Quantitative Investing: a Stock Selection System for Europe

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Abstract

This paper uses the complete universe of European corporate data for the 1989-2016 period to demonstrate that portfolios based on value investing, quality and momentum criteria beat their market benchmarks. Value investment strategies, first introduced by Graham and Dodd (1934) and Graham (1949) have received significant attention in the literature as they represent market anomalies that question the efficient market hypothesis. Using an exclusive data set we are able to construct a systematic investment strategy that selects the companies through an algorithm based on three criteria: value, quality and momentum. We demonstrate that our portfolios, rebalanced on a yearly basis, consistently beat the reference benchmark of the European equity over the long term.

1. Introduction

It is well known to market participants that the efficient market hypothesis has been challenged by numerous empirical studies over the past three decades. The evidence demonstrating the existence of market anomalies has generally concentrated on the use of accounting ratios to help to identify investment opportunities capable to consistently beat reference market index in the long term. The application of such investment criteria to the U.S. market is extensive; however the empirical evidence for the European markets is more limited. This is explained by the absence of a sufficiently detailed database incorporating both: unified long run series of the accounting information, needed for the computation of those ratios, and market information required for a pre-filtering of companies by given market criteria. A new dataset provided by Factset, and traditionally used by investment firms, has allowed us to overcome such problems.

Hence, the analysis presented in this study focuses on the capacity of value investing techniques, applied over the span of European companies, to obtain excess returns, through the systematic use of companies accounting data, in the equity screening process previous to portfolio selection. To do so, for each year since 1989 to 2016, and for the 600 non dual listed, non financial, European companies with the highest market capitalization (in USD), we collect data on: fiscal year end accounting data[1] and monthly total equity returns both in local

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currency and USD.[2] Our initial sample, thus, incorporates data on 1.830 different companies from 33 countries and 19 different economic sectors, totalizing 16.200 registries.[3]

Value investing methodologies were introduced by Graham (1934 and 1949). These define investment criteria that buy undervalued companies. Jegadeesh and Titman (1993) identified the existence of positive persistence in stock returns that are exploited to generate positive additional abnormal returns in the future. Indeed they pointed out that: "U.S. stocks that perform the best (worst) over a three to 12 month period tend to continue to perform well (poorly) over the subsequent three to 12 months". Moreover they show that these strategies continued to be profitable during the 1990s showing momentum based market outperformance in the U.S. stock market.

Market strategies based on quality (profitability) parameters were introduced by Novy-Marx (2013). Quality relates to the company's ability to generate profits. Quality based strategies require investment based on measures that use variable gross profitability (gross profit understood as: income minus the cost of goods sold, divided by total assets). These strategies can achieve significant returns by also incorporating value and signals of momentum within the portfolio selection criteria. Novy-Marx (2013) argue that the incorporation of gross profitability into a strategy of value and momentum should increase the gross returns of the strategy, while reducing the turnover of the portfolio and therefore the transaction costs and additionally reduces substantially the risk of suffer a drawdown on the value of your portfolio. Greenblatt (2010) exerted a great influence the "value investors" by applying quality and value criteria simultaneously. He proposed the value and quality based "magic formula" following the principle underlined by Graham (1949) which requires buying quality companies at a low price.

Following this literature, we compute investment indicators, for each company and year, within three different categories: Price, Quality and Momentum. The Price set of indicators includes: the Book to Market ratio (BTM), the Price to Earnings (PER), the enterprise value to EBIT and to EBITDA ratios (EV/EBIT and EV/EBITDA). The Quality set include: the Gross Profit on Total Assets (GPA), Greenblatt's Return on Capital (ROCgreen) and the Return on Capital inclusive of intangibles (ROCdet). Finally, the Momentum indicator is computed through the use of Monthly Total Equity Returns, aggregated between July and May of two consecutive years, to obtain the Accumulated Total Return of each company. Any company for which one, or more, of those ratios cannot be computed is dropped from our sample. That leads to a reduction in the number of companies included in each year sub-sample, so that the number of registries in our final sample shrinks to 15.674, while preserving the total number of different companies within our sample.

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[1] A detailed list of the accounting data used in this study, along with the expressions used for the computation of ratios, could be found in the appendix.
[2] Total equity return is obtained under the assumption of reinvestment of dividends on payment dates.
[3] A brief description of the initial sample is available upon request.

In this paper we contribute the literature by providing new evidence based on an analysis of the complete universe of European corporates over the 1989-2016 period. We move beyond the standard value studies in that we apply value, quality as well as momentum criteria to European Universe of Corporates that are first ranked by market capitalization. While the previous empirical literature and value investing is extensive, it has mainly concentrated on the U.S. equity market and applied selection criteria individually. Combining value, quality and momentum criteria we improve Sharpe Ratios and achieve abnormal returns that beat the benchmark. Combined investing criteria are applied using an exclusive data set obtained from: Factset, Thomson Reuters Eikon & Datastream.

The rest of the paper is organized as follows. Section 2 discusses data collection and methodology. Section 3 discusses results. Conclusions are described in section 4.

2. Data and methodology

2.1. Data

The process of data collection is one of the main contributions of this paper. This required the use of three different sources: Bloomberg, Thomson Reuters Eikon & Datastream and Factset. While the Bloomberg Equity Screening was restricted to data from 1993 and presented download errors, and Datastream exhibited similar restrictions. The main tool of our data collection process is provided by the Alpha Testing function included in the Factset terminal. That tool allowed us to access all the listings of companies annually, ordered by market cap, as well as grants us access to all contained information in the balance sheet and income statement for all the companies within the European Universe without any restriction. That tool, also provides us with data on, month over month, gross total returns both in local currency and USD. The introduction of the Euro, in January 2002, as a common currency for a relevant subset of countries, reduced currency risks within Europe. However the existence of companies from outside the Eurozone included in our sample, along with the time span selection including dates prior to the introduction of that, led us to the use of USD as a convenience currency to obtain homogeneous results.

