

# ***Stock Screening and Ranking***

**Dr. Ludwig B. Chincarini, CFA**

Professor/Consultant/Entrepreneur  
Georgetown University

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# I. Introduction

- Material in this section based upon my new book entitled *Quantitative Equity Portfolio Management* by McGraw-Hill.
- Available on Amazon or Barnes & Noble for \$47.00. A 658 page book that serves as a great reference for experienced professionals and a great intro book for novices to the field.

# I. Introduction

Praise on this book given by:

- Stephen Ross, Father of APT and Binomial Option Pricing Model
  - Eric Rosenfeld, found of LTCM and JWM
  - David Blitzler, Chairman of S&P Index Committee
  - Dan DiBartolomeo, CEO of Northfield
  - Mark Holowesko, CEO of Hedge Fund
-

# I. Introduction

- We will discuss Chapter 5.
- *Stock Screening and Ranking*
- A common practice among professionals as well as novices for a variety of reasons in constructing a portfolio of equities.

# I. Introduction

## Outline for the presentation

II. Sequential screening

III. Famous Sequential Screens

IV. Simultaneous Screening & the Z-score

V. The Z-score and Expected Return

VI. The Z-score and Multifactor Alpha

## II. Sequential Screening

- The process of ranking stocks by some stock-specific attribute.
- If high values are “good”, then choose a group of stocks with the high value for a portfolio.
- Sometimes, more than one screen will be done, thus, the process continues.

## II. Sequential Screening

Good screens should be:

- Easy to automate and replicate
- Reflect essential beliefs
- Should be ordered to relative importance of factors (*discussed in Chapter 4 of book*)

## II. Sequential Screening

Example:

- PM believes high profit margin and low P/B important for portfolio.
- Step 1: Rank by profit margin, select top 30%
- Step 2: Rank remaining by P/B and select lowest 30%.
- S&P 500 universe, December 2003



## II. Sequential Screening

Example:

**TABLE 5.1**

Selected Stocks from a Sequential Stock Screen

Ticker	Price-to-Book (P/B) Ratio	Net Profit Margin (NPM)
TE	0.933	0.111
EOP	1.085	0.203
BSC	1.306	0.127
AIV	1.444	0.111
UNP	1.524	0.107
MBI	1.524	0.476
MTG	1.536	0.402
KG	1.612	0.162
CEG	1.628	0.115
APC	1.635	0.215
KEY	1.705	0.159

*Note:* These represent the preferred stocks according to the sequential stock screen. The ticker symbols are for the following companies. Teco Energy, Inc. (TE), Equity Office PTY (EOP), Bear Sterns (BSC), APT Investment and Management Co. (AIV), Union Pacific (UNP), MBIA, Inc. (MBI), MGIC Investment (MTG), King Pharmaceuticals (KG), Constellation Energy Group (CEG), Anadarko Petroleum (APC), and Keycorp (KEY). The data are from December 2003.

### III. Famous Sequential Screens

- The strategies of famous portfolio managers can be converted to screens to some extent.
- The chapter contains many well-known screens. For this webcast, we will focus on the Templeton screen based upon the value/growth strategies of Sir John Templeton.

### III. Famous Sequential Screens

- Sir John Templeton founded the Templeton mutual fund family. His approach was a “value” approach that attempted to find bargains internationally as well as domestically.
- Although he was more of a qualitative manager, we can convert some of his ideas into quantitative screens.

# III. Famous Sequential Screens

Name	Screening Steps
Templeton	Step 1: P/B ratio is in the lowest 40% of the Compustat database. Step 2: P/E ratio is less than the average P/E ratio of the past five years. Step 3: The percentage changes in earnings over the trailing 12 months and the past 5 years are positive. Step 4: The percentage change in EPS is greater than the industry average. Step 5: OPM is greater than the average OPM of the past five years. Step 6: The ratio of the long-term debt to equity is less than the industry average. Step 7: The ratio of total assets to total liabilities is greater than the industry average. Step 8: ROE is greater than the industry average.

