The Conservative Formula: Quantitative Investing made Easy

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March 2018

We propose a conservative investment formula which selects 100 stocks based on three criteria: low return volatility, high net payout yield, and strong price momentum. We show that this simple formula gives investors full and efficient exposure to the most important factor premiums, and thus effectively summarizes half a century of empirical asset pricing research into one easy to implement investment strategy. With a compounded annual return of 15.1 percent since 1929, the conservative formula outperforms the market by a wide margin. It reduces downside risk and shows a positive return over every decade. The formula is also strong in European, Japanese and Emerging stock markets, and beats a wide range of other strategies based on size, value, quality, and momentum combinations. The formula is designed to be a practically useful tool for a broad range of investors and addresses academic concerns about 'p-hacking' by using three simple criteria, which do not even require accounting data.

JEL classification: G11, G12, G15

*Van Vliet (corresponding author) and Blitz are both at Robeco Institutional Asset Management. We would like to thank Guido Baltussen and Jan de Koning for valuable discussions and Milan Vidojevic for programming assistance. The views expressed in this paper are not necessarily shared by Robeco Institutional Asset Management. We welcome comments, including references to related papers we have inadvertently overlooked.

Introduction

The early tests of the Capital Asset Pricing Model (CAPM) in the 1970s showed that the empirical risk-return relation is too flat. This low-risk effect is now regarded as one of the very first stock market anomalies. Since then, many other anomalies have been documented, such as the size, value, quality, momentum effects. However, the 'publish or perish' culture in academia may give a bias towards many false positive results. Harvey, Liu, and Zhu (2016) articulate this concern, document the recent explosion in the number of factors, and suggest that thresholds for statistical significance should be raised. Hou, Xue, and Zhang (2017) take a fresh look at the anomalies literature and find that many results cannot be replicated and are therefore likely the result of 'factor fishing'. Moreover, the significance of many factors turns out to be critically dependent on methodological assumptions such as frictionless rebalancing, no leverage costs and unlimited short-selling of micro caps.

Investors who want to profit from academic insights therefore have to be very careful. First, they should be highly critical as to which factors work and which factors don't, since many results are spurious. The number of factors needs to be narrowed down to a subset that is persistent and robust. Second, translating multiple factors into one easily implementable investment strategy is not straightforward. Today, a good starting point for a limited set of persistent factors might be the ones identified by Fama and French (2015). These factors are rigorously tested, complement each other and require a limited amount of trading. In order to benefit investors should tilt their portfolio towards small, attractively priced, profitable firms with low levels of investments. However, Fama and French do not create one integrated investment portfolio, but separate long-short portfolios for each factor, with many overlapping positions. This is of little use for investors looking for an easy and effective factor-based investment strategy. One could consider to identify stocks which score well on each of the Fama-French factors, but with such an approach the resulting number of stocks will be very low. For example, the expected number of stocks with a top quintile score on each of 5 independent factors is less than 1 in 3,000. Moreover, most investors face constraints on leverage and short selling. Therefore, an important practical question is how investors can obtain one liquid, easy to implement long-only portfolio which gives access to multiple factors simultaneously.

These practical considerations are less relevant for academics. If a simple investment strategy is profitable but can be explained by exposures to a wide range of theoretical long-short factors, then from an academic point of view there is no relevant contribution to the existing literature. Even if the control factors require the use of accounting data, rely on micro caps, require high-frequency trading, and assume full shorting opportunities. For practitioners, however, efficient exposure to multiple established factor premiums simultaneously is something desirable. Especially if this can be achieved in one single liquid portfolio which requires infrequent rebalancing, which does not require expensive borrowing and/or shorting, and which is not critically dependent on the inclusion of microcaps.

It comes as no surprise therefore that books which present simple investment formulas are very popular among investors. Value investing was popularized by the investment book 'The Intelligent Investor' by Graham (2005) who presented an intrinsic value formula in the 1973 version of his book. In 1991, a strategy called the Dogs of the Dow was proposed, which selects stocks with the highest dividend yields from the Dow Jones Industrial Average index; see O'Higgins and Downes (2000). Greenblatt (2006) combines value (earnings to enterprise value) with a quality measure (return-on-capital) in his 'Magic Formula' which helps investors to identify the best 30 stocks.

More recently, Van Vliet and de Koning (2017) explain the concept of low-risk investing to investors and present a new investment formula which selects 100 conservative stocks based on volatility, net payout yield and momentum. The aim of this paper is to rigorously test this easy to implement 'Conservative Formula' which aims to give investors full and efficient exposure to the strongest academic factor premiums. The formula relies on simple price data and dividend data only, which enables us to back-test its persistency and robustness all the way back to 1929. The limited number of simple factors also reduces the risk of 'p-hacking' or 'factor fishing'. The formula is applied to the largest 1,000 US stocks to ensure that the results economically meaningful. Turnover is limited by rebalancing on a quarterly basis. Although the formula is based on three simple investment criteria, we evaluate it considering the most advanced asset pricing models that have been proposed in the recent literature. For robustness, we also test the conservative formula on US mid-caps (defined as the second largest 1,000 stocks) and international equity markets. Finally, we also test for sensitivity to different macro-economic regimes and examine the impact of trading costs.

We find that a conservative portfolio consisting of 100 low-risk stocks with high net payout yield and positive price momentum returned 15.1 percent per year since 1929. The performance is persistent over time, with positive returns in every decade. It outperforms a portfolio of speculative stocks with the opposite characteristics (high risk, low net payout yield and negative momentum) by 12.8 percent per year, with lower risk. For US mid-caps, Europe, Japan and Emerging markets we find similar results. The alphas are stable across different economic regimes and are also robust for high levels of trading costs. This conservative investment strategy gives simultaneous positive exposures to the most profitable factor premiums and beats all Fama-French combinations of common investment strategies based on size, quality, value and momentum.

The paper is structured as follows. First the data and global results are discussed. Then results through time are analyzed and the conservative formula is directly compared with single-sorted, double-sorted and triple-sorted Fama-French portfolios. We next apply a battery of academic asset pricing tests to the formula, and examine the robustness across economic regimes, size segments and international markets. Finally, the impact of trading costs is analyzed. The appendix further examines the impact of compounding.

