November 2023

IP-VALUE FACTOR-BASED STRATEGY SHOW OUTPERFORMANCE IN NEARLY ALL INVESTIGATED GLOBAL INDICES

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SUMMARY

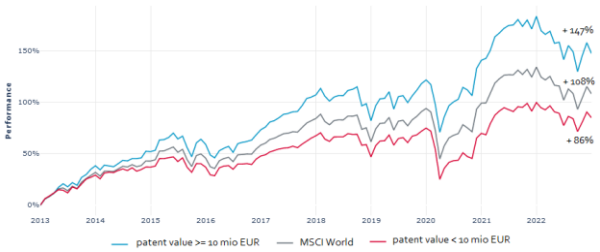
Fund compositions result from fundamental or quantitative analysis, incorporating indicators such as company size, dividend payments, and profit margins, with consideration of changes over time. When considering R&D activities, R&D expenses are often utilized as an indication of innovation. To assess a company's sustainability level, we use external ESG data or conduct our own research by analyzing their sustainability reports, which are based on the corporation's self-assessment. In addition, new metrics based on patents, their value, and quality can reveal crucial factors, such as the company's R&D output or innovation capabilities, hidden assets that are often not included in the balance sheet, and even sustainability efforts that can be inferred from patents. The effectiveness of a patent key-figure based selection is demonstrated through the results of 13 indices where an additional patent-based factor filter was applied and backtested. In all cases, significant outperformance in comparison to the original index composition was observed.

STARTING SITUATION

Patents serve as indicators of early-stage innovation. Unlike R&D expenses, which represent only costs, patent values represent the outcome of R&D activities, providing a more precise indication of innovation that considers both cost and value.

The correlation between a company's patent portfolio value, its development over time, and its success in the market, as indicated by the stock price development of the patent owner, has been previously demonstrated in individual studies.[1][2].

Our own calculations, e.g. using the MSCI World index as an example, show that stocks with patent value > €10 million perform significantly better (blue line) than the benchmark (grey line), and stocks with 0 < patent value <= €10 million (red line) perform worse than the benchmark:



How patents can be utilized in selection strategies and investment decisions and their potential for alpha generation and risk reduction will be demonstrated in this initial analysis utilizing a restricted set of benchmarks..

[1] Hall, Bronwyn H.; Thoma, Grid; Torrisi, Salvatore: THE MARKET VALUE OF PATENTS AND R&D: EVIDENCE FROM EUROPEAN FIRMS; NATIONAL BUREAU OF ECONOMIC RESEARCH; Cambridge, Sept. 2007

[2] Gittelman, Michelle. "A note on the value of patents as indicators of innovation: Implications for management research." *Academy of Management Perspectives* 22.3 (2008): 21-27.

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Twelve significant representative global indices for all regions worldwide were carefully chosen to cover a wide range of geographical areas and to eliminate any sectorial bias. The composition of each index was standardized and used as a benchmark.

Subsequently, equities that satisfied the top 30% of three patent-based selection criteria were filtered from the list of equities within each benchmark:

A. "**Patent Value**"- indicator: Rounded patent portfolio value in [EUR]. The selection strategy based on patent values only is referred to as strategy 1 (S1).

B. "**Patent Value / Market Cap**"- indicator: Usage of relative, dimensionless values: here the ratio of Patent Values divided by Market Cap is used. This selection strategy is referred to as strategy 2 (S2).

C. "**(Patent Value / Market Cap) * (Gross Profit / Total Assets)**"- indicator: In addition, the quotient of Patent Values divided by Market Cap is multiplied by Gross Profit / Total Assets[3] to select the most profitable stocks. This selection strategy is referred to as strategy 3 (S3).

METHODOLOGY

The indices were constructed using the equally weighted stock members (not capital weighted). In all the test-portfolios, the **30% highest** expressions of strategies 1, 2 or 3 are selected in each case were applied to stocks in various indices and the performance of the resulting portfolios was measured.

[3] See "Gross Profitability Premium" by Prof. Robert Novy-Marx Gross, June 2012

STRATEGY 1 (S1)

- Stocks with Patent Value greater 10 million EUR are selected[4]:
  Patent Value >= 10 million EUR
- The stocks are ranked according to **Patent Value**
- A portfolio is created from the shares with the 30% highest Patent Value

STRATEGY 2 (S2)

- Stocks with Patent Value greater 10 million EUR are selected:
  Patent Value >= 10 million EUR
- The stocks are ranked according to **Patent Value / Market Cap**
- A portfolio is created from the shares with the 30% highest Patent Value / Market Cap values

STRATEGY 3 (S3)

- Stocks with Patent Value greater 10 million EUR are selected:
  Patent Value >= 10 million EUR
- The stocks are ranked according to (**Patent Value / Market Cap) * (Gross Profit / Total Assets)**
- A portfolio is created from the shares with the 30% highest (Patent Value / Total Assets) * (Gross Profit / Total Assets) values.

