexing portfolio investing

- Exchange-traded funds (ETFs)
  - A type of security that track indices but can be purchased or sold on a stock exchange the same as a regular stock
  - Some notable example of ETFs
    - SPDR S&P 500 (SPY)
    - Vanguard Total Stock Market (VTI)
    - Invesco QQQ (QQQ)
    - Vanguard FTSE Developed Markets (VEA)
    - Vanguard FTSE Emerging Markets (VWO)
    - iShares Core S&P Small-Cap (IJR)
    - Vanguard Real Estate Index (VNQ)

IEMG

iShares Core MSCI Emerging Markets ETF

Fact Sheet as of 12/31/2020

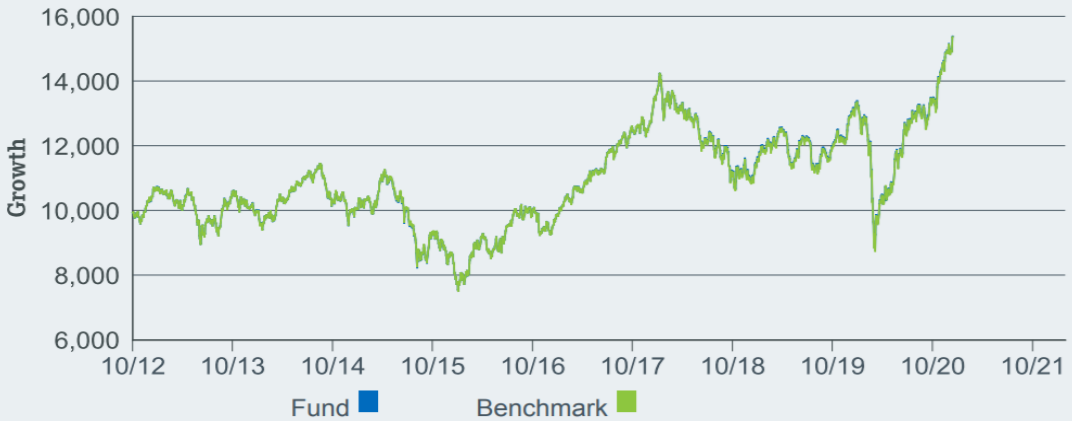
iShares by BLACKROCK®

The iShares Core MSCI Emerging Markets ETF seeks to track the investment results of an index composed of large-, mid- and small-capitalization emerging market equities.

WHY IEMG?

1. Exposure to a broad range of emerging market companies
2. Low cost, comprehensive access to stocks in emerging market countries
3. Use at the core of a portfolio to diversify internationally and seek long-term growth

GROWTH OF 10,000 USD SINCE INCEPTION



The Growth of $10,000 chart reflects a hypothetical $10,000 investment and assumes reinvestment of dividends and capital gains. Fund expenses, including management fees and other expenses were deducted.

PERFORMANCE

	1 Year	3 Year	5 Year	10 Year	Since Inception
NAV	18.18%	5.81%	12.25%	N/A	5.39%
Market Price	17.93%	5.72%	12.35%	N/A	5.36%
Benchmark	18.39%	5.77%	12.22%	3.47%	5.38%

KEY FACTS

Fund Launch Date	10/18/2012
Expense Ratio	0.11%
Benchmark	MSCI Emerging Markets Investable Market Index
30 Day SEC Yield	1.58%
Number of Holdings	2,521
Net Assets	$68,716,612,327
Ticker	IEMG
CUSIP	46434G103
Exchange	NYSE Arca

TOP HOLDINGS (%)

TAIWAN SEMICONDUCTOR MANUFACTURING	5.26
ALIBABA GROUP HOLDING ADR REPRESEN	5.00
TENCENT HOLDINGS LTD	4.74
SAMSUNG ELECTRONICS LTD	4.03
MEITUAN	1.55
NASPERS LIMITED N LTD	1.01
RELIANCE INDUSTRIES LTD	0.88
JD.COM ADR REPRESENTING INC	0.86
PING AN INSURANCE (GROUP) CO OF CH	0.82
CHINA CONSTRUCTION BANK CORP H	0.82
	24.97

Holdings are subject to change.