While our analysis was originally planned to begin in 1985, absence of certain accounting information for the 1985-1988 period, lead us to modify our original scope, inducing us to collect data from 1989 and onwards.[1]

[1] To address this limitation in the near future, the Compustat Global Vantage database will be considered, as a complementary database

The investment universe is defined as follows: the 600 European companies with the highest market capitalization excluding banks, insurance, REITS, and financial holding companies, are first selected on a yearly frequency.

We chose 600 companies following the maximum representativeness (the 600 companies included every year incorporate approximately 90% of the total market cap of the European investment universe, percentage considered in the literature as the frontier to separate the large cap universe from the rest, as discussed in Novy-Marx (2013)) and liquidity principles.

This is important to guarantee that the implantation of the strategy is credible for 26 years of data span that ranges from June 30, 1990 to June 30, 2016. We design a portfolio creation methodology that segments the investment universe in 5 sub-portfolios according to our three dimension investment criteria. Results are then benchmarked to the reference European portfolio.

Following Asness and Frazzini (2012), our portfolio is rebalanced each 30th of June. That date is selected as, by then, data on balance sheet and profit and loss account, for each company, can be guaranteed to procced from previous end year (December) statements. Data on profitability, volatility, Sharpe ratio, and worst drawdown, are additionally calculated for every period under each of the percentiles and for the specific investment universe.

A brief description of the companies incorporated in this study by sector, year and country of origin is presented in Tables 1 and 2, in the Appendix.

2.2 Methodology

In this paper we analyze the extent to which the European equity benchmark can be beaten in the long term using a systematic investment strategy that selects the portfolio of listed shares through an algorithm based on the principles of value investing (combining price and quality criteria) and momentum.

The criteria analyzed are underlined under the: I) the Graham value approach (1934) i.e. it is only relevant to buy "cheap". The objective in this context is to capture the best value ratio on the basis of a single price criterion: A) Book to market (shareholders equity / market cap). This is the most common ratio used for price analyzes from Fama and French (1992) and Lakonishok et al (1994). B) PER (market cap / net profit) used by Graham (1949) in his seven "quality and quantity criteria" and resumed by Novy-Marx (2013): “Moderate price-to-earnings ratios, which typically should not exceed 15”. The other criterion of quantity that mentions is Book to Market, multiple widely used by practitioners and also used by Gray and Carlisle (2012). C) EV/EBIT used by Greenblatt (2010). In both cases they use it because according to

their analysis is the multiple that, independently, is able to obtain better results for the U.S. equity market. D) EV/EBITDA.

II) The second approach, based on the philosophy presented in Greenwald et al (2004) and developed in Greenblatt (2010) and Novy-Marx (2013) among others, is to buy cheap but only quality companies. Its aim is to seek the best combination of value and quality ratios that are able to offer (if possible) greater profitability and lower volatility than price only ratios.

To do so, companies are ranked by both each of previously defined value ratios and, one of the following quality ratios: GPA (Gross profit to asset) obtained as: (Income - Costs of goods sold) / Total Assets proposed by Novy-Marx (2013); ROIC (Return on invested capital) computed as: EBIT/(working capital + net fixed assets) proposed by Greenblatt (2010) and Detailed ROIC calculated as EBIT/(working capital + net fixed assets + intangible assets). Their positions in both classifications are then added and companies re-ranked, accordingly.[2]

III) The price + momentum approach. Its objective is to integrate the two most studied market anomalies (value and momentum) in order to create portfolios with greater profitability and lower volatility than the benchmark. For the calculation of momentum we use monthly total return (market price of the stock + gross dividends) of the last 11 months excluding the most recent one, as proposed by Gray et al (2016). As Momentum can be categorized neither as a price nor as a quality indicator, the approach presented in (II) is followed for the analysis of its effects, while also making use of pure quality indicators on top of value ratios.

3. Results

3.1. Generating Portfolios

The required ratios that describe value and quality criteria are first computed. Then companies are ranked yearly, according to the following criteria: when using a price indicator, companies are ranked from cheaper to more expensive; if a quality indicator is applied, instead, companies are ranked from higher to lower quality; finally, the momentum ranking is obtained by sorting, on a yearly basis, companies from higher to lower accumulated returns. An alternative set of rankings is obtained by adding, and sorting in a descending order, each price ranking to a quality/momentum ranking. As a consequence, the total number of different rankings generated amounts to 24.

[2] An improvement to this methodology can be found in Gray and Carlisle (2012), where the quality and Price criterions are not considered to be equally performance-revealing. Instead, their method is based on a prefiltering according to a Price criterion, with quality then incorporated as a second filter. Results on this method will be present in a later version of this paper

The described procedure allows us to divide, the initial set of companies, into a set of investment portfolios. To do that, a sample of companies is formed yearly and according to each ranking criteria, to deliver one out of five different portfolios. Each company is incorporated into the chosen portfolio with the same weight, while the portfolio (and hence the investment decision) is rolled over every 30th of June yearly. Hence, 120 different portfolios are created. While each company is incorporated into every portfolio with the same weight, constructed portfolios differ in the total number of companies included: portfolios 1 to 4, incorporate 120 different companies each, while portfolio 5 includes the remaining set of companies.