TRADING FREQUENCY

6 months

BACKTESTED BENCHMARK UNIVERSE

China Securities 800
MSCI ACWI
MSCI World
MSCI ESG
NASDAQ COMPOSITE
NYSE Composite
Q-IPR Universe
S&P 1500
S&P 600 Small Cap
Shanghai SE Composite
STOXX Europe 600
TOPIX Stock Price

[4] To select equities with significant patent portfolios and to avoid ranking distortions due to non-significant patent values

PORTFOLIO POSITION WEIGHTS

Equal weighted

BACKTESTED TIME PERIOD

12/2012 – 12/2022

Performance analysis of the patent value indicator (best 30%, simple rank order)

For the backtest, stock indices from the 4 global regions (Europe, North America, Japan and Asia Pacific ex Japan) were used. In order to find out whether an outperformance still can be achieved if a selection is made only on patent-holding companies, a proprietary index, called "Q-IPR Universe", was used for comparison. This consists all shares with patent value greater zero (over 12,000 shares).

The performance was measured using the Fama/French5 factor model published on the Fama French website. For each region (Asia north pacific ex Japan, Japan, Europe and North America) its corresponding 5 factor set was used. The factors used were:

1. Market Return – riskfree rate; The exposure to the excess return between the market and the riskfree rate (market beta)
2. small minus big long short portfolio returns (size risk)
3. high minus low long short portfolio returns (value risk); high book to market risk
4. profitability factor is the difference between the returns of companies with robust (high) and weak (low) operating profitability
5. The investment factor is the difference between the returns of firms that invest conservatively and firms that invest aggressively.

The alpha mentioned is the resulting alpha that remains when the 5 Fama/French factors are taken into account. Ideally, it is positive.

FILTERING RESULTS USING STRATEGY 1 (S1)

The shares are sorted according to 30% highest **Patent Value**.

Index	Avg outperf. per year	Alpha
China Securities 800	2.1%	5.7%
MSCI ACWI	3.8%	0.6%
MSCI World	4.6%	0.6%
MSCI ESG	3.4%	0.4%
NASDAQ COMPOSITE	11.0%	6.1%
NYSE Composite	3.6%	-0.8%
Q-IPR Universe	4.9%	1.3%
S&P 1500	5.0%	2.1%
S&P 600 Small Cap	9.4%	9.0%
Shanghai SE Composite	-1.0%	5.3%
Stoxx Europe 600	1.8%	2.4%
TOPIX Stock Price	1.7%	4.5%

Table 1: Index portfolios and their Alpha and average outperformance per year using a selection strategy that selects the top 30% stocks having the highest **Patent Values**.

With strategy 1 (S1) portfolios can be created that show a positive alpha in 11 of all 12 cases. In all cases, except for the NYSE Composite, the Alpha-value was positive and for some cases even quite high. The average outperformance per year in all cases, except Shanghai SE Composite, was also positive using this strategy.

It should be emphasized that strategy 1 also brings about an alpha for the Q-IPR Universe patent portfolio which includes all worldwide listed companies holding patents. This means that the approach can also be used to select stock portfolios consisting only of stocks with patents.

FILTERING RESULTS USING STRATEGY 2 (S2)

The shares are sorted according to 30% highest **Patent Value / Market Cap** quotient. The patent value is thus related to the size of a share - in this case market cap. We obtain a relative patent value that shows the innovative strength of a share in relation to its size and thus makes all shares comparable with each other.

Index	Avg outperf. per year	Alpha
China Securities 800	3.3%	6.2%
MSCI ACWI	4.5%	1.4%
MSCI World	5.4%	1.4%
MSCI ESG	4.8%	1.7%
NASDAQ COMPOSITE	13.2%	7.5%
NYSE Composite	6.9%	2.4%
Q-IPR Universe	10.7%	6.5%
S&P 1500	7.0%	5.1%
S&P 600 Small Cap	9.9%	9.1%
Shanghai SE Composite	5.3%	9.8%
Stoxx Europe 600	3.3%	2.4%
TOPIX Stock Price	3.6%	5.8%

Table 2: Index portfolios and their Alpha and average outperformance per year using a selection strategy that selects the top 30% stocks having the highest **Patent Values / Market Cap**.

Strategy 2 results in impressive alpha and average annual outperformance for all portfolios. Compared to strategy 1, it is clearly preferable.