Source: https://www.ishares.com/us/literature/fact-sheet/iemg-ishares-core-msci-emerging-markets-etf-fund-fact-sheet-en-us.pdf

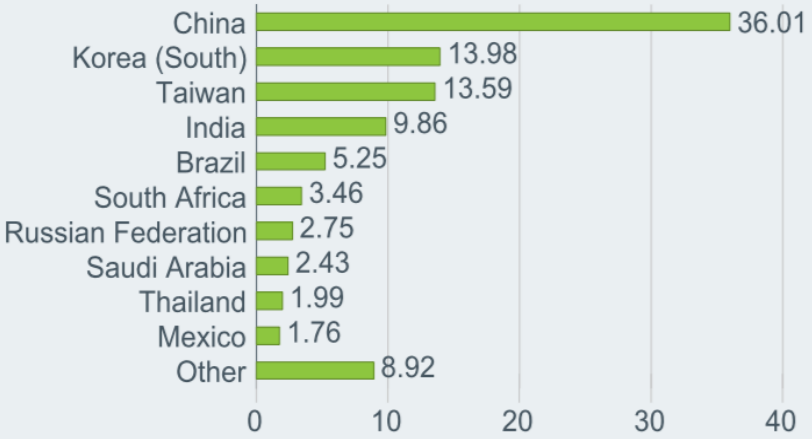
TOP SECTORS (%)

Information Technology	20.17%
Consumer Discretionary	17.66%
Financials	17.13%
Communication	10.80%
Materials	8.02%
Consumer Staples	5.82%
Industrials	5.36%
Health Care	5.29%
Energy	4.71%
Real Estate	2.58%
Utilities	2.23%
Other	0.24%

FUND CHARACTERISTICS

Beta vs. S&P 500	0.89
Standard Deviation (3yrs)	20.04%
Price to Earnings	17.64
Price to Book Ratio	1.93

GEOGRAPHIC BREAKDOWN (%)



FEES AND EXPENSES BREAKDOWN

Expense Ratio		**0.11%**
Management Fee	0.11%	
Acquired Fund Fees and Expenses	0.00%	
Foreign Taxes and Other Expenses	0.00%	

Source: https://www.ishares.com/us/literature/fact-sheet/iemg-ishares-core-msci-emerging-markets-etf-fund-fact-sheet-en-us.pdf

Passive portfolio construction

- Index managers seek to match the performance of a published index
- Any difference in return is called **tracking error**
- Successful S&P 500 indexers track within a few basis points of the index before management fees, whereas Russell 2000 indexers perform within tens of basis points
- The larger tracking error occurs because the index is broader and its constituents less liquid and less correlated
- Asset flows to index funds are driven by their performance relative to actively managed funds

Full replication

- This approach matches the index return by buying every component in the index in the exact weight as in the index
- Full replication **is practical for large asset levels and indices with few constituents**
- If there are no asset flows, all the manager needs to do is reinvest dividend income and buy and sell stocks when S&P announces changes in the constituents
- Except for the changes in index components, weights adjust automatically, in tandem with the index, as prices change
- Any trades must be done precisely and at low cost, with cash kept to a minimum, to minimize tracking error

Sampling

- Portfolio managers often find it impractical to hold all the constituent securities
- Some equity indices have a large number of constituents, and not all of them offer high trading liquidity
- Holding a limited sample of the index components can produce results that track the index return and risk characteristics closely
- **Stratified sampling** arranges a population into distinct subgroupings that match characteristics and performance of the index
- The approach include using industry (or sector) membership and equity styles (size and value)

