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# Size & Value Factor

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# Outline

- 1** Fama-French Three-Factor Model
- 2** Size Factor
- 3** Value Factor

# Capital Asset Pricing Model

The CAPM looks at risk and return through a “one-factor” lens.  
The risk and the return of a portfolio are determined only by its exposure to market beta.

## Part 1

# The Fama-French Three-Factor Model

In 1981,  
Rolf Banz

Market beta does  
not fully explain  
the higher  
average return of  
small stocks

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In 1983,  
Sanjoy Basu

The positive  
relationship  
between the  
earnings yield  
(earnings-to-  
price ratio, or E/P)  
and average  
return is left  
unexplained by  
market beta

>>

In 1985,  
Barr Rosenberg,  
Kenneth Reid,  
Ronald Lanstein

The positive  
relationship  
between average  
stock returns and  
book-to-market  
(B/M)  
ratio

>>

In 1992,  
Eugene Fama,  
Kenneth French

Along with the  
market beta  
factor,  
exposure to the  
factors of size  
and value further  
explains the  
differences in  
returns  
of diversified  
portfolios

## Part 1

# The Fama-French Three-Factor Model

In 1992,  
Eugene Fama,  
Kenneth French

The Cross-Section  
of Expected Stock  
Returns

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Beta as the sole variable in explaining returns on stocks is dead

In 1993,  
Eugene Fama,  
Kenneth French

Common risk  
factors in the  
returns on stock  
and bonds

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$$r = r_f + \beta_1(r_m - r_f) + \beta_2(SMB) + \beta_3(HML) + \varepsilon$$

- $r$  : Expected rate of return
- $r_f$  : Risk-free rate
- $(r_m - r_f)$  : Expected excess return
- $r_m$  : Market portfolio return
- $SMB$  : Excess returns of small-cap over large-cap
- $HML$  : Excess returns of value stocks over growth stocks
- $\beta$  : Factor coefficient
- $\varepsilon$  : Error term

<b>Persistent</b>	It holds across long periods of time and different economic regimes
<b>Pervasive</b>	It holds across countries, regions, sectors, and even asset classes
<b>Investable</b>	It holds up not just on paper, but also after considering actual implementation issues, such as trading costs
<b>Intuitive</b>	There are logical risk-based or behavioral-based explanations for its premium and why it should continue to exist
<b>Robust</b>	It holds for various definitions (for example, there is a value premium whether it is measured by price-to-book, earnings, cash flow, or sales)

## Part 2

# The Size Factor (SMB, Small Minus Big)

The size factor has captured the tendency of small-cap stocks to outperform bigger companies over the long run

### Calculation

annual average return of **small-cap** stocks

- annual average return of **large-cap** stocks

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∴ Size factor

### Small VS. Big

- **Small-cap** stocks
  - within deciles **6–10** of the CRSP index
- **Large-cap** stocks
  - within deciles **1–5** of the CRSP index

\* CRSP U.S. Total Market Index

The CRSP U.S. Total Market index is a well-known indicator of the performance of the US stock market as a whole. It includes almost 4000 companies across mega, large, small and micro capitalizations and covers nearly 100% of the US investable equity market.

**TABLE 2.1: ODDS OF OUTPERFORMANCE (%)**

	1-YEAR	3-YEAR	5-YEAR	10-YEAR	20-YEAR
SIZE	59	66	70	77	86

Table 2.1 shows the persistence of the size premium over the period from 1927 through 2015. We can see a pattern in which the chances of success increase as the time period lengthens, although with somewhat lower values.



## Part 2

# The Size Factor - (2) Pervasive

The size premium can be seen not just domestically, but also in developed and emerging equity markets around the world.

Evidence	Description
<b>MSCI, DFA Index</b> (1970 – 2015)	<ul style="list-style-type: none"><li>- MSCI EAFE Index (large- and mid-cap stocks) : 9.5 %</li><li>- <u>DFA Small-Cap Index : 14.5 %</u></li><li>- MSCI EAFE Small Cap Index : 8.4 % (∴ 1999 – 2015, short period to consider)</li></ul>
DFA's 2015 research report “Dimensions of Equity Returns in Europe”	<ul style="list-style-type: none"><li>- 15 European markets for the 33-year period from 1982 through 2014</li><li>- Small-cap premium overall, as well as in each country but one (Finland, where data were only available beginning in 1990)</li></ul>
<b>Fama-French Index</b> (1989 – 2015)	<ul style="list-style-type: none"><li>- Fama-French Emerging Markets Index : 10.4 %</li><li>- <u>Fama-French Emerging Markets Small Cap Index : 11.7 %</u></li></ul>

