

# Equity Risk Factors Toolkit

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## Abstract

A number of firm characteristics have been shown in the literature to affect equity returns. Some examples can be found in the resources of the **toolkit main website**. Using combinations of such characteristics we can create (long-short) portfolios of stocks and study their performance over time. The portfolios may capture various equity risk factors. This is a customized report of a specific combination of risk factors (firm characteristics) selected using the toolkit.

<sup>1</sup>This report has been generated using the **Equity Risk Factors Toolkit**.

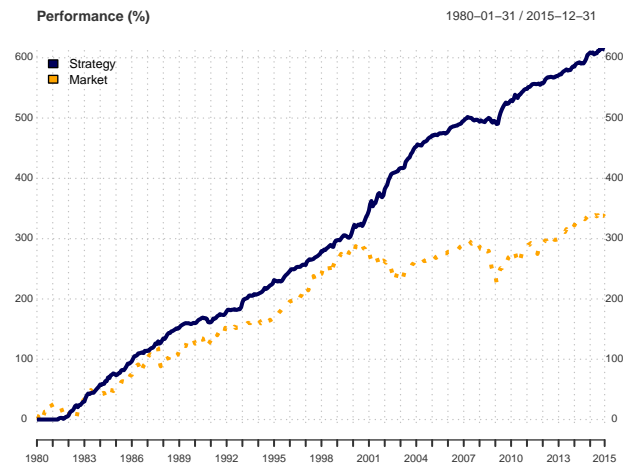
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## Introduction

This report contains the results of a specific strategy using the **Equity Risk Factors Toolkit** [1]. At the beginning of each month all pre-screened US public firms (Step 1) are sorted based on the values of selected firm characteristics (Step 2) the one before last day of the previous month, in decreasing or increasing order. An equal weighted long-short portfolio with the top and bottom firms is then created for each firm characteristic. Hence for each firm characteristic we have a simple long-short trading strategy (a factor) with monthly portfolio rebalancing - with no hindsight, and no transaction costs considered. Finally, a weighted average of all these long-short portfolios (factors) is created in order to construct one final portfolio. The weights on the factors used for this final portfolio are calculated each month with data until the previous month using various portfolio weights estimation methods (Step 3). An analysis of the historic returns of this final portfolio is then performed.

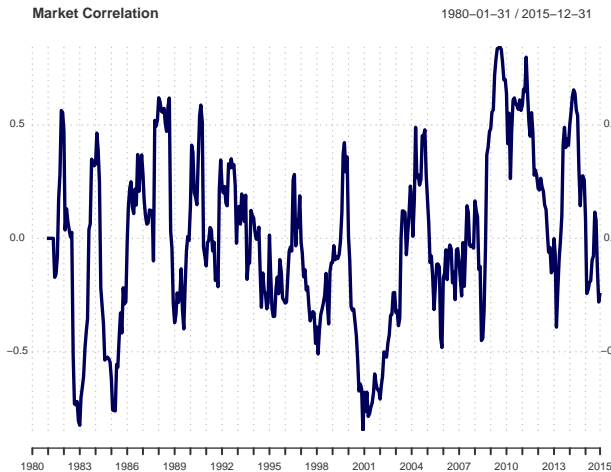


**Figure 1.** The monthly performance of the strategy

## 1. Strategy details

The design of a portfolio (and corresponding "trading strategy") is done in three steps:

- First, the universe of all public US firms (from the CRSP database) is filtered each month using a number of filters. The filters used for this report, if any are selected, are described in Section 1.1;
- A number of firm characteristics (e.g. see tool resources) are selected, and a long-short portfolio (a "factor") is created for each of them using the top and bottom firms according to each characteristic. The ones selected for this report are discussed in Section 1.2. For each of the selected firm characteristics the top and bottom firms are selected based on user defined thresholds. The thresholds defining the number (or percentile) of



**Figure 2.** 12-month rolling correlation with S&P

top/bottom firms for this report are shown in Section 1.3;

- A final portfolio is created each month by taking a weighted average of all the factors using a chosen portfolio weights estimation method. The portfolio weights estimation method used for this report is described in Section 1.4,

Note that all selections (e.g. of firms) for the (long-short) portfolios are done each month with *no* hindsight as only firm characteristics available at most the day before last of the previous month are used every time. Hence all "strategy performances" described below are with no hindsight (other than the experimentation with various factors the user may have done). The portfolio is rebalanced monthly, although many of the firm characteristics only change yearly (as they are reported for example at Compustat) hence rebalancing may happen less frequently. No transaction costs are considered. *Disclaimer:* Performances of the developed trading strategies are not indicative of future returns. It should not be assumed that the strategies will be profitable or that they will not result in losses if used in practice. Moreover, there is no guarantee that the tool is bug free. The tools and customized reports are for educational purposes only.