Sampling

- The goal of forming a passive portfolio is to closely match its return with those of the benchmark or to **minimize tracking error**
- To implement stratified sampling, we start with the following cross-sectional risk model

$$R_i = \sum_{j=1}^{K} a_{i,j} f_j + e_i$$

where f_j is the return of the *j*th risk factor, $a_{i,j}$ is security *i*'s sensitivity or exposure to this factor, and e_i is a specific return measure unique to each stock

- The return on a portfolio of N securities can be explained as follows

$R_p = \sum_{i=1}^{N} w_i R_i = \sum_{j=1}^{K} A_j f_j + \sum_{i=1}^{N} w_i e_i$, where $A_j = \sum_{i=1}^{N} w_i a_{i,j}$

Sampling

- Assuming factor returns are correlated and specific returns are not, it follows that the portfolio return variance can be expressed as

$$var[R_p] = var\left[\sum_{j=1}^{K} A_j f_j\right] + var\left[\sum_{i=1}^{N} w_i e_i\right]$$

- We can calculate active risk or tracking error (the risk of performing differently from the benchmark) as

$$var[R_p - R_b] = var\left[\sum_{j=1}^{K} (A_j - B_j) f_j\right] + var\left[\sum_{i=1}^{N} (w_i - w_{Bi}) e_i\right]$$

- We can rewrite the second term as

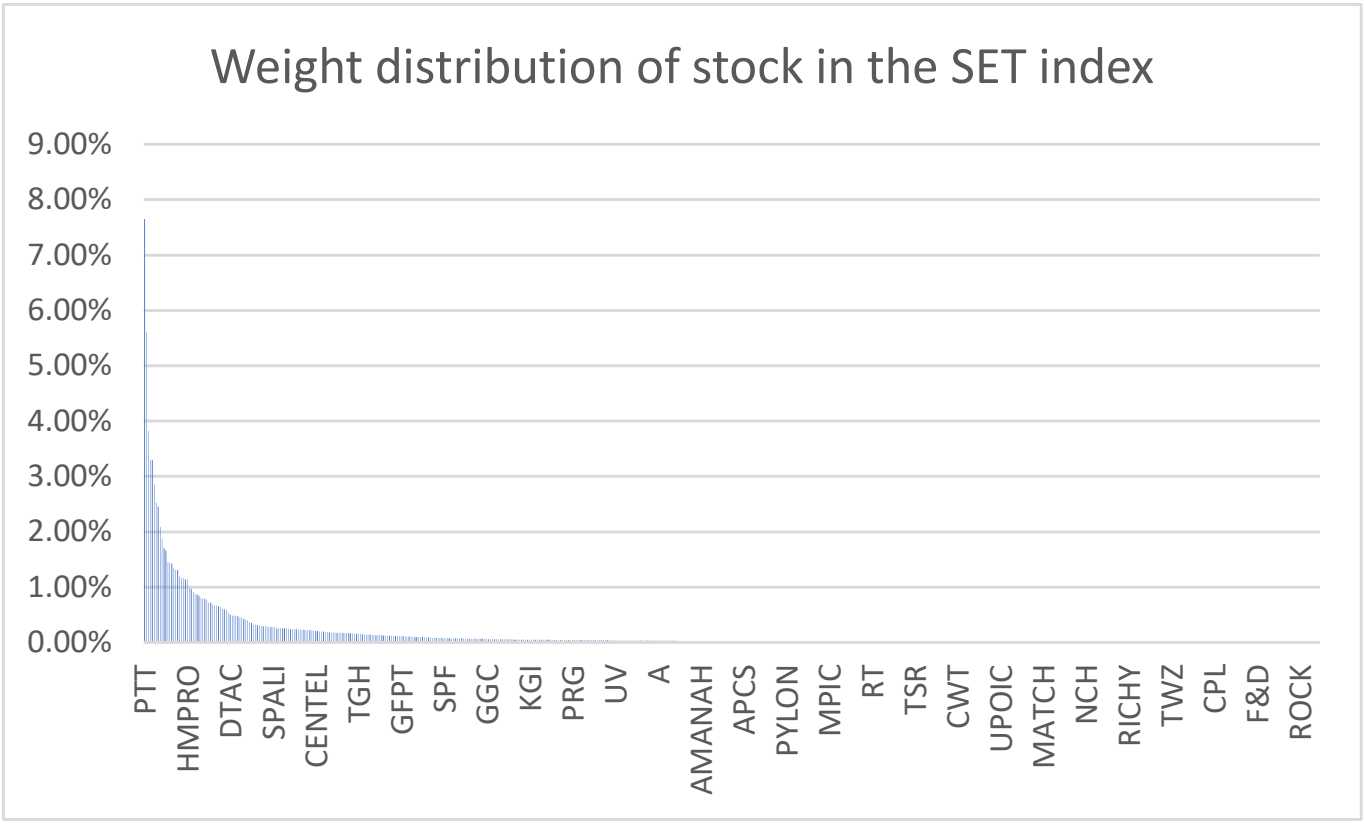
$$\left[\sum_{i=1}^{N} (w_i - w_{Bi})^2\right] var(e_i)$$