Portfolio monthly returns are then generated as the average total equity return of each company within the portfolio. On top of those 120 categorized portfolios, a benchmark index is obtained, for each year. This, includes the full universe of companies, each with the same weight, with its composition varying each 30th of June. That index is created to allow for the direct comparison of portfolios performance, as the existing index of the 600 highest capitalized European companies (Stoxx Europe 600 Total Return) does not cover our full sample period.

3.2 The Value of Value Investing

Table 3 presents descriptive statistics, both in local currency and USD, for the inter-quantile portfolios of each base measures: value, quality and momentum. [3]

Table 3: Descriptive statistics for Quantile portfolios based on basic measures

	Benchmark	Book To Market	PER	EVEBIT	EVEBITDA	GPA	ROC Green	ROC Det.	Momentum
Final Index Value (Mean) (Local)	10.135	9.633	10.312	10.176	10.001	10.363	10.223	10.323	10.300
Final Index Value (Mean) (USD)	3.801	3.652	4.117	3.919	3.917	4.125	4.034	4.212	3.814
Final Index Value (Interquantile SD) (Local)	NA	2.4130	4.9058	4.3302	3.7809	4.0761	3.5039	3.8218	4.7387
Final Index Value (Interquantile SD) (USD)	NA	0.8692	1.8717	1.4895	1.4538	1.9758	1.7124	2.2239	1.1467
Yearly Return (Mean) (Local)	7.354%	7.019%	6.705%	7.072%	6.987%	7.016%	7.108%	7.110%	6.860%
Yearly Return (Mean) (USD)	4.045%	3.818%	3.768%	3.783%	3.802%	3.941%	3.921%	3.920%	3.831%
Yearly Return (Interquantile SD) (Local)	4.297%	4.657%	5.775%	4.895%	4.748%	5.071%	4.932%	4.972%	5.347%
Yearly Return (Interquantile SD) (USD)	3.763%	4.107%	4.846%	4.327%	4.289%	4.524%	4.350%	4.538%	4.495%

[3] The statistics corresponding to the portfolios generated under the approaches described in II) and III) are available upon request from the authors.

Table 3 highlights the pervasive effect introduced, in portfolio composition and performance measurement, by the use of local instead of a homogeneous currency. Effectively, currency risk, measured as the difference between the average yearly return of portfolios build on local and USD currencies, amounts approximately to a 3% (or 45% of reported performance on local currency) with inter-quantile dispersion being reduced around 0.6%.

Moreover, the effects of that distortion are not homogeneous across measures: while the best performing indicator (on average) under a local currency base is the Detailed ROIC, GPA results seem are not as affected in terms of performance when measured under a common basis.

Table 1 also presents initial evidence reflecting outperformance of the value investing portfolio when compared to the benchmark market portfolio. This is true for all our base indicators, except those based on EV.

Figure 1, presents as an example the evolution, in local currency, of the value of each of the portfolios generated according to the Book to Market measure, along with that of the Benchmark portfolio.[4]

Figure 1: The 1990-2017 evolution of the Value of Book to Market Local currency Portfolios (Log Scale)

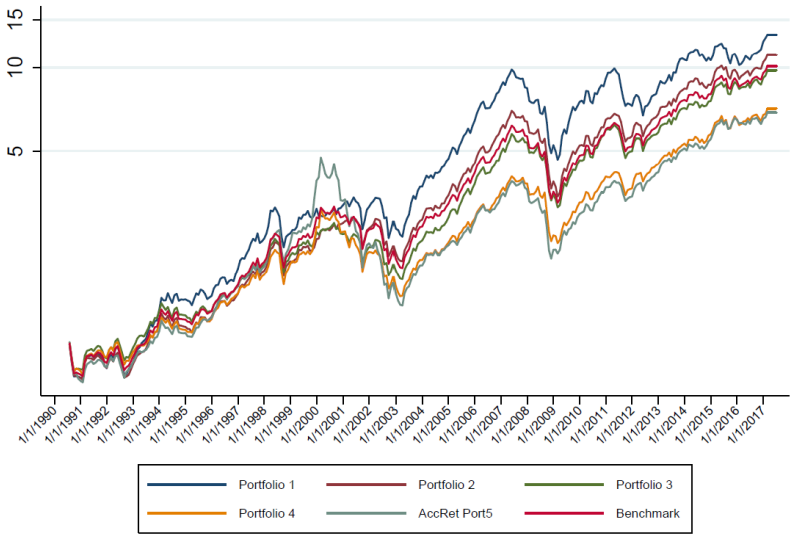


Figure 1 illustrates that all portfolios commove in terms of abnormal returns with a clear outperformance of portfolio 1 followed by portfolio 2 and 3. The benchmark market portfolio however consistently beats portfolio 4 and 5. That, provides graphical evidence on the validity of the criteria applied for portfolio construction as it is visually evident that (higher quality) portfolios tend to over-perform more expensive (lower quality) ones.

[4] Similar figures could be presented for the evolution of portfolios created under alternative measures or currency.

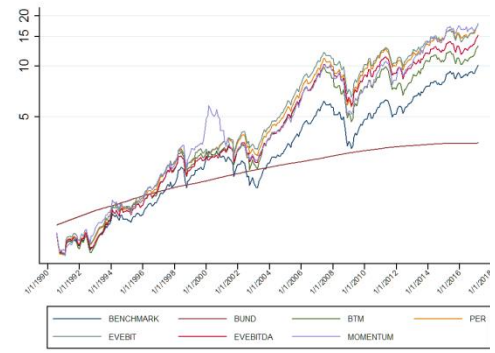
Given the results presented in this section in what follows we focus our analysis on first quantile portfolios (Tier 1, hereafter), as those render the best performance among generated portfolios.