# III. Famous Sequential Screens

Ticker	Company Name	Market Cap	P/B	P/E	1-Year EPS Growth
APF	AMERICAN PACIFIC CORP	69.26	0.78	7.37	6%
AMPH	AMERICAN PHYSICIANS SVC GP	25.95	1.51	11.13	179%
ALOG	ANALOGIC CORP	554.87	1.56	10.98	1526%
CHRS	CHARMING SHOPPES	620.23	1.10	19.57	115%
GMP	GREEN MOUNTAIN POWER CORP	118.78	1.29	10.63	27%
NOLD	NOLAND CO	139.98	0.91	11.16	52%
SMK	MOVIE STAR INC	23.40	1.36	6.25	300%
SISC	STEWART INFORMATION SERVICES	730.95	1.48	4.92	113%
EEI	ECOLOGY AND ENVIRON -CL A	39.71	1.03	10.26	171%
MBI	MBIA INC	8521.72	1.55	11.30	24%
VIA	VIACOM INC -CL B	76981.55	1.23	31.48	61%
EMCI	EMC INSURANCE GROUP INC	243.13	1.54	12.36	101%
PXRE	PXRE GROUP LTD	313.48	1.06	3.89	40%
NYMG	NYMAGIC INC	266.66	1.21	7.72	211%
LTCO	LANDAMERICA FINANCIAL GP	983.27	1.14	4.10	164%
IPCR	IPC HOLDINGS LTD	1878.87	1.45	8.72	26%
OSIS	OSI SYSTEMS INC	280.62	1.56	19.80	24%

a. Market capitalization is in millions. EPS growth in in %. Data for December 2003.

### III. Famous Sequential Screens

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# III. Famous Sequential Screens

- Strategy Performance

Return of Equally-Weighted Portfolio from December 2003 - October 2006

	ALOG	GMP	STC	MBI	VIA	LFG	Portfolio	S&P500
Cumulative Return	33.35%	57.41%	-1.85%	18.83%	-12.33%	18.32%	18.95%	26.46%
Annualized Return	10.37%	16.83%	-0.64%	6.09%	-4.41%	5.94%	6.13%	8.38%

### III. Famous Sequential Screens

- Many other potential screens described in the book like Miller and Buffett to pure quantitative screens, like Earnings Revision and Analyst Upgrades.
- The key is that these are baseline screens. A portfolio manager or analyst can fine tune them towards their investment philosophy and testing.



## IV. Simultaneous Screening

- Sequential screens have a few drawbacks.
- Simultaneous screens are more useful.
  - Need to standardize factors so they can be combined.
  - The Z-score is particularly useful.

## IV. Simultaneous Screening

### The Z-Score

- Standardizes factor exposures across stocks.

$$z_{i,k} = \frac{\beta_{i,k} - \bar{\beta}_k}{S(\beta_k)} \quad (5.1)$$

- Example: Stock AIG P/B = 2.56  
Mean P/B=4.54     SD(P/B) = 8.03.  
Z-score = -0.247

## IV. Simultaneous Screening

### The Aggregate Z-Score

- Compute Z-scores for every stock and every factor add them up.

$$\bar{z}_i = \left( \frac{1}{K} \right) (z_{i,1} + z_{i,2} + z_{i,3} + \cdots + z_{i,K}) \quad (5.2)$$

*Note:* Different weighting schemes, but all else.

## IV. Simultaneous Screening

### The Aggregate Z-Score

- Ad Hoc weighting
  - ex ante beliefs
  - relative importance
  - info ratios
- Optimal weighting

$$r_{i,t} = \gamma_i + \delta_1 z_{i,1,t-1} + \delta_2 z_{i,2,t-1} + \dots + \delta_K z_{i,K,t-1} + \epsilon_{i,t} \quad (5.3)$$