Sampling

- Assuming that the risk of each stock, after **controlling for size, value, sector risk**, is equal and independent, we can conduct a simple optimization within Excel
- Size, value, and sector risk will also be managed using constraints
- We are seeking to **minimize specific risk** by assuming the $var(e_i)$ term is identical for all *i*
- An optimization system is used to select stock weights to minimize the risk of differences between the portfolio and the index return

Sampling – An example

- Considering SET index which contains more than 600 stocks, the top 10% of the SET index components have individual weights of 0.3% or more and together account for 75% of the index



Sampling – An example

- A manager first select the largest market cap stocks of weight greater than or equal to **0.80%** (5^{th} percentile)
- Then additional stocks within each subgroup are chosen to ensure diversified coverage and form a portfolio of **100 stocks in total**
- Randomly assign weight in the portfolio to seed the optimization
- Set following constraints
  - Market cap within +/- 10% of the index
  - P/B within +/- 10% of the index
  - Sector allocation not exceeding 10% of the index
  - Summation of weight = 100%
  - Non-negative weights or minimum/maximum weights
- Solve for weights

Sampling – An example

SET INDEX	31-Dec-20					
Weighted Averag	Market-cap	312,183	=SUMPRODUCT($B$10:$B$614,C10:C614)			
	P/B	3.67	=SUMPRODUCT($B$10:$B$614,D10:D614)			
	Cyclicals	56.59%	=SUMPRODUCT($B$10:$B$614,INT($E$10:$E$614=B5))			
	Financials	28.98%	=SUMPRODUCT($B$10:$B$614,INT($E$10:$E$614=B6))			
	NonCyclicals	14.43%	=SUMPRODUCT($B$10:$B$614,INT($E$10:$E$614=B7))			
Ticker	Weight	Market cap	P/B	Broad sector	industry	sector
PTT	7.65%	1,213,927	1.38	Cyclicals	Resources	Energy & Utilities
AOT	5.60%	889,284	6.25	Cyclicals	Services	Transportation & Logistics
DELTA	3.82%	606,227	16.12	Cyclicals	Technology	Electronic Components
ADVANC	3.30%	523,345	6.93	Cyclicals	Technology	Information & Communication Technology
CPALL	3.30%	523,265	6.81	Noncyclicals	Services	Commerce
SCC	2.86%	453,600	1.41	Cyclicals	Property & Constructio	Construction Materials
GULF	2.53%	401,860	6.28	Cyclicals	Resources	Energy & Utilities
PTTEP	2.46%	390,051	1.12	Cyclicals	Resources	Energy & Utilities
BDMS	2.08%	330,554	3.76	Noncyclicals	Services	Health Care Services
SCB	1.87%	297,114	0.72	Financials	Financials	Banking