Evidence	Description
<b>BRSIX</b> (Bridgeway Ultra-Small Company Market Fund)	<ul style="list-style-type: none"> <li>- The fund returned : <u>10.3 %</u> ( &gt; The CRSP 9–10 Index : 9.5 %)</li> <li>- The Fama-French U.S. Small Cap Index : 8.5 %</li> <li>- The Russell 2000 Index : 7.0 % (1997.08 – 2015.12)</li> </ul>
<b>DFSCX</b> (DFA U.S. Micro Cap Portfolio fund)	<ul style="list-style-type: none"> <li>- The fund returned : <u>11.8 %</u> ( &gt; The CRSP 9–10 Index : 11.0 %)</li> <li>- The Fama-French U.S. Small Cap Index : 11.6 %</li> <li>- The Russell 2000 Index : 10.1 % (1982.01 – 2015.12)</li> </ul>
<b>DFSTX</b> (DFA Small Cap Portfolio fund)	<ul style="list-style-type: none"> <li>- The fund returned : <u>10.4 %</u></li> <li>- The Fama-French U.S. Small Cap Index : 10.45 %</li> <li>- The Russell 2000 Index : 9.0 % (1992.04 – 2015.12)</li> </ul>

Evidence	Description
<b>NAESX</b> (Vanguard Small Cap Index fund)	<ul style="list-style-type: none"> <li>- The fund returned : <u>9.6 %</u> ( &lt; The CRSP 6–10 Index : 10.5 %)</li> <li>- The Russell 2000 Index : 8.9 % (1989.09 – 2015.12)</li> </ul>
<b>DFISX</b> (DFA International Small Company Portfolio Institutional Class fund)	<ul style="list-style-type: none"> <li>- The fund returned : <u>6.7 %</u> ( &lt; International Small Cap Index : 7.7 %) (1996.10 – 2015.12)</li> <li>- The fund returned : <u>9.1 %</u> ( &gt; The MSCI EAFE Small Cap Index : 8.0 %) (1991.01 – 2015.12)</li> </ul>
<b>DEMSX</b> (DFA Emerging Markets Small Cap Portfolio fund)	<ul style="list-style-type: none"> <li>- The fund returned : <u>10.8 %</u></li> <li>- The Fama-French U.S. Small Cap Index : 9.2 %</li> <li>- The MSCI Emerging Markets Small Cap Index : 6.7 % (1998.04 – 2015.12)</li> </ul>

There are clear and simple **risk-based explanations** for the size premium.

Relative to large companies, **small companies** typically are characterized by:

- greater leverage
- a smaller capital base, reducing their ability to deal with economic adversity
- greater vulnerability to variations in credit conditions due to more restrictive access to capital
- higher volatility of earnings
- lower levels of profitability
- greater uncertainty of cash flow
- less liquidity, which therefore makes their stocks more expensive to trade
- a less-proven, or even unproven, track record for the business model
- less depth of management
- small-cap stocks are more volatile than large-cap stocks

## The Size Factor - (4) Intuitive

Additionally, smaller companies tend to perform relatively poorly in bad times, and assets that do poorly in bad times should require a risk premium.

Research	Description
In 2002, Gerald Jensen, Jeffrey Mercer “ <b>Monetary Policy and the Cross-Section of Expected Stock Returns</b> ”	<ul style="list-style-type: none"><li>- They found that when size is isolated, there is a significant small-firm premium only in periods of expansionary monetary policy.</li><li>- In restrictive periods, the size effect is not statistically significant.</li><li>- They concluded that <b>monetary policy</b> has a significant impact on <b>the size effect</b>.</li></ul>
In 2002, Moon K. Kim, David A. Burnie “ <b>The Firm Size Effect and the Economic Cycle</b> ”	<ul style="list-style-type: none"><li>- They found that small companies grow faster than large companies in good economic times (<b>their risk is rewarded</b>) but do poorly in the worst of times (<b>their risk materializes</b>, frequently ending in bankruptcy).</li><li>- The authors concluded that the size effect is really <b>compensation</b> for <b>economic cycle risk</b>.</li></ul>
In 2006, Motohiro Yogo “ <b>A Consumption-Based Explanation of Expected Stock Returns</b> ”	<ul style="list-style-type: none"><li>- Small-cap stocks deliver low returns during recessions, when the marginal utility of consumption is highest.</li><li>- In other words, the returns of <b>small-cap stocks are more pro-cyclical</b> than the returns of large-cap stocks.</li><li>- Thus, investors must be rewarded with high expected returns to hold these risky equities</li></ul>

## Part 2

# The Size Factor - (5) Robust

In 2015, Asness and his colleagues, "Size Matters, If You Control Your Junk"

### Before

Stocks with very poor quality (i.e., "junk") are typically very small.

⋮

These characteristics drive the strong negative relation between size and quality and the returns of these **junk stocks** chiefly explain the sporadic performance of the **size premium** and the challenges that have been hurled at it

### Controlling for quality factor

### After

Small **quality** stocks outperform large **quality** stocks and small **junk** stocks outperform large **junk** stocks, but the standard size effect suffers from a size-quality composition effect.

The authors concluded that after controlling for quality, a significant size premium emerges.

## Part 3

# The Value Factor (HML, High Minus Low)

The foundation of value investing is the notion that cheaply priced stocks outperform pricier stocks in the long term.