Data and global results

We create a liquid universe of stocks by focusing on the largest 1,000 stocks at each point in time. Anomalies or price patterns that are only strong among small-cap or micro-cap stocks have little economic relevance, so we want to stay away from those. Restricting the universe to large-caps is a prudent approach and results are likely to more sustainable. We further reduce the risk of 'p-hacking' by only using market data, so no accounting or other data. Specifically, our formula only uses dividends, shares outstanding, and returns as input data. For the US we use the CRSP stock database which offers data going back to 1926.[1] In addition we also use international data, unlike many studies in the anomalies literature which only consider US data and report results that do not necessarily carry over to other markets. We

[1] The series for the US large stocks are also used in the book 'High Return from Low Risk', Pim van Vliet and Jan de Koning, Wiley Publishers 2017. www.paradoxinvesting.com. The US mid-cap data and international data and the robustness analyses in this study are not included in the book.

focus on three broad regions: Europe, Japan, and emerging markets. Although the US makes up about half of the global stock market, ignoring the other half would be a significant loss of information. Therefore we consider international samples consisting of the 1,000 largest European, 1,000 largest Japanese and 1,000 largest emerging markets stocks at each point in time. The data are sourced from Factset and start in 1986 for Europe and Japan and 1991 for emerging markets. The European and Japanese sample is derived from FTSE World Developed or S&P World Developed index constituents, and the emerging markets sample is derived from the S&P/IFC Global Emerging Markets index. Stocks which do not have at least thirty six-months of return data available are not eligible for inclusion in the various top 1,000 universes. We gather monthly gross stock returns in local currencies, as well as in U.S. dollars, taking into account dividends, stock splits, and other capital adjustments. Our stock return data sources are Interactive Data Exshare, MSCI, and S&P/IFS, in that order. Monthly returns are truncated at 500%. The free-float adjusted market capitalization data come from FTSE and S&P/IFC. Portfolio returns are in US dollars. Stock level volatility is calculated using returns in local currency. Finally, as a robustness check we also test the formula on the second largest 1,000 US stocks. This sample starts in 1970, as from that point in time onwards the CRSP database contains more than 2,000 stocks in total.

At the end of each quarter the 1,000 largest stocks at that point in time, are sorted into two groups, each consisting of 500 stocks, based on their historical 36-month stock return volatility. Each stock is further ranked on its 12-1 month price momentum (Jegadeesh & Titman, 1993) and total net payout yield (NPY) to shareholders (Boudoukh, et al, 2007). This shareholder yield consists of dividend yield and the net change in shares outstanding (calculated as the latest level divided by the 24-month average). The momentum and NPY ranks (1-500) are simply averaged and the top 100 of stocks are selected. To limit turnover this procedure is repeated on a quarterly basis. All factor scores are compared directly across sectors and (for Europe and EM) countries and the 100 stocks in the final portfolio are equally weighted. We also create an opposite 'speculative' portfolio by selecting from the 500 stocks with the highest volatility those stocks with the weakest combined scores on momentum and NPY. This portfolio is used for comparing returns and for testing the formula in a long-short context. Figure 1 conceptually illustrates the selection mechanism of the Conservative Formula.

< Insert Figure 1 about here >

Figure 2 shows the main findings for the US and international equity markets. For all regions, the Conservative Formula portfolio exhibits much lower risk than the speculative portfolio, yet much higher returns. The finding that ex post risk for the formula is consistently low implies that historical volatility is a good predictor of future risk, also on a portfolio level. The risk reduction varies from 50% for the US and Emerging Markets (EM) to about 35% in Europe and Japan. The return difference varies between 8.8% for Japan, 12.9%-12.8% for the US, 14.2% for Europe, and finally 17.2% for EM. This is a very large and internationally consistent return spread and shows the global potential of factor-based investing. In other words, the Conservative Formula offers a consistently high return-to-risk ratio across all markets. These results are based on the full samples and are not yet related to alternative factor-based strategies, nor tested for significance. We will proceed by taking a closer look at the US stock market, for which the richest data history exists. After this we further examine the results for the other markets.

< Insert Figure 2 about here >

Results over time

A $100 investment in the 1929 US equity market (CRSP value-weighted portfolio) would have grown to $246,000 dollars at the end of 2016. This translates into a compounded annualized nominal return on investment of 9.3 percent per year. Note that actual returns to investors tend to be lower due to taxes, implementation costs and adverse market timing.[2] The Conservative Formula portfolio exhibits a terminal wealth that is almost a factor 100 higher compared to the market, with a compounded return on investment of 15.1 percent per year. By contrast, the speculative portfolio shows a meagre compounded return of only 2.1 percent per year. A visual inspection of Figure 3 shows that the dollar wealth development of the Conservative Formula portfolio is robust over time.

< Insert Figure 3 about here >

Figure 4 shows performance by decade. The average return for conservative stocks is remarkably stable, with positive (>8%) returns during each individual decade. The absence of negative 10-year investment results is important, since most investors have relatively short investment horizons (e.g. Benartzi & Thaler, 1995). The return is also higher than the market average in 8 out of 9 decades, with the exception being the 1990s. The speculative portfolio shows consistently weak returns, falling short of the conservative portfolio during each decade.

< Insert Figure 4 about here >

Comparison with single factor portfolios

Results look stable through time, but how does this compare to well-known alternative factor strategies such as size, value, and momentum? To this end we directly compare the Conservative Formula to other single factor strategies using the same methodology: equally weighting 100 top stocks from the universe consisting of the largest 1,000 stocks. In the next section we compare the Conservative Formula with publicly available double-sorted and triple-sorted portfolios, and in the section after that we control for factor exposures using various specifications of different multi-factor asset pricing models.

Table 1 shows that the Conservative Formula has a return similar to strategies based on size, value, momentum and net payout yield, but with markedly lower risk. The simple return of small, value and momentum strategies is a bit higher, but the compounded return shows a different ranking. Interestingly, the return gap between simple returns and compounded returns is only 0.4% for the formula. For most other factors this return gap is above 1 percent, and in the case of small-cap and value it even amounts to almost 4 percent. Asset pricing theory, such as the CAPM, does not specify the length of the investment horizon. Still, Table 1 shows that the assumed investment horizon matters a lot. This horizon determines the average return and is for most investors longer than 1-month (simple return) but shorter than the full sample (compounded return). Some of the return drag is technical and driven by a higher volatility of the underlying strategy. To better compare strategies we de-risk all factors to the same volatility level as for the Conservative Formula (16.5%). For example, the de-risked market factor invests for 88% in stocks and 12% in the risk-free asset so as to end up with the same risk as the Formula. This approach converts Sharpe

[2] Adverse market timing reduces average equity returns by 1.3% (Dichev, 2007) and implementation costs are often above 1%. Furthermore, real returns are 2.8% lower due to inflation over this sample period.

ratio differences into return differences.[3] The Conservative Formula has the highest return per unit of risk compared to all other factors. The formula, which consists of three factors, also has a higher return compared to each of its three components: low volatility, momentum and NPY. On an equal-risk basis, the return differences amount to 2-3 percent per year. Since the methodology is exactly the same, 100 stocks equal weighting and quarterly rebalancing, this difference can only be attributed to the integration and diversification benefits of combining multiple factors into one strategy.