FILTERING RESULTS USING STRATEGY 3 (S3)

The shares are sorted according to 30% highest **(Patent Value / Market Cap) * (Gross Profit / Total Assets)**.

Index	Avg outperf. per year	Alpha
China Securities 800	3.2%	6.1%
MSCI ACWI	5.0%	1.8%
MSCI World	5.9%	2.1%
MSCI ESG	4.8%	1.8%
NASDAQ COMPOSITE	14.1%	9.5%
NYSE Composite	7.6%	3.0%
Q-IPR Universe	11.0%	7.0%
S&P 1500	7.2%	5.3%
S&P 600 Small Cap	19.6%	9.4%
Shanghai SE Composite	4.4%	8.2%
Stoxx Europe 600	3.7%	2.7%
TOPIX Stock Price	5.1%	7.1%

Table 3: Index portfolios and their Alpha and average outperformance per year using a selection strategy that selects the top 30% stocks having the highest **(Patent Values / Market Cap) * (Gross Profit / Total Assets).**

Compared to strategy 2, strategy 3 is slightly better overall in terms of performance key figures.

OVERVIEW FILTERING RESULTS: AVERAGE OUTPERFORMANCE PER YEAR

Index	S1	S2	S3
China Securities 800	2.1%	3.3%	3.2%
MSCI ACWI	3.8%	4.5%	5.0%
MSCI World	4.6%	5.4%	5.9%
MSCI ESG	3.4%	4.8%	4.8%
NASDAQ COMPOSITE	11.0%	13.2%	14.1%
NYSE Composite	3.6%	6.9%	7.6%
Q-IPR Top 1000	4.9%	10.7%	11.0%
S&P 1500	5.0%	7.0%	7.2%
S&P 600 Small Cap	9.4%	9.9%	19.6%
Shanghai SE Composite	-1.0%	5.3%	4.4%
Stoxx Europe 600	1.8%	3.3%	3.7%
TOPIX Stock Price	1.7%	3.6%	5.1%
Ø out performance per year	**4.2%**	**6.8%**	**7.1%**

Table 4: the 3 strategies introduced before in comparison: S2 and S3 outperform all 12 indices tested, with S3 delivering the highest yearly average outperformance.

CONCLUSION:

- For almost all markets analysed, all 3 patent strategies show a considerable average annual outperformance and alpha.
- Relating patent value to the size of a share is preferable.
- The use of patent value/market capitalisation quotient results in a larger positive annual outperformance and a positive alpha compared to patent value for all markets. This relative patent indicator can be combined with proprietary fundamental strategies to achieve a better and more robust performance.
- Combining gross profit / total assets - a simple gross profitability indicator - with relative patent value gives a further slight improvement.

The results of the simulations show in general, that the use of patent value indicators as a stock selection strategy offers enormous potential for outperformance. This implies that the introduction of patent-based indicators into already existing strategies can deliver the most promising outperformance. Furthermore, it also shows a huge potential for additional analysis, the combination with additional strategies, additional patent indicators and perhaps even a list of characteristics (e.g. company size or sector) that can be used to give preference to a particular type of patent-based strategy. This will be explored in further future studies on our side. However, the 3 (standard) strategies presented could already deliver impressive results in most cases, according to our analysis.

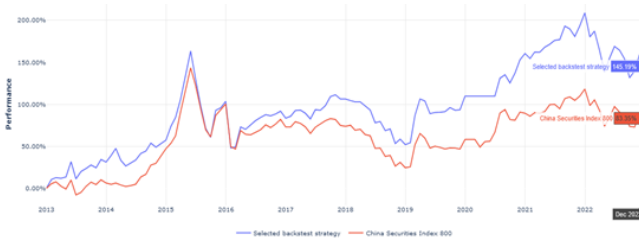
Appendix

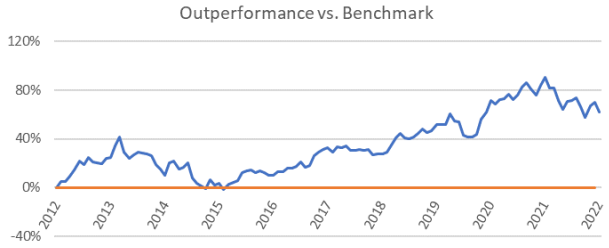
Individual performance charts of Strategy 3 on different indices

Backtest conditions:

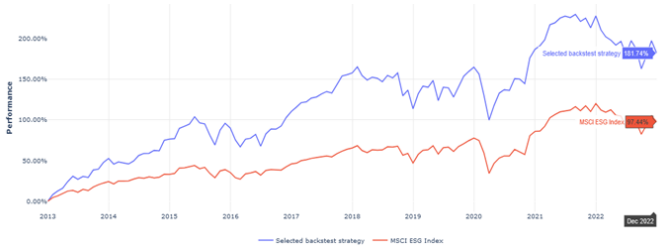
Strategy 3 that selects the top 30% stocks having the highest (Patent Values / Market Cap) * (Gross Profit / Total Assets) values, equal weighted portfolios, quarterly adjustment degree of investment = 100%; no risk management; no fees; all stock prices are calculated in EUR

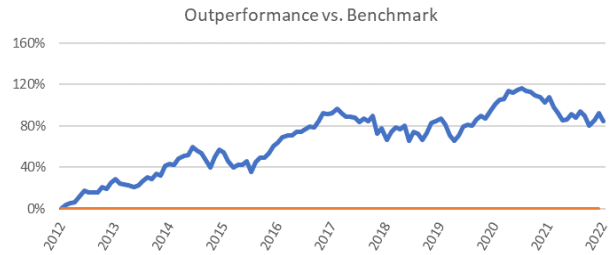
China Securities Index 800



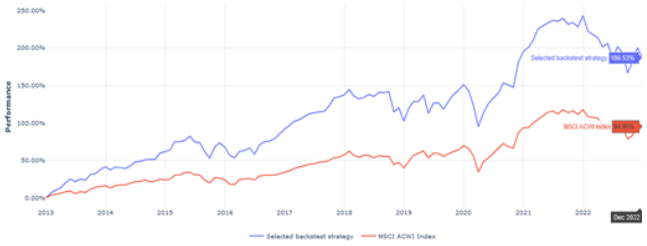


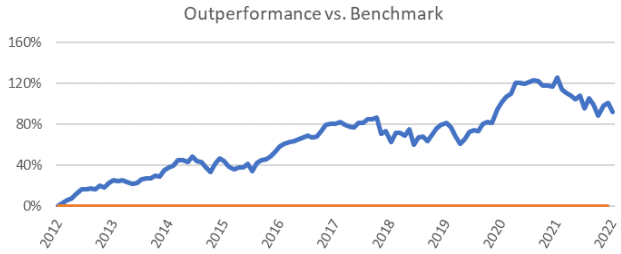
MSCI ESG Index



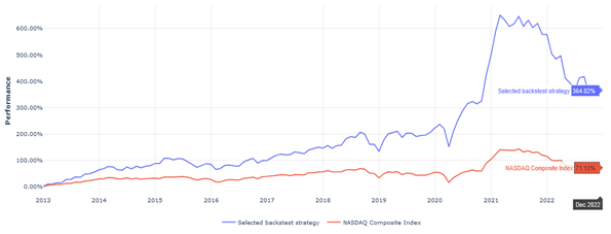


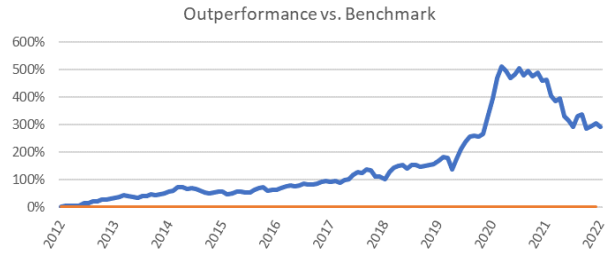
MSCI ACWI Index