Source: Datastream, Author's calculation

Sampling – An example

Step 2: Sort by P/B					
			Correl	0.3094	
	Ticker	Index Weight	Market Cap (Mils)	P/B	Broad Sector
1	TQM	0.25%	40,350	16.81	Financials
2	DELTA	3.82%	606,227	16.12	Cyclicals
3	STARK	0.32%	50,721	13.68	Cyclicals
4	Com7	0.29%	46,800	12.15	Noncyclicals
5	CBG	0.72%	114,500	11.50	Financials
6	MICRO	0.03%	4,544	9.10	Financials
7	GRAMMY	0.05%	7,462	9.01	Cyclicals
8	SDC	0.02%	3,511	8.63	Cyclicals
9	MAKRO	1.19%	189,600	8.53	Noncyclicals
10	RS	0.11%	16,824	8.40	Noncyclicals

Source: Datastream, Author's calculation

Sampling – An example

Step 3:									
	Weight:	0.80%							
	Rnd	0.870							
	Total:	100							
Random Number	Saved Random Number	Indicator	Saved Indicator	Group	Ticker	Index Weight	Market Cap (Mils)	P/B*	Broad Sector
0.6584	0.2919	0	1	2	PTT	7.65%	1,213,927	1.38	Cyclicals
0.1624	0.9328	1	1	1	AOT	5.60%	889,284	6.25	Cyclicals
0.6637	0.7782	0	1	1	DELTA	3.82%	606,227	16.12	Cyclicals
0.5473	0.7239	0	1	1	ADVANC	3.30%	523,345	6.93	Cyclicals
0.1468	0.7490	0	1	1	CPALL	3.30%	523,265	6.81	Noncyclicals
0.4073	0.7535	0	1	2	SCC	2.86%	453,600	1.41	Cyclicals
0.5428	0.0211	0	1	1	GULF	2.53%	401,860	6.28	Cyclicals
0.4200	0.5974	0	1	2	PTTEP	2.46%	390,051	1.12	Cyclicals
0.4638	0.3769	1	1	1	BDMS	2.08%	330,554	3.76	Noncyclicals
0.2324	0.3185	0	1	3	SCB	1.87%	297,114	0.72	Financials