### Calculation

annual average return of **value** stocks

- annual average return of **growth** stocks

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∴ Value factor

### High VS. Low

- **Value** stocks
  - 30 percent of stocks with the **highest** BtM ratio
- **Growth** stocks
  - 30 percent of stocks with the **lowest** BtM ratio

- **BtM (Book-to-Market) ratio**

The ratio compares a firm's book value to its market value.

**TABLE 3.1: ODDS OF OUTPERFORMANCE (%)**

	1-YEAR	3-YEAR	5-YEAR	10-YEAR	20-YEAR
VALUE	63	72	78	86	94

Table 3.1 shows the persistence of the size premium over the period from 1927 through 2015.

We can see a pattern in which the chances of success increase as the time period lengthens.



Evidence	Description
<b>Fama-French Index</b> (1975 – 2015)	<ul style="list-style-type: none"><li>- Fama-French International Growth Index : 8.6 %</li><li>- <u>Fama-French International Value Index : 13.8 %</u></li></ul>
<b>Fama-French Index</b> (1989 – 2015)	<ul style="list-style-type: none"><li>- Fama-French Emerging Markets Growth Index : 9.3 %</li><li>- <u>Fama-French Emerging Markets Value Index : 13.0 %</u></li></ul>
DFA's 2015 research report "Dimensions of Equity Returns in Europe"	<ul style="list-style-type: none"><li>- 15 European markets for the 33-year period from 1982 through 2014</li><li>- The value premium was 4.9 % for Europe as a whole</li></ul>
In 2013, Asness and his colleagues "Value and Momentum Everywhere"	<ul style="list-style-type: none"><li>- 18 developed market countries and found a significant return premium to value in every stock market, with the strongest performance in Japan</li></ul>

Evidence	Description
<b>DFLVX</b> (DFA U.S. Large Cap Value Portfolio Institutional Class fund)	<ul style="list-style-type: none"> <li>- The fund returned : <u>9.8 %</u> ( &gt; MSCI US Prime Market Value Index : 9.3 %)</li> <li>- The Russell 1000 Index : 9.4 % (1993.03 – 2015.12)</li> </ul>
<b>DFSVX</b> (DFA U.S. Small Cap Value Portfolio Institutional Class fund)	<ul style="list-style-type: none"> <li>- The fund returned : <u>11.6 %</u> ( &gt; MSCI US Small Cap Value : 10.6 %)</li> <li>- The Russell 2000 Index : 9.7 % (1993.04 – 2015.12)</li> </ul>
<b>DFVIX</b> (DFA International Value III Portfolio fund)	<ul style="list-style-type: none"> <li>- The fund returned : <u>5.9 %</u> ( &gt; MSCI EAFE Value Index : 5.1 %) (1994.06 – 2015.12)</li> </ul>
<b>DISVX</b> (DFA International Small Cap Value Portfolio I fund)	<ul style="list-style-type: none"> <li>- The fund returned : <u>7.4 %</u> ( = MSCI EAFE Small Cap Value Index) (1995.01 – 2015.12)</li> </ul>
<b>DFEVX</b> (DFA Emerging Markets Value Portfolio Institutional Class fund)	<ul style="list-style-type: none"> <li>- The fund returned : <u>9.8 %</u> ( &gt; MSCI Emerging Markets Value Index : 5.7 %) (1997.01 – 2015.12)</li> </ul>

Keyword	Description
<b>Confuse familiarity with safety</b>	<ul style="list-style-type: none"><li>- In 1994, Josef Lakonishok and his colleagues, “Contrarian Investment, Extrapolation, and Risk”</li><li>- Because they tend to be more familiar with popular growth stocks, those stocks tend to be overvalued</li></ul>
<b>Anchoring</b>	<ul style="list-style-type: none"><li>- Anchoring is a form of cognitive bias that investors to weigh new information based on their first impressions</li><li>- Anderson and Zastawniak hypothesized that investors may anchor on the price-to-earnings (P/E) ratio of a stock when they initially invest in it</li><li>- Such investors fail to adjust their future expectations sufficiently according to mean reversion</li></ul>
<b>Loss Aversion</b>	<ul style="list-style-type: none"><li>- Loss aversion is the tendency to be more sensitive (place greater utility) on losses than on gains</li><li>- Value stocks are generally associated with companies that have performed poorly in the recent past, as evidenced by their current low prices</li><li>- The pain of the recent loss causes investors to perceive these stocks as even riskier</li><li>- They therefore raise the required risk premium</li></ul>

## The Value Factor – (5) Robust

These findings give us confidence that these results for value are not just random outcomes.

“Value vs. Glamour: A Long-Term Worldwide Perspective” by The Brandes Institute, which covered developed markets for the period from January 1980 through June 2014, found a similar value premium **no matter the metric used**

- BtM metric : 6.1 %
- The earnings-to-price metric : 7.3 %
- The cash flow-to-price metric : 8.0 %

**The value premium** was there across all market capitalizations, in the non-U.S. developed markets, and in emerging markets as well.

# References

- 1 Your Complete Guide to Factor-Based Investing (Andrew L. Berkin)
- 2 Factor Investing Focus : Size (MSCI)
- 3 Factor Investing Focus : Value (MSCI)