# IV. Simultaneous Screening

## An Example

**TABLE 5.2**

Selected Factor Exposures and Z-Scores of Selected Stocks

Ticker	Price-to-Earnings (P/E) Ratio	Price-to-Book (P/B) Ratio	Debt-to-Equity (D/E) Ratio	Size	Momentum (M12M)	Z-Score of P/E Ratio	Z-Score of P/B Ratio	Z-Score of D/E Ratio	Z-Score of Size	Z-Score of M12M	Aggregate Z-Score
AIG	23.27	2.56	8.50	11.93	-0.94	-0.093	-0.247	0.533	2.519	-1.232	-0.789
C	15.47	2.84	11.65	12.40	1.82	-0.287	-0.212	0.882	2.950	0.037	-0.659
XOM	13.46	3.21	1.05	12.39	0.56	-0.337	-0.166	-0.290	2.937	-0.543	-0.537
GE	20.33	4.52	8.03	12.57	0.70	-0.166	-0.003	0.482	3.106	-0.475	-0.779
INTC	48.61	6.18	0.25	12.30	4.06	0.536	0.203	-0.378	2.857	1.068	-0.43
IBM	22.86	6.84	3.24	11.96	0.40	-0.104	0.285	-0.048	2.547	-0.614	-0.659
PFE	58.89	12.84	1.32	12.45	0.68	0.792	1.033	-0.259	3.000	-0.484	-1.01
WMT	28.39	6.12	1.41	12.39	0.32	0.034	0.196	-0.250	2.943	-0.652	-0.715
MSFT	32.54	4.55	0.30	12.53	-0.87	0.137	0.001	-0.372	3.073	-1.201	-0.808
CSCO	39.14	5.60	0.32	11.96	3.56	0.301	0.131	-0.369	2.554	0.838	-0.356
S&P 500											
Mean	27.03	4.54	3.67	9.16	1.74	0	0	0	0	0	0
SD	40.24	8.03	9.05	1.10	2.17	1	1	1	1	1	N/A

Note: Size is the natural logarithm of market capitalization. Momentum is defined as the monthly average return (in percentage terms) over the past 12 months. Negative P/E and P/B ratio values were given a value of zero for purposes of computation. The stocks were selected from the S&P 500. The ticker symbols are for the following companies. American International Group (AIG), Citigroup, Inc. (C), Exxon Mobil Corp (XOM), General Electric Co (GE), Intel Corp (INTC), International Business Machines Corp. (IBM), Pfizer, Inc. (PFE), Wal-Mart Corp. (WMT), Microsoft Corp. (MSFT), and Cisco Systems, Inc. (CSCO). All values were computed as of December 2003. The data were obtained from Compustat.

## IV. Simultaneous Screening

### An Example

- AIG's Aggregate Z-score

$$\begin{aligned} z_{AIG} &= \frac{1}{5} [-z_{AIG,P/E} - z_{AIG,P/B} - z_{AIG,D/E} - z_{AIG,size} + z_{AIG,M12M}] \\ &= \frac{1}{5} [ -(-0.093) - (-0.247) - (0.533) - (2.519) + \\ &\quad (-1.232) ] = -0.789 \end{aligned} \tag{5.4}$$

*Note:* Importance of adding up Z-scores.

## IV. Simultaneous Screening

### Factor Groups and the Agg. Z-Score

- Some portfolio managers separate the K-factors into M factor groups.
- Why?
  - (a) Simple Organization
  - (b) A diversification of factors
  - (c) Easier to change weights due to changing circumstances

## IV. Simultaneous Screening

### Factor Groups and the Agg. Z-Score

- Step 1: Determine groups.
- Step 2: Determine factors for groups.
- Step 3: Compute all factors
- Step 4: Compute mean/sd of factors.
- Step 5: Compute Z-scores.
- Step 6: Compute Z-score for group.
- Step 7: Compute Agg. Z-score



# IV. Simultaneous Screening

## Example: Factor Groups

- Step 1: Choose 4 groups
  - Valuation, Profitability, Financial-Soundness, and Technical
- Step 2: Factors for groups.

**TABLE 5.3**

A Possible Categorization of Factors into Composite Groups

Group Number	Factor Group	Factors
1.	Valuation composite	Price-to-earnings (P/E) ratio Price-to-book (P/B) ratio Price-to-sales (P/S) ratio
2.	Profitability composite	Gross profit margin (GPM)
3.	Financial-soundness composite	Interest coverage ratio (ICR) Debt-to-equity (D/E) ratio
4.	Technical composite	12-month momentum (M12M)

## IV. Simultaneous Screening

### Example: Factor Groups

- Step 3, 4, 5, 6, and 7.
- All of this is done on stock data for the S&P 500 for December 2003.
- We equally-weight all factors within groups and equally-weight groups for this example.