< Insert Table 1 about here >

Comparison with Fama-French portfolios

Since a large portion of the return can be attributed to integrating multiple factors we also compare the Conservative Formula with other multi-factor strategies. In particular, we consider the commonly used portfolios of Fama and French (1993, 2015): double-sorted (2x3) portfolios based on size and book-to-market and based on size and momentum, and triple-sorted (2x4x4) portfolios on size, book-to-market, profitability, and investments.[4]

< Insert Figure 5 about here >

Figure 5 shows that the Conservative Formula has the highest Sharpe ratio compared to all other Fama-French factor-combination strategies. The small-winner (SW) and small-value (SV) strategies have the highest Sharpe ratios among the double-sorted portfolios, but still they all fall short of the Conservative Formula. The triple-sorted Fama-French portfolios offer more detailed insight. Due to limited data availability for profitability and investments the sample for triple-sorted portfolios starts in July 1963. Small value stocks with high profitability are among the best performing portfolios, with a Sharpe ratio of around 0.75. This comes close to the Sharpe ratio of 0.84 of the Conservative formula over this sample period, but still falls a bit short. Moreover, the Fama-French portfolio consists of only 26 stocks with an average market capitalization of USD 350 million as of December 2016. This specific portfolio may look attractive on paper, but represents less than 0.05% of the total US stock market, which means that large investors have limited opportunity to invest in this portfolio. By contrast, the conservative portfolio consists of 100 stocks with an average market capitalization of USD 35 billion as of December 2016. This makes up almost 20% of the total US market. The lowest Sharpe ratios are earned by small, growth firms with low profitability. We also observe that the positive relation between profitability and return is not consistent in the large-cap segment. Finally, small value stocks with low levels of investment earn high Sharpe ratios. Within the small-cap segment the relation between investment and risk-adjusted return is not linear. In the large cap segment this relationship is more persistent and the large-value portfolio with low levels of investment earns a high Sharpe ratio. However, none of these triple-sorted portfolios is able to match the Sharpe ratio of the Conservative Formula.

[3] This de-risking explains most of the return drag due to compounding, but not all (See appendix).

[4] The FF portfolios include all stocks available in the CRSP universe, but the universe is divided based on the NYSE median. The FF small cap portfolio (below median) grows from 227 stocks to 2,329 at the end of the sample. The large cap portfolio (above median) grows from 251 to 856 in the end of the sample. To further limit the impact of micro caps or small caps driving results, the FF portfolio returns are value-weighted.

Control for factor exposures

The return spread between the Conservative portfolio and Speculative portfolio is 13.0% per year. How much of this return spread can be attributed to exposure to the classic Fama-French long-short factors or exposure to newer factors? In order to answer this question we apply time-series spanning tests to the Conservative minus Speculative (CMS) portfolio. Some factors are available since 1929, while other factors only come available at a later date. Table 2 shows various regression outcomes using the longest available data histories.

< Insert Table 2 about here >

Panel A of Table 2shows that the CMS portfolio has a full-sample CAPM alpha of 13.9%. This goes along with a large negative exposure to the market factor, which is not surprising given that the formula is long low-volatility stocks and shorts high-volatility stocks. The 3-factor alpha is somewhat higher, mainly caused by a negative size (SMB) exposure. The positive exposure to large-caps (and negative exposure to small caps) is caused by the inclusion of the low-volatility factor in the formula. In general larger stocks tend to have lower volatility and smaller stocks tend to have higher volatility. Over the long run, value stocks are more volatile and have higher betas than growth stocks (see Ang and Chen, 2007) and the formula loads negatively on the HML factor over the full sample period. Although net payout yield is a price-based measure which tilts the portfolio to value (book-to-price) this is countered by the fact that low volatility is strongly negatively exposed to HML in the earlier part of the sample (1930s) and to momentum most of the time. Therefore the formula exhibits a negative exposure to value over the full sample period. When momentum (MOM) is added, the 4-factor alpha drops to 8.8%, which is expected since momentum is one of the three building blocks of the formula. The alpha remains highly significant though.

Panel B of Table 2 shows that over the more recent (1963-2016) period the CAPM alpha of the formula remains similar, at 14.0%. During this period value stocks are less risky and volatile. At 13.0%, the 3-factor alpha is not much lower, as the impact of a positive loading on the HML value factor is largely offset by a negative loading on the SMB size factor. Fama and French (2015) propose to extend their classic 3-factor model to a 5-factor model, by augmenting it with profitability (RMW) and Investment (CMA) factors, for which data is available from 1963. Panel B shows that the conservative strategy has positive loadings on both these new factors, which reduces the alpha to 8.8%. When we additionally control for the momentum factor we get another positive loading, and the 6-factor alpha is further reduced to 3.3%. In sum, the CMS strategy gives positive and significant exposure to the value (HML), momentum (MOM), profitability (RMW) and investment (CMA) factors at the same time. Factor tilts most investors would like to see in their portfolio, since all these factors are known to be associated with higher returns. After controlling for all these factors, a small but still statistically significant positive alpha remains. Unreported results show that this is mainly driven by the inclusion of NPY in the formula.

In Panel C of Table 2 we subject the CMS portfolio to the recently proposed q-factor model of Hou, Xue, and Zhang (2015), who argue that this model is superior to the Fama-French models.[5] We find large positive loadings on the investment (IA) and profitability (ROE) factors in the q-factor model, but after

[5] We thank Prof. Zhang for kindly providing the data.

controlling for these exposures an alpha of 4.1% per annum remains. Thus, the formula is also attractive for investors looking for efficient exposure (and some more) to the factors in the q-factor model.

In the final spanning test we augment the Fama-French 3-factor model and the Carhart 4-factor model with the quality (QMJ) factor of Asness, Frazzini and Pedersen (2013) and the betting-against-beta (BAB) factor of Frazzini and Pedersen (2014). We call this the AQR model, as the authors of these two studies are employed at that firm. In Panel D of Table 2 we observe large positive loadings on both the QMJ and BAB factors, implying that the formula also provides exposures towards these factor premiums. We also observe that only the combination of the classic value and momentum factors of Fama-French and the two new AQR factors is powerful enough to render the alpha of the CMS portfolio insignificant, although even in this case it does remain positive. It is good to keep in mind here though that the QMJ factor consists of over twenty underlying variables, which are aggregated into one combined quality score. The formula, on the other hand, only uses three variables, which do not even require accounting data. Thus, the formula is able to match or outperform the most advanced asset pricing factors with much lighter data input requirements.