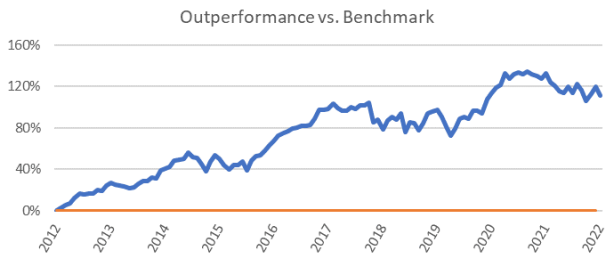


NASDAQ COMPOSITE

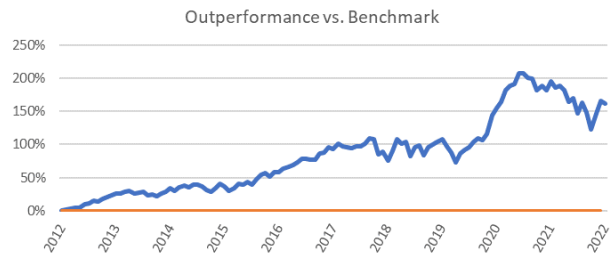




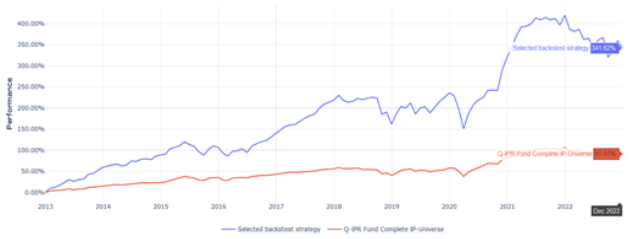
MSCI World Index

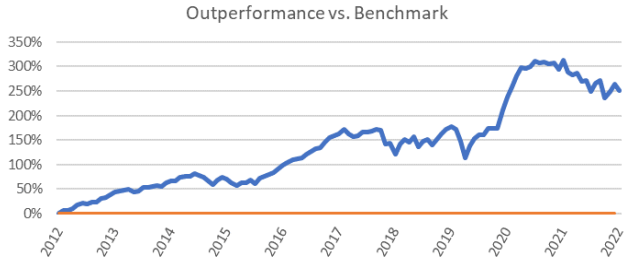


NYSE Composite Index

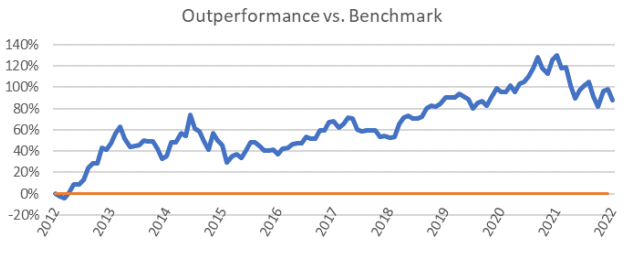


Q-IPR Universe

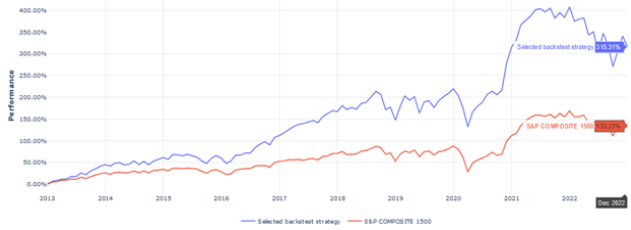


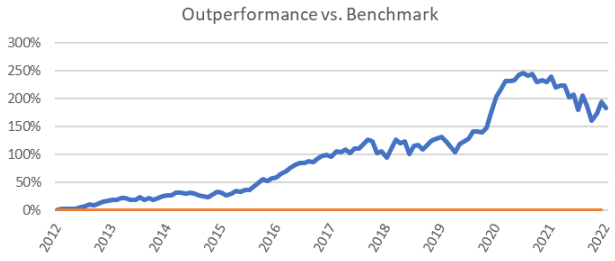


Shanghai SE Composite Index

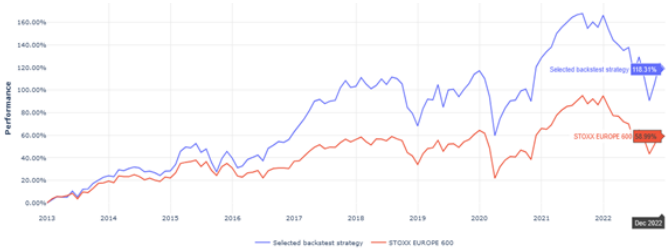


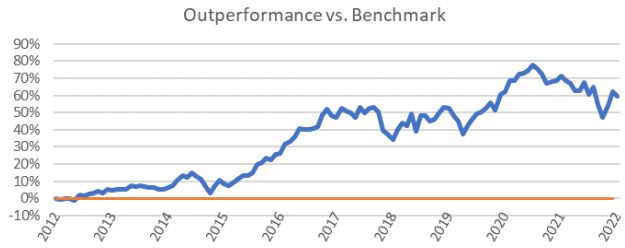
S&P COMPOSITE 1500



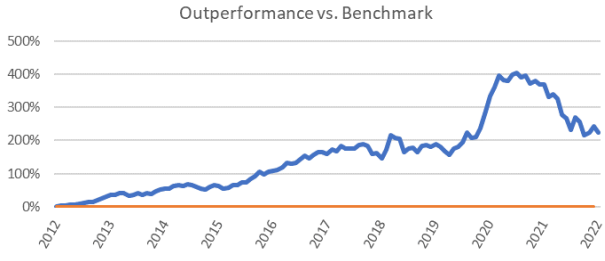


STOXX EUROPE 600





S&P 600 Small Cap Index



TOPIX Stock Price Index