3.2.1 Local Currency Tier 1 Portfolios

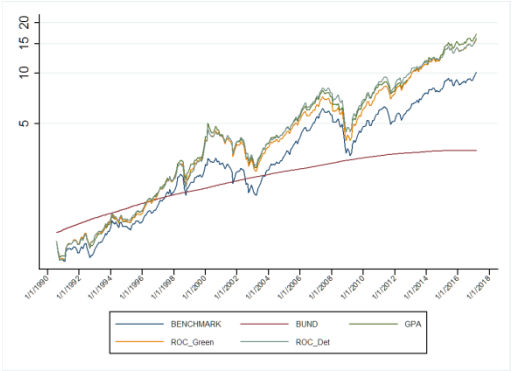
We start our discussion by analyzing the performance of Tier 1 portfolios generated without any currency risk consideration, that is, with equity returns all expressed on local currency.

Figure 2: Value Evolution of Tier 1 Portfolios

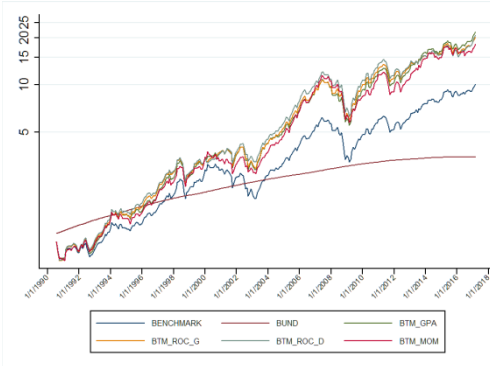
(a) Value and Momentum



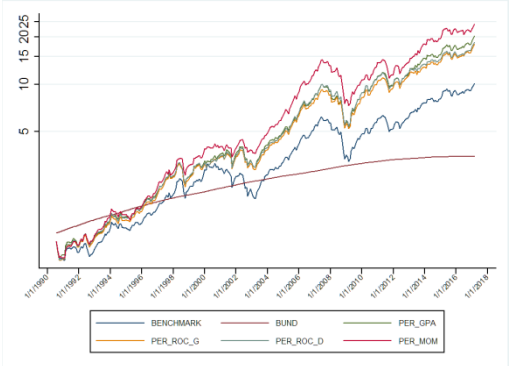
(b) Quality Portfolios



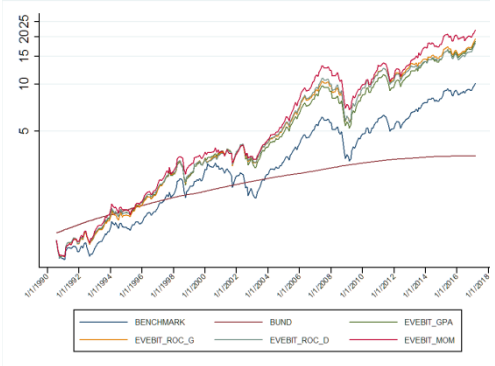
(c) BTM: Quality and Mom



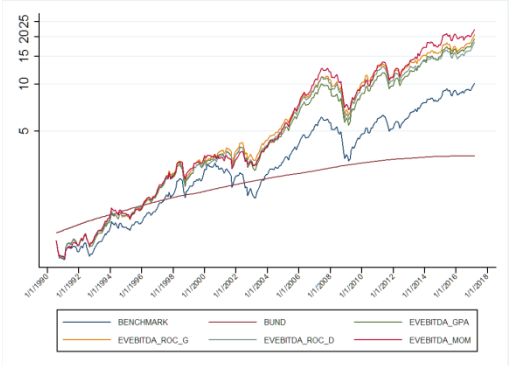
(d) PER: Quality and Mom



(e) EVEBIT: Quality and Mom



(f) EVEBITDA: Quality and Mom



Figures 2 (a)-(f) present the evolution of accumulated returns for each of our Tier 1 portfolios, the Benchmark portfolio, and the accumulated return for a risk free (BUND) investor.[5] Results corresponding to Price and Momentum portfolios are presented in 2(a). Then, the results corresponding to quality portfolios are presented in 2(b). Finally, figures 2(c) to 2(f), show the results on mixed portfolios.

Reported results suggest that the proposed investment criteria are highly powerful when applied to the universe of European markets. Each of our Tier 1 portfolios show higher accumulated profits than the replicating index or risk free strategy. The winning portfolios based on plain (one criterion) strategies are those constructed on the basis of PER, detailed ROC and Momentum, any of those leading to a value increase by more than 15 fold.

It is also important to note the increase in performance that would follow the use of mixed strategies based on quality and value strategies. Those would improve yearly returns around 85 bps with respect to their corresponding plain value strategies. Amongst those, the portfolio result of the interaction of Book-To-Market and GPA, exhibit the best performance, as it multiplies its value by more than 20 fold.

While the performance of value-quality based portfolios are impressive, those are deeply outperformed (in terms of return) when the market criterion (momentum) is combined with a non-Book-to-Market based value measure. Portfolios conformed under such criterions are almost able to multiply their value by 25 fold along our 26 years of sampling, with PER and Momentum strategies outperforming any other portfolio, and yielding a final yearly return of 12.67%.

Hence, our results demonstrate that the proposed strategies based on a value investing criteria, render an average premium of around 350 bps, when compared with the benchmark portfolio. In this context, we underline that the average return on the used risk free asset exceeds that of the benchmark equity portfolio, during our sample period. This can be explained by a close look of figure 2, which shows that prior to the creation of the Euro, in 2002, German government bonds have, on average, outperformed equity returns. However, after the introduction of the Euro there is an important reduction in credit spreads as illustrated by the reduction of the equity risk premia.