US mid-cap and international results

The largest 1,000 stocks represent about 90% of total US market capitalization at the end of 2016. The market capitalizations for the next 1,000 stocks range from USD 3.0 billion to USD 0.5 billion. Although this group of stocks represents less than 10% of total market capitalization, it provides an interesting robustness test for the conservative formula. The total number of stocks in CRSP exceeds 2,000 from 1970 onwards, when Amex stocks were added to the database, so for this analysis we consider the 1970-2016 sample period. For comparison purposes we also show the alphas of the Conservative formula for the largest 1,000 stocks over this period. Table 3 shows that the mid-cap Conservative minus Speculative portfolio exhibits factor betas that are very similar to the large-cap CMS portfolio. The table shows positive factor tilts towards the four factors with the highest premiums: HML, MOM, RMW and CMA. The mid-cap CMS premium is 13.0 percent, which is about 3 percent higher than the CMS premium in the large-cap segment. The multi-factor alphas are all statistically significant, ranging between 6% and 18% per annum. The pattern in alphas is very similar compared to the results for the largest 1,000 US stocks. Although returns are higher, expected implementation costs are also higher in this particular market segment, so after-cost return differences are likely to be smaller.

< Insert Table 3 about here >

We also test for global robustness of the conservative formula by considering the European, Japanese and emerging stock markets. In order to calculate multi-factor alphas we use local factors provided in the Kenneth French data library for Europe and Japan, and global factors for emerging markets. As already shown in Figure 2, the Conservative portfolio consistently outperforms the speculative portfolio in all regions. Table 3 shows the betas of the four regional CMS portfolios to the six different factors. For all regions we find a negative market beta exposure and also a negative size (SMB) exposure, which is consistent with the US results. We also find positive factor tilts to profitability (RMW), momentum (MOM), investment (CMA) and value (HML) for all regions, which is again consistent with the US results. This is a desirable feature, since each of these four factors carries a positive premium in each region. Panel B shows that the value premium is stable at around 4 percent, while the new Fama-French profitability and investment factors have premiums of around 3 percent. Momentum carries the highest premium of 7 percent, but this varies between very high in Europe (10 percent) and quite low in Japan (2 percent). The low momentum premium in Japan is a known phenomenon; see e.g. Griffin, Ji, and Martin (2003) and Asness (2011). Panel C shows the return spread and the single- and multi-factor alphas for the regional strategies. The CAPM alphas are all positive, with the highest alpha in Emerging Markets and the lowest alpha in Japan. Most of the high returns can be explained by a positive exposure to the four factors which give the highest premiums: value, momentum, profitability and investment. When the momentum factor is added to the Fama-French 3-factor and 5-factor models, we see the largest part of the alpha being explained. Interestingly, the momentum factor carries the highest premium, but is also most difficult to implement in practice since it requires very high levels of turnover. That is one of the reasons why Fama and French prefer to not include this factor in their multi-factor asset pricing models. The Conservative formula offers positive and significant exposure to the momentum factor, but since momentum is integrated with other factors, it is able to achieve this with a relatively modest level of turnover. This lower turnover is a desirable feature for any practically implementable investment strategy.

Macro risk and trading costs

It could be that systematically investing in stable stocks with high net payouts that are in a positive trend gives exposure to some form of macro-economic risk. For example, one might be concerned that these stocks are sensitive to the economic cycle and underperform when the economy is in recession. Or they might be sensitive to interest rate changes or credit cycles.

< Insert Figure 6 about here >

Figure 6 shows that the Conservative Formula long portfolio (100 stocks) has an average CAPM alpha of 6.2 percent, and that this alpha is spread evenly across expansions and recessions and also that it is stable across high and low levels of interest rates. The alpha is sensitive to changes in interest rates, dropping to 3.3 percent when rates are rising. This rate sensitivity is a known feature of low-volatility stocks; see for instance Baker and Wurgler (2012), and De Franco, Monnier, and Rulik (2017). Compared to a generic low-volatility approach the formula does mitigate the sensitivity to interest rate changes by also including other factors, in particular momentum. In any case, the alpha remains significant, with all t-statistics being above 3.5. There is no clear relation with the credit cycle, as neither credit spread levels nor changes seem to have a large impact on results.

Finally, we estimate the impact of transaction costs on results. The formula is designed to suffer limited impact from transaction costs, by assuming a quarterly (instead of monthly) rebalancing frequency. This reduces turnover, which is the most important driver of transaction costs (Novy-Marx and Velikov, 2016). Also, the focus is on the largest 1,000 US stocks. Nevertheless, implementation costs could still be significant and negatively affect net results. Table 4 shows for each of the regional strategies the amount of (single-counted) turnover needed to implement the Conservative Formula. The turnover levels are all very similar, at around 30% per quarter, which translates into an average stock holding period of slightly less than 1 year. The turnover can easily be brought down with more sophisticated trading rules, for instance rules which do not immediately sell a stock if its rank drops to number 101 out of 1000, but stay invested in such positions until they drop beyond a certain sell threshold. We will refrain from such sophistications here, and work with the raw turnover levels to keep matters simple. Frazzini and Israel

(2014) estimate transaction costs to be less than 20bps for US and international large/mid cap stocks. We show results for a low assumed transaction cost level of 10bps (20bps for emerging markets) and a high assumed transaction cost level of 30bps (60bps for emerging markets). For the most conservative estimate applied to emerging markets we find that net returns go down up to 1.5 percent per year, which is not a lot compared to the raw return of the formula. In all cases trading costs amount to less than 10 percent of the total return, so more than 90 percent of the returns remain for investors.

< Insert Table 4 about here >

Conclusion

We propose a Conservative Formula which is designed to make quantitative investing easy for investors. Using three simple investment criteria many different factor premiums can be captured with a single investment strategy consisting of 100 liquid stocks. The Conservative Formula uses past returns and net payout yield only, which means that no accounting or other data sources are needed. Despite its simplicity, the strategy gives simultaneous positive exposure to well-known factors such as low-beta, value, quality, and momentum. The returns are consistent over time and consistent across international stock markets and present in US small/midcap stocks. In sum, this simple formula can be used by active investors as a way to profit directly from half a century of academic insights, by applying one simple investment formula.

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Figure 1: Visual illustration of the Conservative Formula

This figure visually illustrates the Conservative Formula.