# IV. Simultaneous Screening

## Example: Factor Groups

**TABLE 5.4**

Selected Factor Exposures and Group Z-Scores of Selected Stocks

Ticker	Valuation Composite			Profitability Composite	Financial Soundness Composite		Technical Composite	Valuation Composite Z-Score	Profitability Composite Z-Score	Financial Composite Z-Score	Technical Composite Z-Score	Aggregate Z-Score
	P/E	P/B	P/S	GPM	ICR	D/E	M12M					
AIG	23.27	2.56	2.24	0.08	2.52	8.50	−0.940	0.156	0.136	−0.261	−1.232	−0.300
C	15.47	2.84	2.64	0.15	1.63	11.65	1.817	0.169	0.319	−0.437	0.037	0.022
XOM	13.46	3.21	1.34	0.06	14.36	1.05	0.556	0.301	0.079	0.177	−0.543	0.003
GE	20.33	4.52	2.20	0.12	2.48	8.03	0.704	0.103	0.233	−0.235	−0.475	−0.094
INTC	48.61	6.18	8.19	0.12	38.11	0.25	4.058	−0.799	0.235	0.275	1.068	0.194
IBM	22.86	6.84	1.92	0.07	30.63	3.24	0.403	0.014	0.090	0.093	−0.614	−0.104
PFE	58.89	12.84	7.91	0.28	33.91	1.32	0.685	−1.134	0.709	0.206	−0.484	−0.176
WMT	28.39	6.12	0.98	0.03	7.77	1.41	0.319	0.092	−0.003	0.142	−0.652	−0.105
MSFT	32.54	4.55	8.63	0.31	N/A	0.30	−0.875	−0.643	0.785	1.686	−1.201	0.157
CSCO	39.14	5.60	8.31	0.19	N/A	0.32	3.559	−0.709	0.442	1.685	0.838	0.564
S&P 500												
Mean	27.03	4.54	2.67	0.03	−0.02	3.67	1.737					
SD	40.24	8.03	3.33	0.35	222.19	9.05	2.174					

Note: For ticker symbols, see the note to Table 5.2. All values are as of December 2003. The data were obtained from Compustat. Negative P/E and P/B ratio values were given a 0 value for purposes of computation. Some companies, such as CSCO and MSFT, had no interest expense for December 2003. Their ICR technically would be infinite. We gave them a Z-score of 3 for this attribute.

## IV. Simultaneous Screening

### Example: Factor Groups

- Focus: CSCO (last stock in table)

$$\begin{aligned} z_{\text{CSCO},V} &= \frac{1}{3} \left[ -z_{\text{CSCO},P/E} - z_{\text{CSCO},P/B} - z_{\text{CSCO},P/S} \right] \\ &= \frac{1}{3} \left[ - \left( \frac{39.14 - 27.03}{40.24} \right) - \left( \frac{5.60 - 4.54}{8.03} \right) - \left( \frac{8.31 - 2.67}{3.33} \right) \right] \quad (5.7) \\ &= \frac{1}{3} \left[ -(0.30) - (0.13) - (1.69) \right] = -0.709 \end{aligned}$$

- Do this for other groups and get overall CSCO Z-score of 0.564.

## V. Agg. Z-Score and Returns

### Implied Expected Return

- Z-scores are just relative rankings of stocks
- They say nothing about expected returns
- In constructing a quantitative portfolio, we like to maximize return for a given level of risk – thus, knowing expected returns would be useful.

## V. Agg. Z-Score and Returns

### Implied Expected Return

- One way we can translate Z-scores to returns is by running a regression of:

$$r_{i,t} = \gamma_i + \delta z_{i,t-1} + \epsilon_{i,t}$$

- The expected return of the stock for portfolio construction purposes is:

$$E(r_{i,T+1}) = \gamma_i + \delta z_{i,T}$$

## V. Agg. Z-Score and Returns

### The Forecasting Rule of Thumb

- It's actually just a simple transformation of a regression equation on previous slide – nothing new.
- That's what nice about regressions.

$$\begin{aligned} E(r_{it} | z_{i,t-1}) - E(r_t) &= \delta [z_{i,t-1} - E(z_{t-1})] \\ &= \frac{C(r_t, z_{t-1})}{V(z_{t-1})} z_{i,t-1} \quad (5.10) \\ &= \rho(r_t, z_{t-1}) S(r_t) z_{i,t-1} \\ &\equiv IC \cdot \text{volatility} \cdot \text{score} \end{aligned}$$

## V. Z-Score, Alpha, and Software

- Expected return issue once again
- One-to-one mappings
- Estimation as in Slide 29
- Estimation of the equation below and then forecast the alpha of all stocks.

$$r_{i,t} - \beta_i' \mathbf{f}_t = \gamma_i + \delta z_{i,t-1} + \epsilon_{i,t} \quad (5.14)$$

- All have drawbacks.



## VI. Summary

- Stock screening and ranking.
- Simultaneous and the Z-score
- Z-scores and Expected Returns
- These are only parts of a much larger process known as quantitative equity portfolio management (QEPM).