Also, Figure 2 presents graphical evidence on the existence of return outperformance of Momentum based portfolios when compared to the best pure Value Investing Portfolios. While

[5] Risk Free Returns corresponds to those obtained by the continuous investment on a 10 year German Government Bond (Bund)

this has not a common historical finding in the literature, we contend that new post crises regulatory measures may have affected the role of fundamentals in explaining equity prices.

While the performance of our portfolios is impressive, doubts could be presented regarding the implications of such strategies in terms of assumed riskiness. However, Table 4 presents evidence, for our best performing portfolios, against such argument.

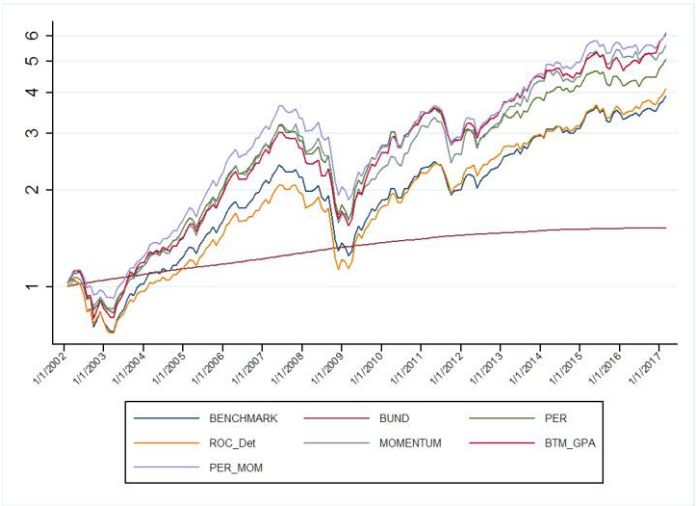
Table 4: Performance Ratios for Best Performing Portfolios

	Benchmark	BUND	PER	ROC_Det	Momentum	BTM_GPA	PER_Momentum
Yearly Return (Full Sample)	9.0667%	4.7744%	11.4171%	11.0051%	11.4416%	12.2452%	12.6742%
Yearly Return (Mean)	7.4134%	7.8046%	10.5824%	10.2945%	10.8078%	10.7993%	12.1864%
Yearly Return (SD)	4.1754%	2.8575%	4.3210%	3.2194%	4.0726%	4.3575%	3.6211%
Sharpe Ratio			0.7973	0.7511	0.7622	0.7676	0.8265
Accumulated Jensen's Alpha			3.4553%	2.3090%	2.4944%	2.8553%	4.5394%
SD Jensen's Alpha			1.0300%	0.9017%	0.9662%	0.9132%	1.5564%

This table reports average annualized returns, standard deviations, Sharpe Ratios and Jensen's Alphas, for the different portfolios formed on the basis of value, quality and momentum criteria over the 1990-2017 period. Portfolios are rebalanced on a yearly basis and strategies are performed out of sample.

The effect of managerial techniques based on value investment criterion is not only evident in terms of additional return, with a significant CAPM alpha within a range of 230-453 bps, but also not paired with a significant increase of riskiness. The volatility of returns increases slightly, for PER or Momentum based strategies, while is reduced for the best performing quality and Value-Momentum portfolios. For those, the reduction on yearly return volatility is, roughly, equivalent to a 23% and 13%, respectively, when compared to benchmark's volatility, and with a risk-reward ratio (Sharpe) which is always below 1.33 and *"minimal"* for quality based portfolios.

Figure 3: Evolution of Best Performing Portfolios during the 2002-2017 period



Potential limitations to our results could come from its long run sustainability and resilience to major events, like a common currency introduction. To test whether our results are subject to such criticism, Figure 3 presents the evolution of our portfolios, along with that of the benchmark, under a scenario where investment strategies are put in place the 1st of January of 2002 (when the Euro was introduced) instead of in 1990, with their ratios shown in Table 5.

Figure 3 confirms our previous findings on the restricted period, for all but for our quality based (Detailed ROC) portfolio. While the Benchmark portfolio has multiplied its value by around 4 fold, value investing techniques lead to an increase in portfolio values of up to 6 fold while systematically beating its Benchmark. Also, as for the full sampling period, the best performing portfolios are those based on mixed selection strategies, with the value-momentum criterion (PER_MOM) yielding the best performance, amongst considered indicators, up to 2007 and since 2012 to today.

Table 5: Returns and Standard Deviations of Best Portfolios (2002-2017)

	Benchmark	**RF**	**PER**	**ROCdet**	**Momentum**	**BTM_GPA**	**PER_MOM**
Yearly Return (2002-2017)	9.4172%	2.7932%	11.3258%	9.7884%	12.0543%	12.6588%	12.7223%
Yearly Return (Mean)	9.0175%	3.8050%	13.4643%	8.0238%	13.2663%	13.4434%	15.3448%
Yearly Return (SD)	3.6406%	0.4805%	4.0647%	3.7336%	4.1511%	3.5002%	4.6363%
Mean-Volatility Ratio	2.47692	7.91876	3.31251	2.14909	3.19587	3.84079	3.30974

This table reports average annualized returns, standard deviations and mean-volatility ratios for the different portfolios formed on the basis of value, quality and momentum criteria over the 2002-2017 period. Portfolios are rebalanced on a yearly basis and strategies are performed out of sample.

Table 5 points towards the validity of our findings with respect of the capacity of value investing techniques not only to systematically provide superior portfolios in terms of return, but also the capacity of those to optimize the return by unit of risk. When compared to the results presented in Table 4 we can see that while the yearly return over the entire sample period remained essentially unaltered, there has been a jump on average returns. However, the increase for the benchmark index is close to 160 bps and it almost doubled for the best performing value-momentum strategy.