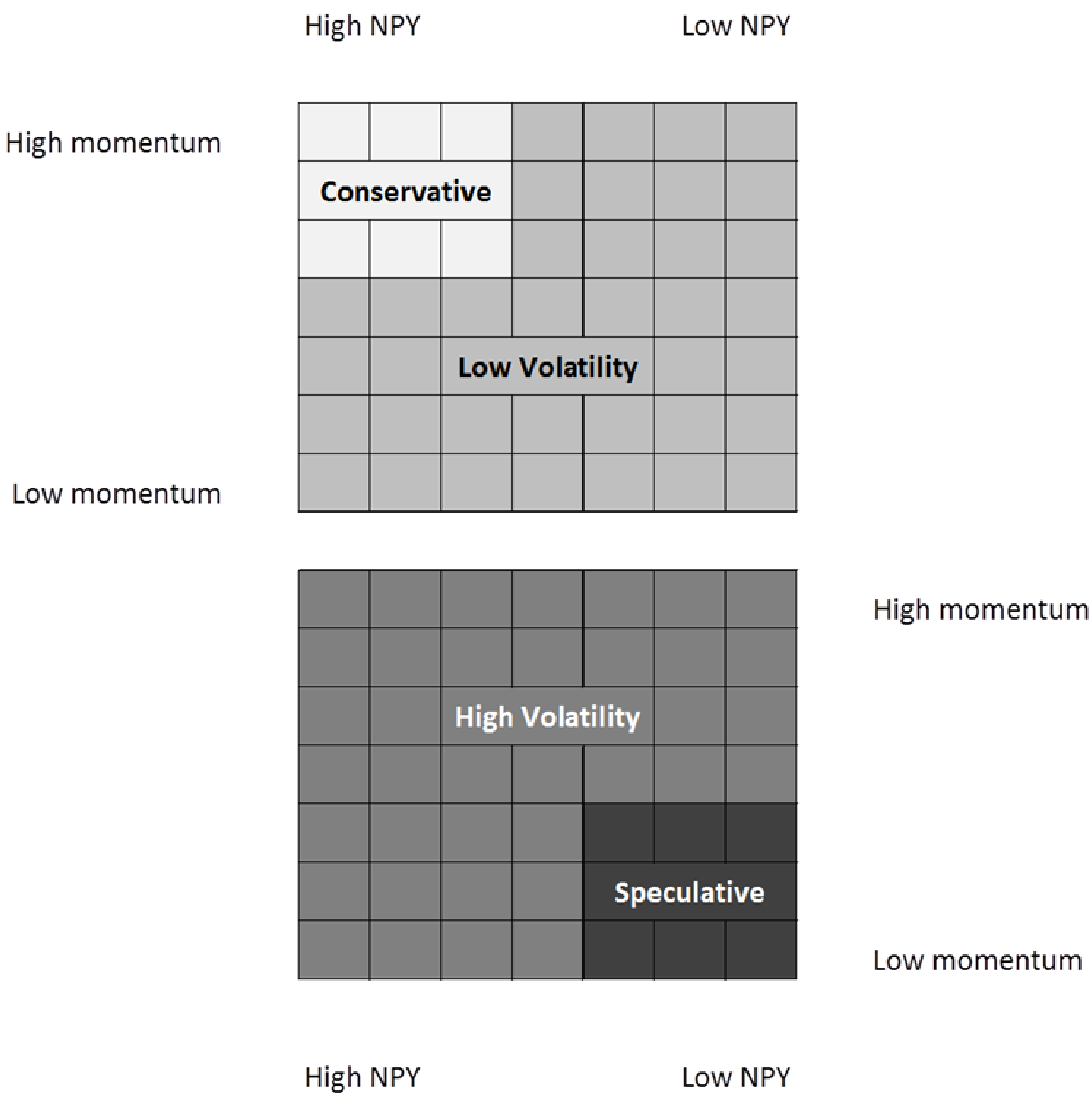


Figure 2: Summary

This figure shows the main results of this study. The total of largest 1,000 stocks are screened on historical 3-year volatility. From the top 500 low-risk stocks the Conservative formula (blue) selects the 100 stocks with the best combined 12-1M momentum and net payout yield factor scores. The speculative portfolio (red) consists of stocks with complete opposite characteristics. Portfolios are equally weighted and rebalanced on a quarterly frequency. The figure shows results for the United States, US midcaps, Japan, Europe, and Emerging markets. Vertical axis denotes average compounded return, the horizontal axis shows the full sample volatility. Note that the EM vertical axis is adjusted.

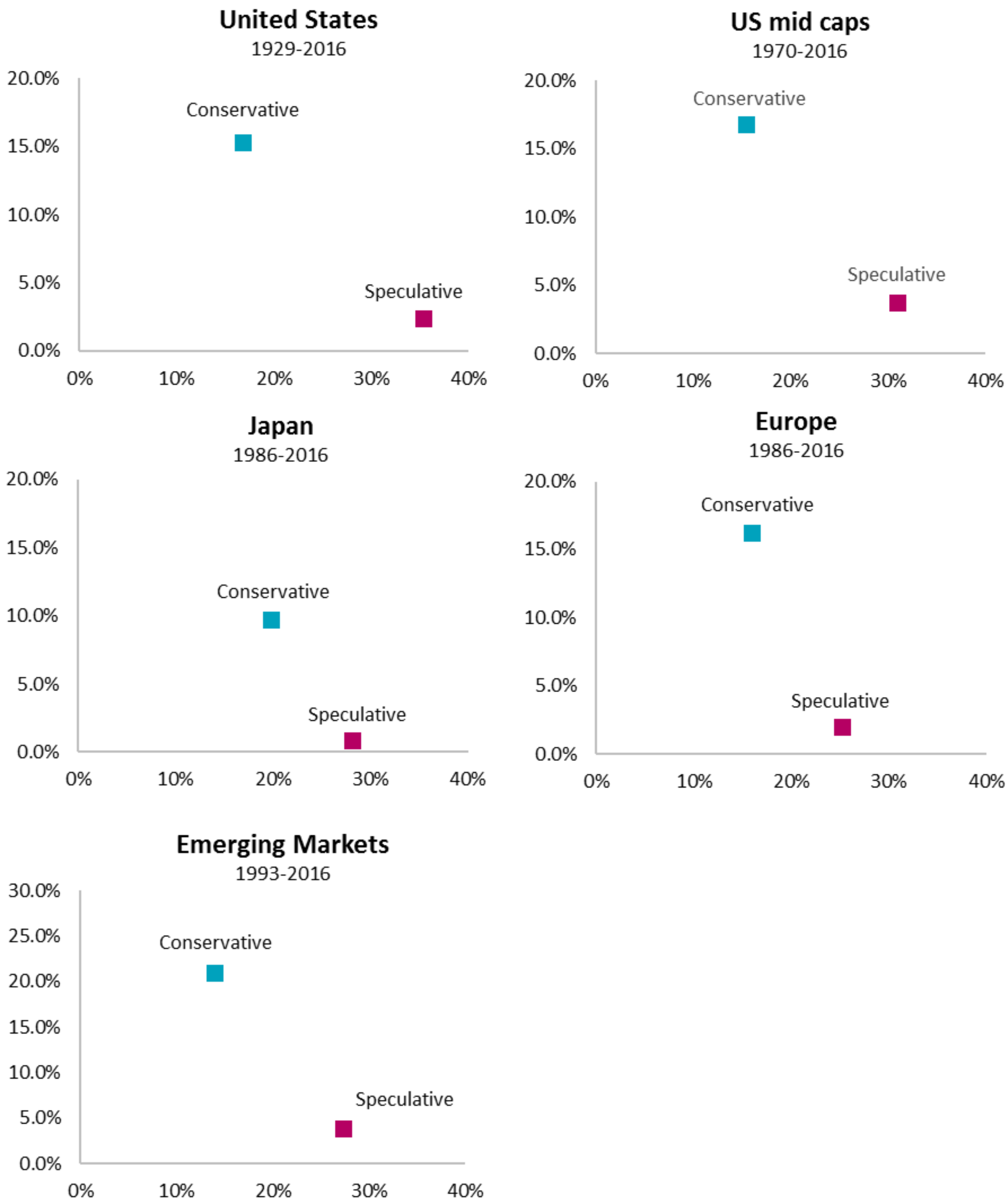


Figure 3: Development dollar value over time

This figure shows the dollar development over time for the Conservative and Speculative portfolios. The active portfolios each consist of 100 stocks and are equally weighted and rebalanced on a quarterly frequency. For comparison we also show the US stock market portfolio (CRSP value-weighted). The results are gross of implementation costs and before taxes.