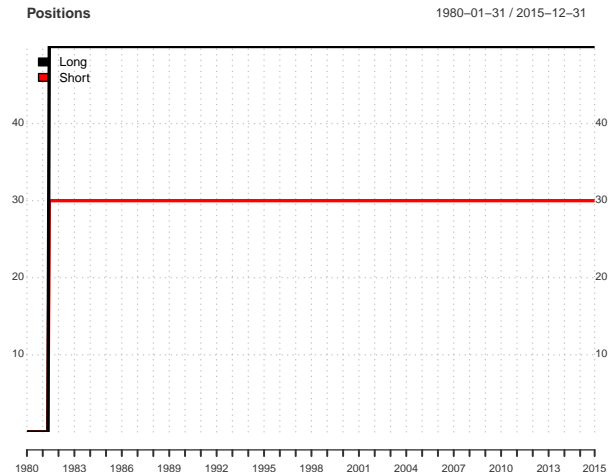
### 1.1 Filtering

Market capitalization filter: values 500 to 1e+07 million USD. Price filter: values 1 to 1e+11 USD. Only companies in major stock exchanges (NYSE, AMEX and NASDAQ) were used. Companies from all industries were used.

### 1.2 Factor definitions

The chosen factors are detailed in the appendix.

Going long the companies with high values for a particular factor implies that higher values of the factor are indicators of superior company performance. Going long the companies



**Figure 3.** Number of long and short positions over time

with low values for a particular factor implies that lower values of the factor are indicators of superior company performance.

### 1.3 Long-short percentiles

For the long-short strategy the chosen percentiles were:

- Top number of companies to go long: 50
- Bottom number of companies to go short: 30

### 1.4 Factor combination

The simplest way of averaging the constructed (long-short) factors is giving each factor an equal weight. Alternatively, the weights of individual factors can be calculated using risk parity allocation, or mean-variance optimization across factors. For risk parity allocation the user can choose a risk measure among the following: standard deviation, median absolute deviation, Sharpe ratio, maximum drawdown and Sortino ratio. For mean-variance optimization the user can choose the covariance matrix estimation method, which can be either standard or regularized using for example the graphical lasso algorithm. The risk measures and the covariance matrix are computed using a user-defined number of lookback months.

The factors portfolio weights estimation method used for this report was: risk parity. The risk measure used for risk parity was Maximum drawdown, with a lookback period of 18 months.

## 2. Strategy performance

The following results are reported:

1. The returns of the customized trading strategy (for the selected firm characteristic(s));
2. The 12-months rolling correlation of the trading strategy with S&P;
3. The number of long and short positions over time

## 2.1 Trading Strategy Performance

For the monthly returns of the strategy see figure 1 on page 1 and table 1 in the appendix. The 12-month rolling correlation of the strategy with the S&P, is shown in figure 2.

The key statistics of the strategy are:

- Mean annualized return is 17.1%;
- Annualized volatility is 8.4%;
- Annualized Sharpe ratio is 2.12;
- Maximum drawdown is 11.7%.

## Acknowledgments

The Equity Risk Factors Toolkit has been developed by T. Evgeniou, O. Tsinalis, V. Kapartzianis, N. Nassuphis and D. Spinellis.

## References

- [1] Equity Risk Factors Toolkit. **Toolkit main website**. *Website*, 2016.