In what follows we present the results of our analysis when value investing selection criterions are applied to the same sample of companies and equity returns converted in a common (USD) currency.

While, so far, our results seems to point towards the validity of value investing techniques, systematically applied to the universe of European companies, for the conformation of portfolios capable of beating their reference benchmark,

3.2.2 USD based Tier 1 Portfolios

Similarly to those presented in Figure 2, the evolution of our value investing portfolios, when equity returns are converted in USD, are presented in Figure 4. That allows us to conclude that, as for previous case, where equity returns were expressed in local currency, value-investing based portfolios are able to over-perform its corresponding Benchmark.

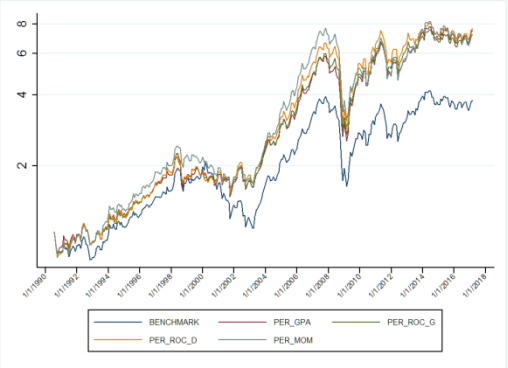
Figure 4: Value Evolution of Tier 1 Portfolios

(a) Value and Momentum

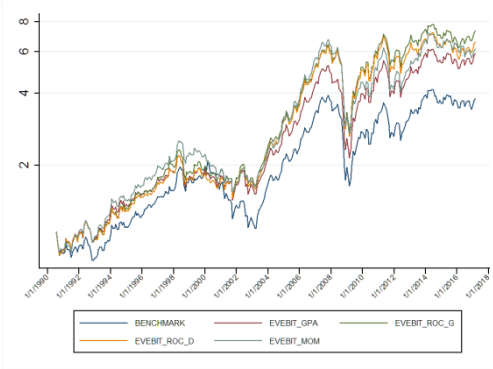
(b) Quality Portfolios

(c) BTM: Quality and Mom

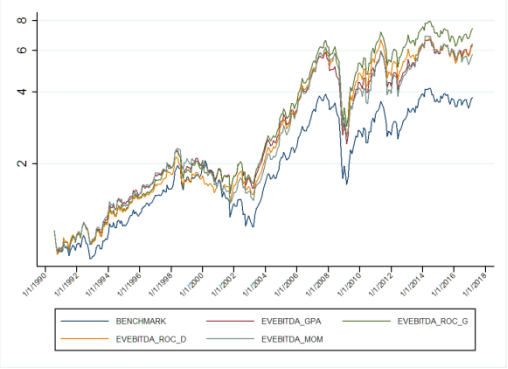
(d) PER: Quality and Mom



(e) EVEBIT: Quality and Mom



(f) EVEBITDA: Quality and Mom



However, while over-performance in local currency was systematic almost over the entire sample period, for every selection variable, that is not the case when equity returns are re-expressed in USD.

As illustrated in (a), and in lesser extent in (c)-(e), value based portfolios exhibited a behavior close to that of the benchmark up to 2002, while (b) shows the systematic over-performance of Quality and Momentum based portfolios over the entire period. Since 2002, however, and especially prior to the burst of the subprime crisis, value based portfolios significantly beat the market. That change in behavior reflects the structural break following the introduction of the Euro and will constitute the basis of further research in the topic.

On average, pure value portfolios multiplied their value by 5.35 fold, pure quality portfolios by 7.43 fold, momentum by 5.29 and mixed portfolios by 6.8 fold. By contrast, our Benchmark portfolio increased their value by 3.8 fold.

Following with the path of previous section, we now turn to the selection of the best performing portfolios. This task is simplified by the fact that the currency conversion does not result on a modification of the within classes ordering. Hence, the best performing value and quality portfolios are those based on PER and detailed ROC. The former portfolio increased its value by 6.3 fold, while the later did so in 8 fold. Similarly, the Momentum, BTM-GPA and PER-Momentum portfolios increased their value in 5.29, 7.8 and 7.2 fold, respectively.

However, and as illustrated in Table 6, the differences (roughly equal to 150 bps) in yearly returns do not seem to justify the divergence in portfolio value between PER and ROC portfolios, as those should also be understood as the result of the amplification mechanism imposed by the, very low, return volatility presented by ROC based portfolios (the 2.9575% exhibited by that is close to the 2.5875% presented by the BUND, and hence close to the minimum value).

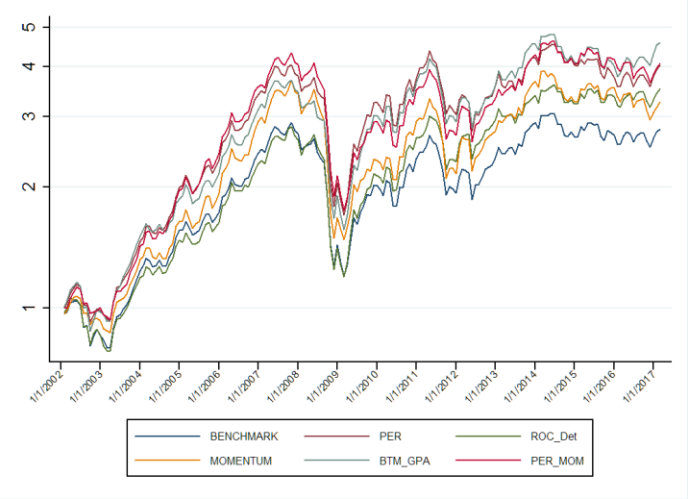
Table 6: The effect of Currency Conversion