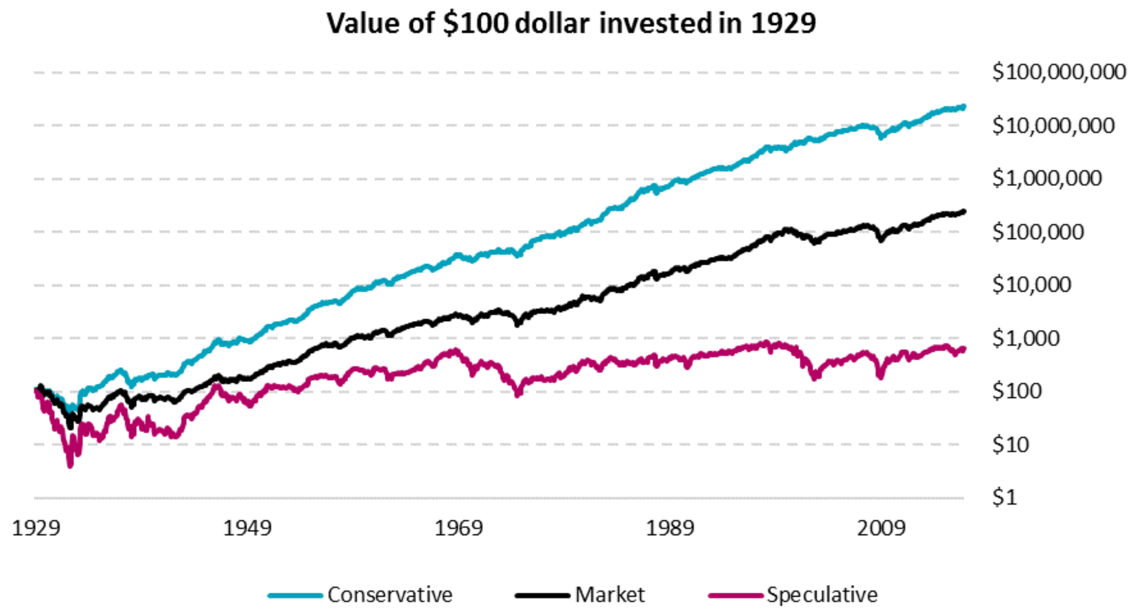


Figure 4: Performance across decades

This figure shows the average 10-year return of the Conservative and Speculative portfolios. The active portfolios each consist of 100 stocks and are equally weighted and rebalanced on a quarterly frequency. For comparison we also show the US stock market portfolio (CRSP value-weighted). The results are gross of implementation costs and before taxes.

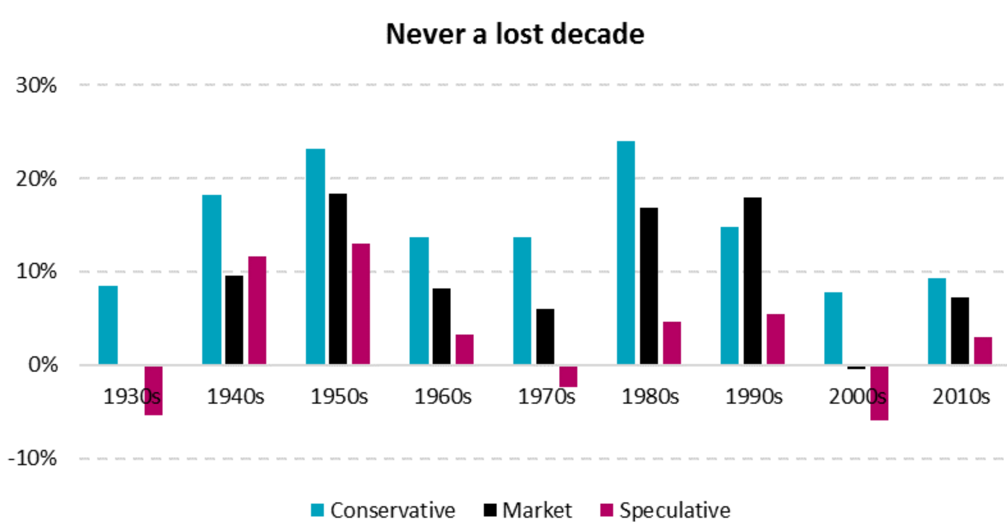
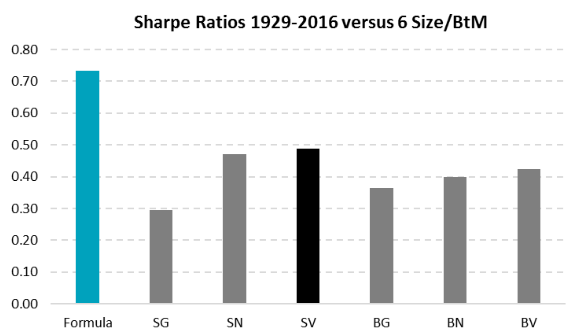
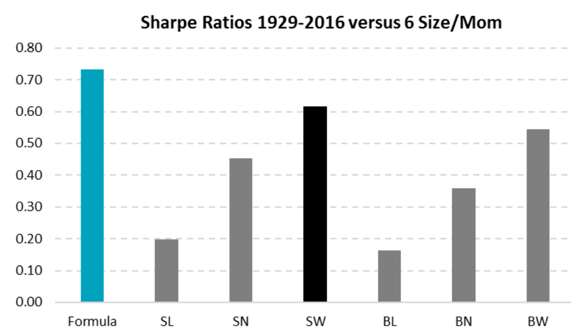
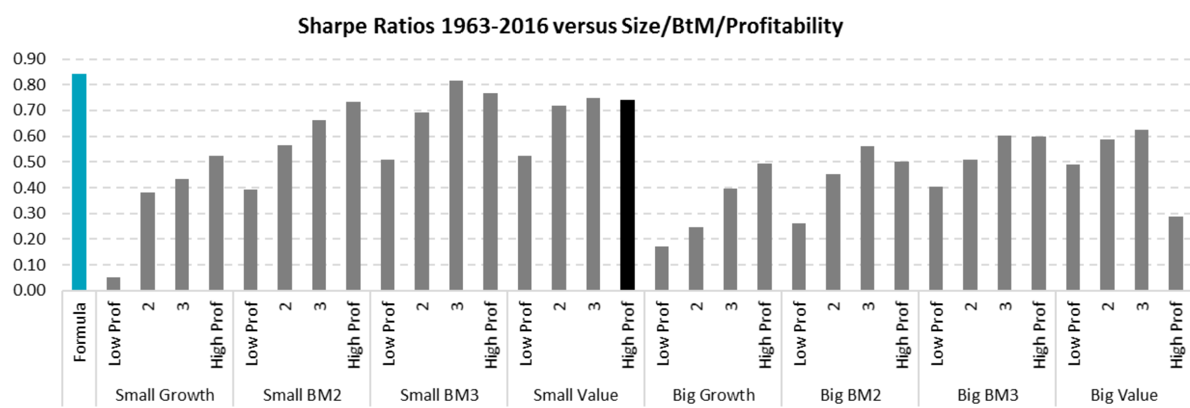