Source: Datastream, Author's calculation

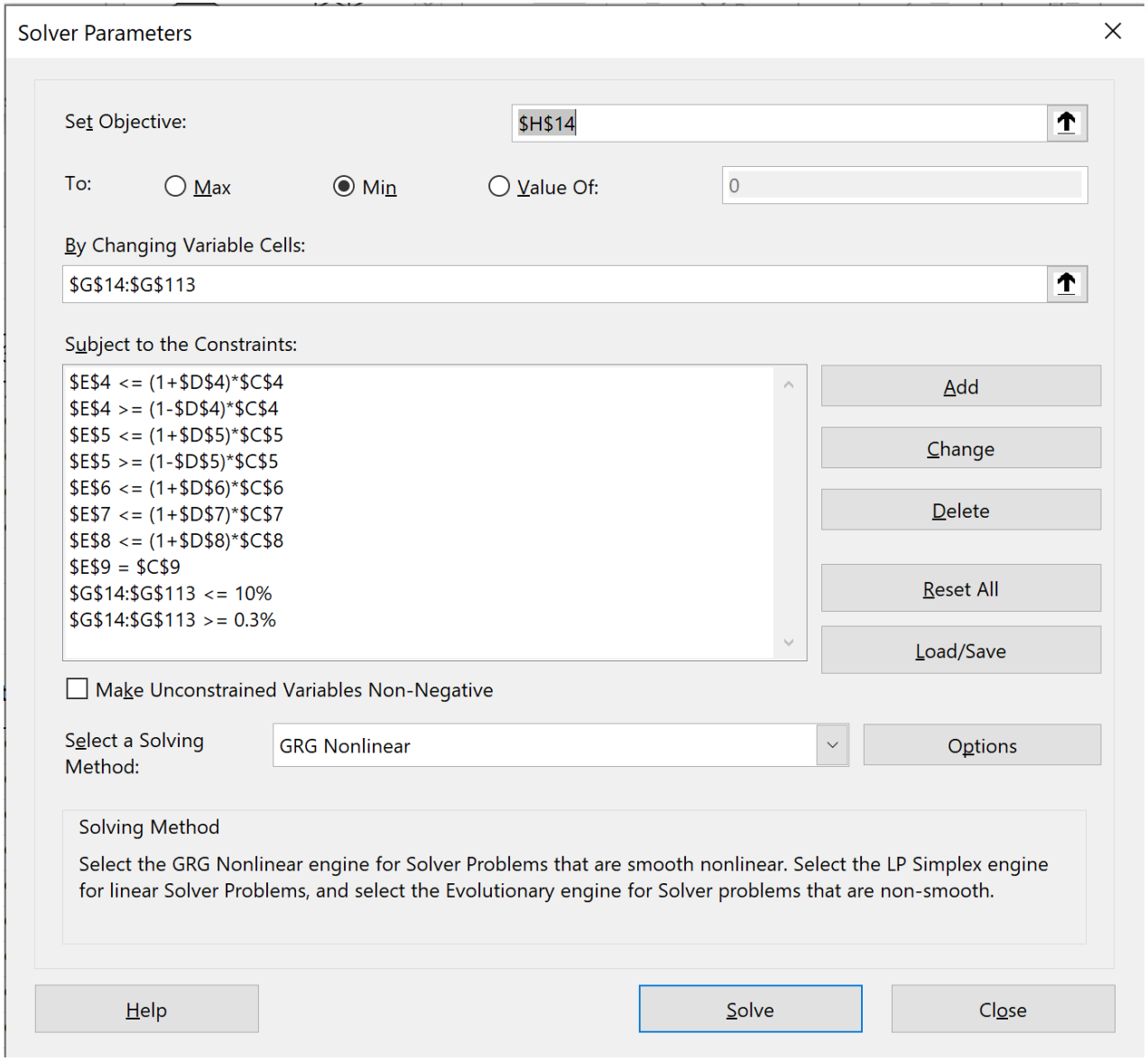
Sampling – An example

Objective	Minimize	21.4219						
Constraints	Target	Range	Wtd Avg					
Market Cap	312,183	10%	280,965	=SUMPRODUCT(D14:D113,G14:G113)				
P/B	3.67	10%	3.36	=SUMPRODUCT(E14:E113,G14:G113)				
Cyclicals	54%	10%	60%	=SUMPRODUCT($G$14:$G$113,INT($F$14:$F$113=B6))				
Financials	29%	10%	27%	=SUMPRODUCT($G$14:$G$113,INT($F$14:$F$113=B7))				
NonCyclicals	14%	10%	13%	=SUMPRODUCT($G$14:$G$113,INT($F$14:$F$113=B8))				
Weight	100%		100%					

	Ticker	Index Weight	Market Cap (MM)	P/B*	Broad Sector	Fund weight	Active Weight (bp)	$(w_P - w_I)^2$ (bp)
1	PTT	7.65%	1,213,927	1.38	Cyclicals	5.65%	(200.03)	40,013
2	AOT	5.60%	889,284	6.25	Cyclicals	5.19%	(41.54)	1,726
3	DELTA	3.82%	606,227	16.12	Cyclicals	3.84%	2.19	5
4	ADVANC	3.30%	523,345	6.93	Cyclicals	3.28%	(1.29)	2
5	CPALL	3.30%	523,265	6.81	Noncyclicals	3.28%	(1.44)	2
6	SCC	2.86%	453,600	1.41	Cyclicals	2.85%	(1.22)	1
7	GULF	2.53%	401,860	6.28	Cyclicals	2.64%	10.90	119
8	PTTEP	2.46%	390,051	1.12	Cyclicals	2.51%	5.21	27
9	BDMS	2.08%	330,554	3.76	Noncyclicals	2.23%	15.17	230
10	SCB	1.87%	297,114	0.72	Financials	2.02%	14.67	215

Source: Datastream, Author's calculation

Sampling – An example



Source: Datastream, Author's calculation