	Benchmark	**PER**	**ROC_Det**	**Momentum**	**BTM_GPA**	**PER_Momentum**
Yearly Returns (USD)	5.1314%	7.1944%	8.1051%	6.4473%	7.9898%	7.6939%
Currency Premia	-3.9353%	-4.2226%	-2.9001%	-4.9943%	-4.2555%	-4.9803%
Yearly Returns (USD) (Mean)	4.1171%	6.1132%	7.5782%	6.9617%	6.6056%	7.5787%
Yearly Returns (USD) (SD)	3.5500%	3.7730%	2.9574%	3.4477%	3.7028%	3.1280%
Mean-Volatility Ratio	1.1597	1.6203	2.5624	2.0193	1.7839	2.4229

This table reports average annualized returns, standard deviations, mean-volatility ratios and Currency Premiums for the different portfolios formed on the basis of value, quality and momentum criteria over the 2002-2017 period. Portfolios are rebalanced on a yearly basis and strategies are performed out of sample.

Currency premiums for best performing portfolios of previous section ranged from -290 bps to -500 bps with conversion effects having the lowest impact on pure quality based portfolios and the highest on Momentum portfolios. That empirical finding is in line with the negative correlation observed between exchange rates and equity performance for highly internationalized (High Quality) companies.[6]

Figure 5: Evolution of Best performing portfolios since 2002



Finally, following our procedure on previous section and given the behavioral asymmetries observed after the introduction of the Euro, Figure 5 presents the evolution of the best performing portfolios when the strategy is undertaken starting in January 2002, with major statistics displayed on Table 7.

Table 7: USD Returns and Standard Deviations of Best Portfolios (2002-2017)

	Benchmark	**PER**	**ROCdet**	**Momentum**	**BTM_GPA**	**PER_MOM**
Yearly Return (Full Sample)	7.0016%	9.6216%	8.6377%	8.1002%	10.5518%	9.6816%
Yearly Return (Mean)	10.4851%	16.4925%	10.8842%	13.0593%	15.8921%	16.3205%
Yearly Return (SD)	4.5996%	6.1940%	3.9530%	5.3367%	5.3743%	6.6446%
Mean variance Ratio	2.27958	2.66266	2.75341	2.44707	2.95705	2.45620

This table reports average annualized returns, standard deviations and mean-volatility ratios for the different portfolios formed on the basis of value, quality and momentum criteria over the 2002-2017 period. Portfolios are rebalanced on a yearly basis and strategies are performed out of sample.

The results, then demonstrate that while there is significant currency risk affecting portfolio performance, investment criteria techniques remain highly profitable.

Under significant currency risk we show that the use of mixed value-quality and value-momentum portfolios cannot improve the results of the best performing pure quality portfolio.

[6] A recent example of this negative correlation could be found on the after Brexit Evolution of the Sterling Pound Exchange Rates and the FTSE. The abrupt fall in exchange rates was neutralized by the increase in equity prices.

However, value-quality (Book-to-Market and GPA) and value-momentum (PER) portfolios should be applied when currency risk is absent, as suggested on previous empirical literature applied to the U.S. market.

4. Conclusions

In this paper we provide new evidence of portfolio performance based on value investing strategies applied to the complete universe of European corporates over the 1989-2016 period. We move beyond the standard value studies in that we apply value, quality as well as momentum criteria to European Universe of Corporates that are first ranked by market capitalization. While the previous empirical literature and value investing is extensive, it has mainly concentrated on the U.S. equity market and applied selection criteria individually. Value investing studies with European market are highly limited. This is explained by the absence of a sufficiently detailed database incorporating both: unified long run series of the accounting information, needed for the computation of accounting ratios, and market information required for a pre-filtering of companies by given market criteria. A new dataset provided by Factset, and traditionally used by investment firms, has allowed us to overcome such problems. We therefore contribute to the literature by applying simultaneously three investment criteria to the whole universe of European equity market data.

Combining value quality and momentum criteria we find significant cumulative and abnormal returns that beat their European counterparts. We therefore provide some new evidence that challenges the efficient market hypothesis.

We also report the existence of asymmetric optimal performance when there is significant currency risks incorporated in the portfolios. While mixed strategies, based on value-quality and value-momentum selection variables, are preferred when currency risks are absent, pure quality strategies proved to be unbeatable when those risks are significant.

Important lines of future research include the improvement of value investment techniques by early detection of market downturns through macroeconomic analysis. Macro variables have shown in recent history early signs of a change in economic cycle.