Figure 5: Conservative formula versus Fama-French portfolios

This figure shows the Sharpe ratios of the conservative formula with double-sorted and triple-sorted portfolios. The double-sorted portfolios are based on Size (ME) and Book-to-market ratio and Size (ME) and momentum (12-1 month return). Profitability is defined as 1-year operational profitability and Investment is defined as 1-year change in total assets. The sample starts in January 1929 for the double-sorted portfolios and in July 1963 for the triple-sorted portfolios. FF portfolios are value-weighted and include all stocks in the CRSP database, including small and micro caps. The average number of included stocks is 2,569 stocks over the 1929-2016 period, of which 668 classify as above median NYSE. All figures are annualized. These results are gross of implementation costs and before taxes.







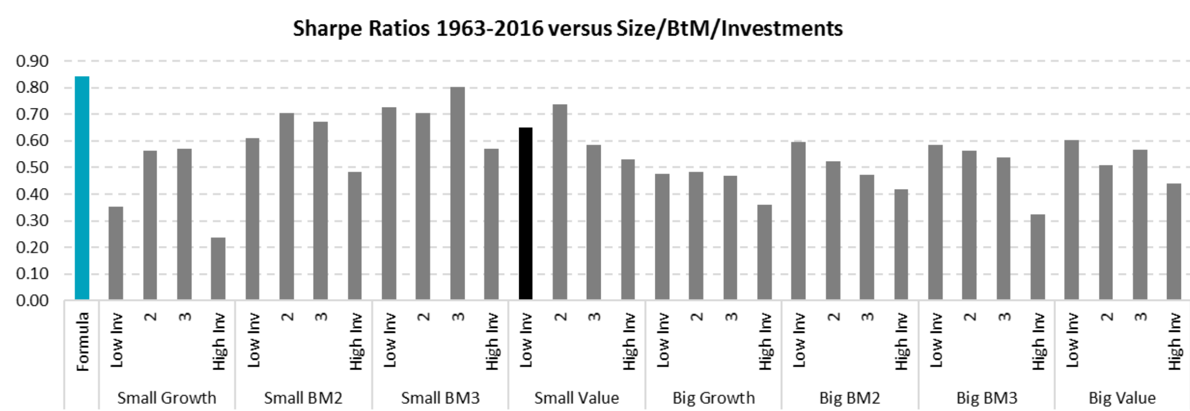


Figure 6: Conservative formula alpha across economic regimes

This table shows the Conservative Formula long-only CAPM alpha (6.2%) and the CAPM alphas across different regimes for the period 1929-2016. In total 10 economic regimes are defined: NBER expansion and recession, low/high 10-year bond yields, falling/rising 10-year bond yields, low/high credit spreads (defined as Baa-Aaa) and falling/rising credits spreads.

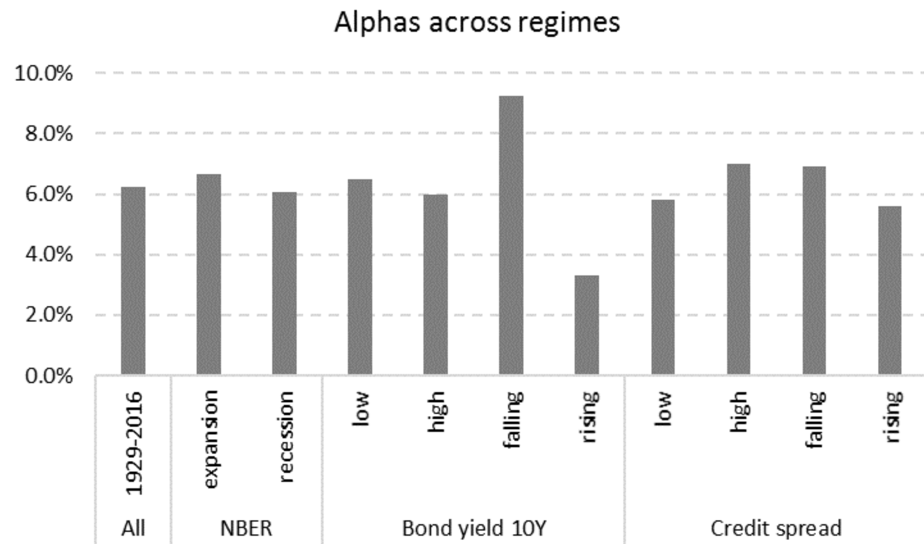


Table 1: Conservative formula versus other factors

This table shows the portfolio with 100 Conservative stocks (formula) compared to other factors. These single factor strategies equally weight the top 100 stocks based on market capitalization of equity (Small), book-to-market ratio (Value), 12-1 month return (momentum), 3-year volatility (lowvol) and net payout yield (NPY). Rebalancing is on a quarterly basis. Furthermore, the portfolios are scaled to the same volatility for a 1-1 comparison. The Sharpe ratio is calculated as the simple average excess return (minus US 30-day T-bill) divided by the volatility. All figures are annualized. These results are gross of implementation costs and before taxes.

1929-2016	**Formula**	**Market**	**Small**	**Value**	**Momentum**	**Lowvol**	**NPY**
Return (simple)	15.5%	10.6%	15.8%	16.9%	18.2%	10.6%	15.6%
Return (compounded)	15.1%	9.3%	12.0%	13.1%	15.9%	10.2%	14.5%
Difference (simple-comp)	0.4%	1.4%	3.8%	3.8%	2.3%	0.4%	1.1%
Volatility	16.5%	18.7%	31.4%	31.7%	25.7%	13.3%	20.1%
De-risking factor	100%	88%	52%	52%	64%	124%	82%
Sharpe (simple)	0.94	0.57	0.50	0.53	0.71	0.80	0.78
Return same risk	15.5%	9.8%	9.9%	10.4%	12.9%	12.3%	13.4%

Table 2: Conservative formula dissected using multi-factor models

This table shows the Conservative minus Speculative (CMS) portfolio controlled for multiple factor models. All factors are from the online data library of Kenneth French. The sample for the 3-factor and 4-factor model starts in January 1926, while the 5-factor and 6-factor models start in July 1963 both end at December 2016.