# VI. Summary

## An Overview of QEPM

**Chapter 1**  
**The Power of QEPM**

**Chapter 2**  
**Basic QEPM Models**

**Chapter 3**  
**Fundamentals of  
QEPM**

# VI. Summary

## Portfolio Construction and Maintenance

**Chapter 4  
Factors  
and  
Factor Choice**

**Chapter 5  
Stock Screening  
And  
Ranking**

**Chapter 6  
Fundamental  
Factor  
Models**

**Chapter 7  
Economic  
Factor  
Models**

**Chapter 8  
Forecasting  
Factor Premiums  
And  
Exposures**

**Chapter 9  
Portfolio  
Weights**

**Chapter 10  
Rebalancing  
And  
Transaction  
Costs**

**Chapter 11  
Tax Management**

# VI. Summary

Alpha Mojo

Chapter 12  
Leverage

Chapter 13  
Market Neutral

Chapter 14  
Bayesian Alpha

# VI. Summary

## Performance Measurement

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**Chapter 15**  
**Performance**  
**Measurement**  
**and**  
**Attribution**

## Practical Application

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**Chapter 16**  
**The Backtesting**  
**Process**

**Chapter 17**  
**The Portfolios'**  
**Performance**

# VI. Summary

## • Thank you.

(continued from front flap)

valuable figures, tables, equations, mathematical solutions, and formulas. In addition, the book as a whole has appendices covering a brief history of financial theory, fundamental models of stock returns, a basic review of mathematical and statistical concepts, an entertaining explanation and quantitative approach to the casino game of craps, and other on-target supplemental materials.

An essential reference for professional money managers and students taking advanced investment courses, *Quantitative Equity Portfolio Management* offers a full array of methods for effectively developing high-performance equity portfolios that deliver lucrative returns for clients.

### ABOUT THE AUTHORS

LUDWIG B. CHINCARINI, PH.D., CFA, is a professor of finance at Georgetown University as well as a financial consultant to institutional investors. Previously, he was director of research at Rydex Global Advisors, the index mutual fund company. Prior to that, Dr. Chincarini was director of research at FOLIOfin, a brokerage firm that pioneered basket trading. He also worked at the Bank for International Settlements and holds a Ph.D. in economics from the Massachusetts Institute of Technology.

DAEHWAN KIM, PH.D., is a professor of economics at the American University in Bulgaria. Previously, he was employed as a financial economist for FOLIOfin. Dr. Kim also worked as a financial journalist, writing regular columns on financial markets for business media in Asia. He also holds a Ph.D. in economics from Harvard University.

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—DAN DIBARTOLOMEO, President and Founder, Northfield Information Services, Inc.



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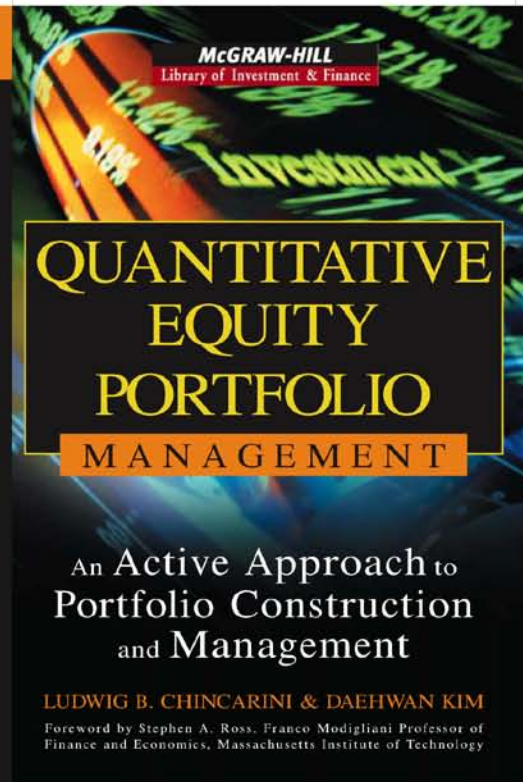
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(continued on back flap)

## ***Contact Information***

Dr. Ludwig Chincarini, CFA  
Adjunct Professor & Consultant

Georgetown University

Phone: 703-848-1858

Fax: 202-687-4031

chincarinil@hotmail.com

<http://faculty.msb.edu/lbc22>