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Appendix

Table 1: Companies by Sector and Year

	Year																												
Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total
Commercial Services	25	25	18	19	20	17	16	16	23	27	32	32	35	34	31	33	29	27	28	26	25	25	27	27	31	32	29	709
Communications	11	11	10	11	13	13	18	21	26	30	37	35	35	33	35	32	31	31	32	32	32	31	31	28	31	34	32	716
Consumer Durables	30	32	30	31	32	34	30	27	26	24	20	25	27	29	31	31	29	30	21	25	23	26	29	31	32	35	33	773
Consumer Non-Durables	66	60	62	60	53	54	55	57	56	52	47	57	58	61	58	59	57	53	51	51	50	47	51	50	50	50	53	1478
Consumer Services	36	34	38	42	40	40	42	45	52	56	62	59	52	54	55	56	59	52	42	38	38	38	36	40	41	42	40	1229
Distribution Services	19	19	19	19	16	15	15	13	11	12	14	11	12	11	12	10	10	9	5	6	8	7	9	9	8	9	9	317
Electronic Technology	26	24	25	25	26	23	25	21	25	27	37	30	27	23	28	23	25	23	20	26	24	25	30	28	27	32	30	705
Energy Minerals	18	18	16	15	14	16	19	22	19	16	13	16	15	19	17	24	28	29	35	36	33	31	34	32	27	22	22	606
Health Services			2	1	1	3	3	4	3	4	4	4	4	4	4	4	6	3	3	4	4	4	5	5	6	5	6	96
Health Technology	22	23	27	30	24	24	27	27	26	28	35	36	38	39	38	38	35	41	38	43	38	37	37	40	41	41	47	920
Industrial Services	34	31	31	30	32	29	25	31	31	27	20	25	26	26	25	33	37	39	49	44	44	44	46	41	40	37	30	907
Miscellaneous																						1						1
Non-Energy Minerals	40	40	36	34	38	37	37	38	35	36	29	32	34	31	35	35	36	40	47	40	45	49	41	34	30	26	26	981
Process Industries	73	73	68	62	69	72	67	59	55	45	39	34	41	37	34	33	34	32	33	35	40	38	42	49	43	42	40	1289
Producer Manufacturing	94	86	86	78	76	78	72	73	67	58	52	54	52	53	52	46	56	62	63	60	61	61	52	58	65	63	70	1748
Retail Trade	45	45	51	55	52	52	58	57	49	52	45	44	49	47	45	38	33	33	30	30	33	34	32	38	40	41	39	1167
Technology Services	9	7	6	8	7	6	14	16	21	27	41	26	17	16	20	17	13	13	13	17	17	16	18	17	15	16	24	437
Transportation	18	23	24	23	20	22	19	21	25	25	23	30	30	32	31	37	31	33	38	32	31	32	33	29	30	34	32	758
Utilities	34	49	51	57	67	65	58	52	50	54	50	50	48	51	49	51	51	50	52	55	54	54	47	44	43	39	38	1363
Total	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	16200

Table 2: Data by Year and Country of Origin

	Year																											
Country	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total
AUSTRIA	9	8	5	5	7	7	7	7	7	7	5	6	7	9	7	10	10	9	14	12	12	11	11	10	10	9	12	233
BELGIUM	20	18	15	16	19	18	18	17	16	19	14	12	15	13	14	13	14	14	12	13	12	13	13	14	14	14	18	408
CROATIA																			1	2	2	2	2	1	1	1	1	13
CYPRUS																	1				1	1	3	3				9
CZECH REPUBLIC									1	3	3	2	2	3	3	4	3	3	3	2	2	3	4	2	2	1	2	48
DENMARK	13	11	10	10	14	13	11	11	11	14	12	13	14	13	14	17	15	17	15	15	17	15	14	15	19	19	22	384
FINLAND	15	9	7	12	15	16	17	21	22	17	15	16	19	17	22	22	20	20	19	20	21	21	17	18	17	16	16	467
FRANCE	102	93	94	94	95	95	90	92	91	86	83	88	85	80	81	81	83	81	82	82	81	83	80	84	92	88	88	2354
GERMANY	83	91	87	86	91	86	78	74	78	77	80	73	73	75	70	68	70	72	74	79	72	76	77	81	77	72	84	2104
GIBRALTAR																	1											1
GREECE	1		1			1	1	4	5	7	9	8	12	11	11	9	11	10	11	12	7	5	3	3	6	2	2	152
HUNGARY							1	2	3	2	3	3	3	3	3	3	3	3	2	3	3	3	3	2	2	2	2	54
ICELAND														1	1	1	1	1										5
IRELAND	3	5	5	6	3	6	5	8	9	6	6	10	8	8	9	11	11	13	10	8	10	11	9	12	11	12	11	226
ITALY	42	34	30	31	28	24	22	20	33	33	39	41	37	42	37	39	35	39	33	35	29	29	25	27	30	30	31	875
KAZAKHSTAN																		1	1	1	1	1	1	1	1	1	1	10
LUXEMBOURG		1	1	1	1	1	1	1	1	2	2	4	3	5	7	7	6	6	6	5	5	6	7	8	8	8	8	111
MALTA																											1	1
NETHERLANDS	33	31	31	30	29	32	34	36	34	33	37	32	28	24	26	30	33	31	27	25	24	26	26	24	25	25	25	791
NORWAY	15	8	8	5	8	12	10	14	12	9	8	7	10	7	9	14	14	13	16	12	13	14	15	14	10	9	10	296
POLAND										2	3	3	2	3	4	4	4	5	7	8	9	11	13	12	10	9	6	115
PORTUGAL	5	2		1	2	5	5	7	8	8	10	8	8	8	8	8	7	8	8	9	9	8	7	7	8	6	4	174
ROMANIA																		2	1	1	1	1	1	1	2	2	2	14

SLOVENIA															1	1	1	2	2	2	1	1	1	1	1	1	1	16
SPAIN	33	34	27	25	26	24	22	27	35	35	31	37	40	41	39	41	37	43	42	40	33	32	29	28	34	34	31	900
SWEDEN	17	22	25	25	27	28	36	38	35	30	27	31	28	28	28	27	33	31	27	30	33	32	33	35	37	38	43	824
SWITZERLAND	36	36	33	31	34	39	35	31	31	35	41	41	45	41	43	40	41	43	45	42	46	50	44	42	42	44	47	1078
TURKEY						2	1	4	4	3	10	7	5	10	8	10	10	11	12	15	22	20	20	22	16	18	17	247
UKRAINE																			8	3	9	4	2	3				29
UNITED KINGDOM	173	197	221	222	201	191	206	186	164	172	162	158	156	158	155	140	136	122	122	124	125	121	140	130	125	139	115	4261
Total	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	16200