A: Fama and French (1993) / Carhart (1997)

1929-2016	Alpha	Mkt-RF	SMB	HML	MOM
Coeff	13.9%	-0.88			
t-value	7.07	-29.45			
Coeff	16.5%	-0.65	-0.90	-0.38	
t-value	10.35	-24.66	-21.08	-9.96	
Coeff	8.8%	-0.50	-0.89	-0.07	0.65
t-value	7.00	-23.98	-26.93	-2.27	27.03

B: Fama and French (2015)

1963-2016	Alpha	Mkt-RF	SMB	HML	RMW	CMA	MOM
Coeff	14.0%	-0.74					
t-value	6.93	-19.45					
Coeff	13.0%	-0.55	-0.60	0.35			
t-value	7.29	-15.80	-12.12	6.48			
Coeff	8.8%	-0.44	-0.46	0.03	0.59	0.75	
t-value	5.22	-12.67	-9.29	0.38	8.67	7.56	
Coeff	3.3%	-0.36	-0.51	0.36	0.43	0.49	0.64
t-value	2.95	-15.62	-15.67	8.03	9.53	7.44	29.10

C: Hou, Xue and Zhang (2015)

1967-2016	Alpha	Mkt-RF	ME	IA	ROE
Coeff	4.1%	-0.45	-0.30	0.98	0.80
t-value	2.39	-13.76	-6.52	13.00	14.67

D: AQR

1963-2016	Alpha	Mkt-RF	SMB	HML	QMJ	BAB	MOM
Coeff	4.7%	-0.40	-0.39	0.27	0.67	0.45	
t-value	3.21	-12.77	-8.65	5.78	9.83	11.45	
Coeff	1.0%	-0.33	-0.45	0.52	0.51	0.27	0.58
t-value	0.97	-15.42	-14.71	15.96	11.12	9.95	29.49

Table 3: US mid-cap and international results

This table shows the US small/midcap and international results for the Conservative minus Speculative (CMS) portfolio. The US large cap portfolio consists of the largest 1,000 stocks and the US mid-cap portfolio consists of the second largest 1,000 stocks. For each international market the largest 1,000 stocks are used to construct the two portfolios. The US sample starts in January 1970, the European and Japanese samples start in January 1986, and the Emerging Markets sample starts in January 1993. For Europe and Japan regional Fama-French control factors are used and backfilled prior to November 1990 with US long-short factors. For Emerging Markets global long-short factors are used. Panel A shows the factor betas and Panel B shows the factor premiums and Panel C shows the CMS premium and the factor-corrected alphas of the four regional strategies. Asterisks are used to indicate significance at 5% (*) or 1% (**) level.

A: Factor betas CMS

	Mkt-RF	SMB	HML	MOM	RMW	CMA
US large caps	-0.36	-0.47	0.41	0.66	0.46	0.36
US mid caps	-0.37	-0.59	0.43	0.58	0.71	0.29
Europe	-0.29	-0.18	0.01	0.56	0.60	0.58
Japan	-0.28	-0.28	0.34	0.57	0.03	0.09
Emerging Markets	-0.52	-0.36	0.03	0.49	0.09	0.49

B: Factor premiums

	Mkt-RF	SMB	HML	MOM	RMW	CMA
US large caps	6.35%	1.87%	4.76%	7.60%	3.20%	4.32%
US mid caps	6.35%	1.87%	4.76%	7.60%	3.20%	4.32%
Europe	7.43%	-0.12%	3.70%	10.44%	4.71%	3.08%
Japan	0.33%	0.37%	3.81%	2.47%	1.86%	1.76%
Emerging Markets	6.29%	1.69%	4.66%	7.07%	3.74%	3.41%

C: Alphas CMS

	Premium	CAPM	3FM	4FM	5FM	6FM
US large caps	10.19%**	15.00%**	13.47%**	5.96%**	8.85%**	3.40%**
US mid caps	13.02%**	17.99%**	16.55%**	9.83%**	11.33%**	6.54%**
Europe	11.17%**	14.62%**	15.31%**	6.60%**	6.86%**	2.75%
Japan	6.50%*	8.04%**	7.64%**	4.89%**	6.72%**	4.82%**
Emerging Markets	12.69%**	17.25%**	17.41%**	11.97%**	14.44%**	10.93%**

Table 4: After trading net returns

This table shows the impact of trading costs on the net returns of the Conservative Formula for the four regional strategies. The quarterly turnover is shown, which is calculated single-counted. For transaction costs a low level of 10bps per dollar traded and high level of 30bps per dollar traded are assumed. For Emerging Markets these figures are 20bps and 60bps respectively. Total trading costs include both market impact and broker costs. The net return assumes the conservative high estimate of transaction costs.

	US	**Europe**	**Japan**	**EM**
Gross Return	15.24%	16.18%	9.63%	20.93%
Turnover Quarterly	32%	33%	32%	30%
Estimated trading costs - low	0.26%	0.26%	0.26%	0.48%
Estimated trading costs - high	0.77%	0.79%	0.77%	1.44%
Trading costs (high) as % of return	5.0%	4.9%	8.0%	6.9%
Net Return (high trading costs)	14.47%	15.39%	8.86%	19.49%

Appendix Table 1: Compounding matters, even when strategies have the same volatility

This Appendix table disentangles the difference between compounded returns and simple returns by splitting the 'return drag' in volatility and correlation components. When all strategies are brought to the same risk level, differences between simple and compounded returns could remain, but are solely caused by non-zero time-series correlation. Without time-series correlation, we expect a return difference of 0.5*variance (0.5*16.5%^2) of 1.4% per annum. The Conservative formula has a return drag of only -0.4 percent, which is caused by a favorable (negative) autocorrelation pattern. By contrast Small and Value strategies have positive autocorrelation, which increases the return by about 2.5 percent.

1929-2016	**Formula**	**Market**	**Small**	**Value**	**Winner**	**Lowvol**	**NPY**
% leverage factor	100%	88%	52%	52%	64%	124%	82%
Simple return	15.5%	9.8%	9.9%	10.4%	12.9%	12.3%	13.4%
Compounded return	15.1%	8.8%	9.0%	9.5%	12.1%	11.6%	12.7%
Total return drag	-0.4%	-1.0%	-0.9%	-0.9%	-0.7%	-0.8%	-0.6%
caused by volatility	-1.4%	-1.1%	-0.4%	-0.7%	-0.9%	-1.3%	-0.5%
caused by correlation	1.0%	0.3%	0.4%	0.5%	0.6%	0.6%	0.7%