## Appendix

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1980	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	<b>0.00</b>
1981	0.00	0.00	0.00	0.00	0.00	2.18	0.57	-0.04	-1.63	1.21	2.22	0.22	<b>4.76</b>
1982	1.79	4.52	2.80	0.83	2.61	4.95	1.47	-3.29	3.54	-0.05	2.76	2.56	<b>27.12</b>
1983	0.60	5.89	4.62	2.87	-0.90	1.39	0.77	-0.14	2.70	2.64	2.48	2.32	<b>28.11</b>
1984	3.70	-0.63	1.63	-0.02	4.68	-0.24	6.25	-1.21	4.49	1.43	1.97	-1.03	<b>22.76</b>
1985	-2.00	0.88	2.22	0.72	4.01	1.10	-0.64	2.96	3.64	4.44	-0.34	1.79	<b>20.23</b>
1986	2.35	4.09	4.33	0.43	1.13	3.18	0.18	0.77	0.71	-1.23	3.86	-0.60	<b>20.75</b>
1987	1.16	-0.64	3.03	1.57	0.37	2.65	4.58	-1.14	4.68	-3.77	1.33	3.80	<b>18.69</b>
1988	3.47	-0.93	3.28	3.98	2.66	-0.07	2.70	0.70	1.34	1.56	1.53	-0.65	<b>21.25</b>
1989	1.50	2.82	1.62	1.23	1.30	0.86	-0.34	0.27	-0.88	-0.79	1.13	1.09	<b>10.20</b>
1990	-0.70	0.94	2.82	2.09	0.89	1.65	0.97	-1.20	0.36	-1.34	-5.30	-0.65	<b>0.28</b>
1991	0.32	2.14	4.06	-0.40	1.58	2.74	1.35	2.07	-1.02	-0.28	-0.23	2.37	<b>15.59</b>
1992	3.79	2.65	-0.15	-0.80	0.89	0.14	0.90	-1.32	0.24	0.90	-0.05	3.29	<b>10.83</b>
1993	8.14	4.69	1.17	0.73	0.93	3.65	0.43	-0.74	0.33	2.57	-1.17	0.71	<b>23.24</b>
1994	0.80	1.20	1.01	1.29	2.70	3.74	-1.87	1.55	2.26	2.19	1.09	1.82	<b>19.19</b>
1995	5.92	-0.86	-0.98	-0.61	1.21	-1.17	0.98	3.53	3.43	2.71	1.82	2.34	<b>19.61</b>
1996	2.76	2.80	0.12	-0.30	1.02	2.52	0.61	-0.06	0.18	2.31	1.39	-0.37	<b>13.69</b>
1997	-0.39	5.34	2.33	1.89	-0.89	0.62	0.86	2.14	1.21	1.33	1.74	2.16	<b>19.81</b>
1998	4.35	-0.54	3.01	-0.60	2.48	1.77	2.26	1.84	-2.60	-0.76	7.33	3.40	<b>23.85</b>
1999	0.11	1.00	-0.89	3.12	2.71	2.58	-0.15	-1.22	-2.07	-0.75	2.05	6.25	<b>13.16</b>
2000	7.42	5.85	-3.81	1.83	2.38	-1.25	2.62	-3.78	3.96	5.81	5.67	3.60	<b>33.87</b>
2001	6.61	10.64	5.27	-8.91	4.46	0.86	7.23	7.71	1.83	-5.07	-1.95	3.00	<b>34.39</b>
2002	10.26	3.96	3.04	8.46	4.52	4.89	1.67	0.80	0.79	1.04	0.64	4.11	<b>53.56</b>
2003	1.21	0.10	-0.25	1.23	9.13	3.13	2.85	1.41	5.84	2.89	4.56	3.65	<b>41.74</b>
2004	1.20	3.62	-1.43	-0.01	-0.64	3.92	2.31	0.53	1.50	3.12	2.07	0.65	<b>18.01</b>
2005	2.73	-0.35	1.76	-0.22	-0.80	2.21	1.15	-0.46	0.61	0.36	-1.31	1.13	<b>6.95</b>
2006	2.27	3.27	3.40	0.71	1.36	0.20	0.90	0.11	1.74	0.80	0.91	3.30	<b>20.62</b>
2007	1.41	2.58	1.07	2.53	-1.07	-0.36	-0.29	-2.82	-1.33	0.99	0.48	-1.14	<b>1.92</b>
2008	-2.37	2.30	-1.77	-0.27	-0.99	3.62	1.38	2.16	-1.50	-4.51	-1.93	3.04	<b>-1.18</b>
2009	-1.69	-3.65	0.50	10.72	7.23	5.71	4.55	3.79	3.14	-2.29	0.75	3.24	<b>35.90</b>
2010	2.27	-1.87	3.51	7.35	-3.13	-2.37	5.26	0.79	3.14	1.93	2.70	1.24	<b>22.32</b>
2011	-0.07	3.22	-0.02	2.03	2.65	0.49	0.10	-0.45	0.29	0.71	-2.17	2.80	<b>9.88</b>
2012	-0.51	2.22	4.45	2.23	1.58	-0.26	0.94	-0.46	-1.02	0.58	1.87	-0.05	<b>12.06</b>
2013	1.64	1.28	0.03	3.34	1.94	1.12	1.97	-2.00	0.63	0.25	3.66	2.36	<b>17.35</b>
2014	-0.39	3.71	1.81	0.95	0.70	-2.04	0.44	-0.24	3.32	4.49	6.23	2.02	<b>22.77</b>
2015	2.06	-1.24	1.44	-3.35	1.52	0.27	4.20	0.32	3.81	-0.32	-1.03	-0.83	<b>6.80</b>

Table 1. The monthly performance of the strategy per year

## Appendix (contd.)

	Factor	Description	Compustat	Filtering	Range
1	Share Price	Share Price	PRCC.F	values	[500, 1e+07]
2	Market Cap	Share price multiplied by the number of shares outstanding.	PRCC.F * CSHO	values	[1, 1e+11]

**Table 2.** Firm pre-screening Criteria

	Factor	Description	Compustat	Long
1	Asset Growth (Yearly)	Yearly percentage change in total assets.	$(AT(t) - AT(t-12)) / AT(t-12)$ , where t is the current month	Low
2	Market Beta	Market Beta		Low
3	Operating Leverage	The sum of cost of goods sold and selling, general and administrative expense divided by total assets.	$(COGS + XSGA) / AT$	High
4	Total Net External Financing	(Sale of Common and Preferred Stock - Cash Dividends - Purchase of Common and Preferred Stock + Sale of Long-Term Debt - Purchase of Long-Term Debt) / Total Assets	$(SSTK - DV - PRSTKC + DLTIS - DLTR) / AT$	Low
5	Faustmann ratio	The ratio of market capitalization to net worth	$MKVALT / (ICAPT + CHE - (DLTT + DLC + DCVT))$	Low

**Table 3.** Predefined Risk Factors

	Factor	Lookback.Months	Time.Series.Filtering
1	momentum	12	L2 trend filtering

**Table 4.** Technical Factors